Choosing to Care: the Determinants of Nurses' Job Preferences in South Africa

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2010

Thesis submitted to the University of London
for the Degree of Doctor of Philosophy

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Abstract

There is a growing recognition that a better understanding of the heterogeneity of motives and determinants of labour market choices is needed to inform policies intended to redress current maldistribution of health workers, particularly in developing countries.
This thesis explored the influence of altruism and other individual characteristics on nurses' job preferences in South Africa, to investigate the impact of potential policy interventions designed to attract nurses to under-served areas. Primary data collection was carried out with a sample of 377 nurses.

First, measures of altruism were constructed by playing the dictator game, a behavioural economic game. The nurses showed greater altruism than is usually seen in such experiments, suggesting that more altruistic individuals self-select into the nursing profession. Since actual choices could not be observed, a labelled choice experiment was then used to reproduce the job opportunities offered to nurses at the beginning of their career. In the analysis of nurses' job preferences, a positive correlation was found between pro-social values and preferences for public jobs, while individuals from rural backgrounds were more likely to prefer rural jobs. Another choice experiment was used to model the effects of potential policy levers to make rural public jobs more attractive. The analysis showed that packages including monetary incentives were often the most powerful, and it confirmed the preferences of nurses from rural backgrounds. Combining the two choice experiments, a Markov model was constructed to predict the long-term effects of different policies on nurses' distribution in the labour market. Building on these outcomes, a cost-effectiveness model compares the effectiveness of several intervention packages to attract nurses to rural areas. This analysis showed that monetary incentives are never cost-effective, unlike education opportunities and the selection of more individuals who were more likely to prefer rural areas, such as people of rural origins.

Acknowledgements

I would like to express my profound gratitude to my supervisor John Cairns for the enormous amount of time and support he has given me during this PhD. It has been a privilege to learn from him, and this experience will undoubtedly shape the rest of my career.

Thanks also go to Natasha Palmer, my secondary supervisor, who has provided me with unlimited and unwavering support over the years. Her kindness and humour were a source of strength and inspiration.

This study would not have been possible without the continued support of my collaborators in South Africa, Duane Blaauw and Ermin Erasmus. I have benefited immensely from Duane's encouragement and from all the discussions we have had about my ideas, the empirical approach used in this thesis and the South African health system. I am greatly indebted to Ermin who made the research possible, through his dedication and perseverance to organise fieldwork activities in a record time in 2008. Ermin has always remained available to answer my questions and help me obtain additional data or information.

Thanks also to all the members of the Centre for Health Policy who ensured that my stays in Johannesburg were always friendly and enjoyable.

Thanks also go to members of my advisory committee, Kara Hanson and Richard Smith, for their useful comments and suggestions at different stages of the thesis.

I am grateful for the funding provided by the Consortium for Equitable Health Systems (CREHS), a five-year research programme funded by the British Department for International Development. I am also grateful for the additional funding provided by a small grant of the Economic and Social Research Council to carry out the economic experiments in this work.

I am incredibly grateful to many of my friends and colleagues who provided advice, laughter, inspiration, cookies, encouragement, coffee breaks, proofreading, etc. In particular, I would like to thank Marie-Laure, Lesong, Viola, Jo, Ann, Tim, Patricia, Edith, Tania, Loveday and Nicola.

Finally, I dedicate this work to Mathieu, who started to support the idea of doing this PhD a long time ago, and has remained understanding and patient even in my grumpiest moments! Thank you for always being there to lift my spirits and give me the confidence and encouragement to keep going.

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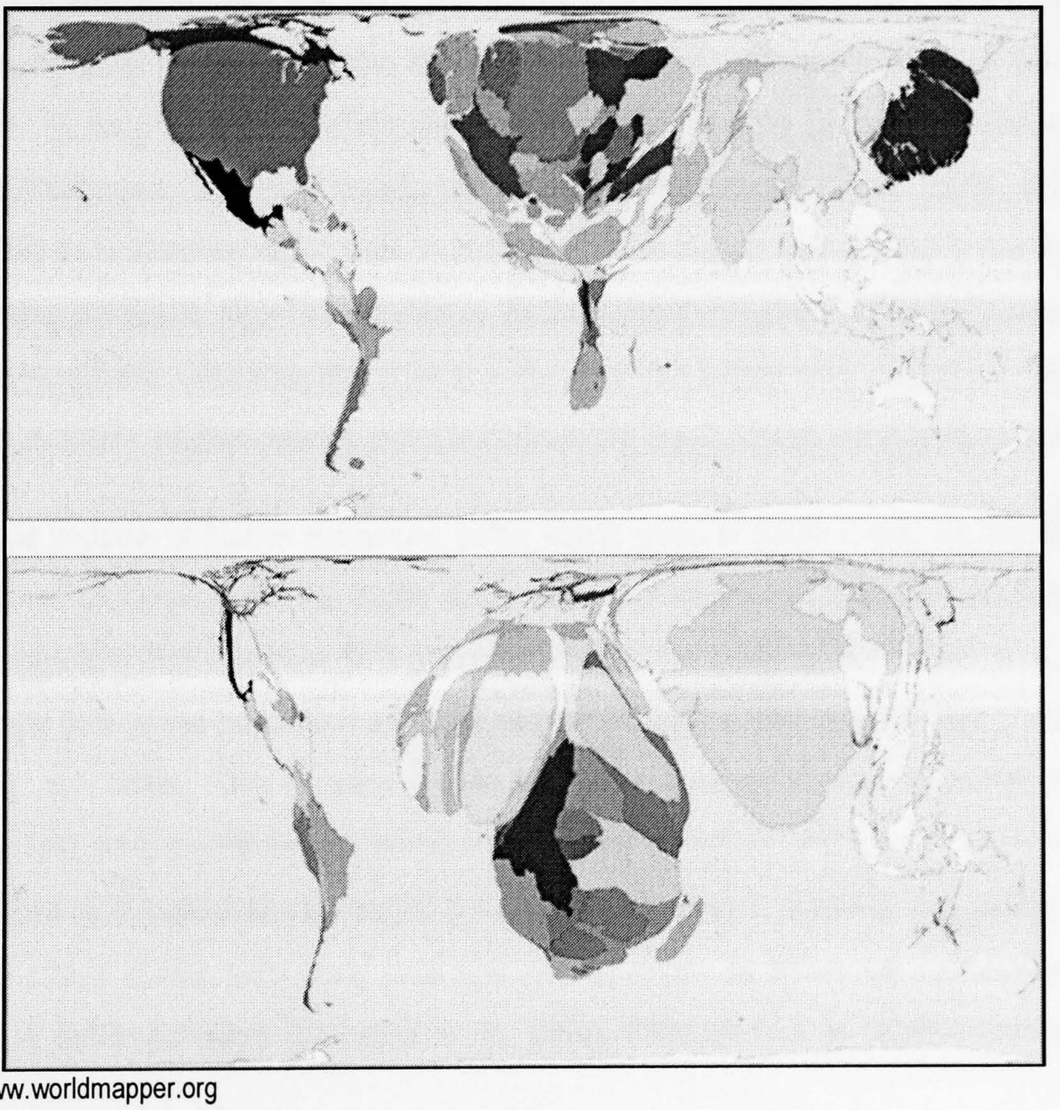
Abbreviations

ANC	African National Congress
CEAC	Cost-Effectiveness Acceptability Curve
CEAF	Cost-Effectiveness Acceptability Frontier
CREHS	Consortium for Research on Equitable Health Systems
DCE	Discrete Choice Experiment
DFID	Department for International Development
DG	Dictator Game
EN	Enrolled Nurse
ENA	Enrolled Nursing Auxiliaries
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GP	General Practitioner
HRH	Human Resources for Health
ICER	Incremental Cost-Effectiveness Ratio
IIA	Independence of Irrelevant Alternatives
IID	Independent and identically-distributed
MNL	Multinomial Logit (model)
NHRP	National Human Resources Plan for Health
NMB	Net Monetary Benefit
OSD	Occupation Specific Dispensation
PHC	Primary Health Care
PN	Professional Nurse
PSA	Probabilistic Sensitivity Analysis
RN	Registered Nurse
RPL	Random Parameter Logit (model)
SANC	South African Nursing Council
SAQ	Self-Administered Questionnaire
SD	Standard Deviation
UK	United Kingdom

1.1. The human resources crisis in health systems

Since the adoption in 2000 of the Millennium Development Goals, several initiatives and reports have focused on the critical role played by human resources in improving health system performance, and the challenges posed by the Human Resources (HR) crisis (WHO, 2000, Liese et al., 2003, Joint Learning Initiative, 2004, WHO, 2006). Health professionals are particularly scarce where they are mostly needed as evidenced at the global level in Figure 1.1, while at the country level, rural areas are predominantly affected (Dussault and Franceschini, 2006, Serneels et al., 2007). This issue is particularly acute for nurses, whose presence and role are underlined as critical for the good functioning of health systems in developing countries (Buchan and Calman, 2004).

Figure 1.1: The world redrawn according to nursing population density (top) and maternal mortality (bottom)



Source: www.worldmapper.org

The long-term supply of registered nurses in the labour market can be defined as the number of adequately trained nurses who are available to work as a nurse[1]. In any labour market, this number is driven by several external factors. The capacity of the education system, specifically the number of training institutions and the size of the teaching faculty, is a key driving factor of the production of trained nurses, together with the length of time required to obtain a nursing degree. The number of trained nurses is also determined by factors influencing students' decisions to start training as nurses: level of tuition fees, and the anticipated return to nursing training compared to other training. Finally, exogenous factors such as the statutory age for retirement, the age distribution of the current nursing workforce, the mortality rate in the population of interest and migration patterns of workers are also responsible for the attrition of the available workforce in the long-run.

In South Africa, where this thesis was undertaken, the current lack of nurses stems from a growing demand for nurses and failure of the supply of nurses to keep pace.
The demand for nurses has been fuelled by the transformation of the public health system after the end of Apartheid in 1994, the continued growth of private hospital groups, and the growing health needs of a country with the highest number of HIV-infected people in the world[2]. Meanwhile, the long-term supply of nurses is insufficient to meet the demand for nurses, mainly due to the inadequate capacity of nursing training institutions (Coovadia et al., 2009), which have been unable to produce enough nurses to compensate the natural flow of leavers caused by an aging nursing workforce, high HIV prevalence and significant emigration of skilled workers since the end of Apartheid. Consequently, at least in the short-run before more nurses can be trained and made available, market clearing is not possible in the South African nursing labour market.

Beyond this problem of human resources, public health goals in South Africa are threatened by two additional problems. First, the public sector suffers more acutely from staff shortages, with studies suggesting that less than 50% of nurses work in the public sector (Breier et al., 2009), whilst nearly 85% of the population uses this sector for hospital care and 80% for primary care (Chopra et al., 2009b). This situation compounds some socio-economic inequalities inherited from Apartheid, as it contributes to deteriorating working conditions and quality of care in health facilities used by the more disadvantaged groups. Second, there is evidence suggesting that the nursing shortage affects particularly rural and remote areas, as these rely exclusively on the presence of public providers (Coovadia et al., 2009). Although lack of detailed data prevents

[1] As opposed to the short-term labour supply, which pertains to the decisions made by existing (trained) nurses to participate or not in the labour market.
[2] All these factors are presented in greater detail in Chapter 4.

measuring the problem adequately, official statistics show that nurse to population ratios are systematically lower in the more rural provinces (SANC, 2008). Since significant domestic public resources are devoted to health workers' salaries, this geographic unequal distribution of the workforce translates into inequitable benefits of public subsidies. Overall, these problems of maldistribution of the available nursing workforce in South Africa contribute directly and indirectly to fuel existing inequalities of access to basic health care and of health outcomes (Chopra et al., 2009a).

1.2. Uncovering nurses' preferences

Although these HR issues are particularly critical, current policy debate rests on little evidence, in particular concerning the effects of policy interventions (Grobler et al., 2009). Despite this lack of evidence, the South African government has recently introduced two initiatives to attract and retain nurses in the public sector and in rural areas: a 24% salary increase was granted to nurses in 2007 (Department of Public Service and Administration, 2008), and a one-year compulsory service was introduced the same year. Qualitative evidence suggests that these two initiatives might not necessarily bring the desired effects (Breier et al., 2009):

> *"In the focus group discussions with students conducted after the announcement of the OSD, we were disappointed to encounter the view that the salaries alone were insufficient to prevent students who already planned to emigrate from doing so."*

At the same time, there is a growing body of work underlying the complexity of the determinants of human behaviour and the possible role played by "intrinsic motivation" (Deci, 1971, Deci et al., 1999) in contexts where economic incentives might not have the desired effect. In 1970, when Richard Titmuss argued that monetary compensation for donating blood might reduce the supply of blood donors (Titmuss, 1970), his views were met with scepticism among economists (Solow, 1971, Arrow, 1972) whose theories had long placed material and financial interests at the centre of human motivation. However, in his 1759 Theory of Moral Sentiments, Adam Smith already presented human behaviours not only driven by self-interest, but also by "sympathy" towards others:

> *"However selfish so ever man may be supposed, there are evidently some principles in his nature, which interest him in the fortunes of others, and render their happiness necessary to him, though he derives nothing from it, except the pleasure of seeing it."* (Smith, 1759)

These words echo those of South African nurses interviewed in a recent study (Breier et al., 2009):

> *"The reason why I chose nursing is just basically to make a difference...just to help people...It should be a passion...to be there for people in need." (p.87)*

"After a long day, the patient just goes to you and says 'thank you', then you go home and you are happy." (p.110)

"When the patient at the end of the day says thank you, [it] gives me a boost to come back tomorrow." (p.110)

"A dedicated nurse is motivated by an intrinsic desire to help the sick and vulnerable and by the particular kind of professional but emotional intimacy and trust that develops between nurse and patient in the course of care." (p.110)

"All you need is just a patient to come to you and say thank you." (p.110)

"A student who had already been in nursing for 19 years spoke of nursing as a calling and said it takes a 'special' person to be a nurse: "No one can say I'm going to become a nurse because of the job or for money...because there's no money in it...it's got to be a calling." (p.87)

There is a growing recognition that a better understanding of the motives and determinants of health professionals' labour market choices is needed to design interventions aiming to redress the current maldistribution of staff (Vujicic and Zurn, 2006, Glassman et al., 2008). As explained earlier, the long-term nursing labour supply is mainly driven by exogenous factors or regulatory decisions, which are irrelevant to understand the dynamics that determine the distribution of nurses in the short run. To inform the design of interventions aiming to redress the inadequate distribution of nurses in South Africa, it is critical to understand better what drives the decisions made by nurses who are already in the labour market. This work therefore considers the short-run supply of nurses, specifically the decisions of individuals who are already qualified as nurses and have to decide whether they want to work and for which employer.

1.3. Outline of the thesis

The objective of this thesis is to explore the influence of altruism and other individual characteristics on the job choices made by graduate nurses in South Africa, with a view to inform the design of policy interventions to attract nurses to under-served areas.

The thesis starts with a review of the literature on the determinants of job choices and how the main issues have been tackled in the health care literature (Chapter 2). This review characterises how the labour economics literature explains the determinants of the labour supply decision. It then shows how recent developments in behavioural economics can provide a richer perspective on individuals' motives, and the review provides some evidence from other bodies of literature showing why such approach might be particularly relevant to health workers. This chapter also includes discussions of the types of policy interventions that have been implemented in developed and developing countries to incentivise health workers, and discusses the limitations of evidence of their effectiveness.

Building on findings from the literature, the following chapter develops a conceptual framework and associated empirical strategy (Chapter 3). The conceptual framework describes the possible elements affecting the decisions made by nurses on the labour market. It then depicts the expected effects of different incentives on these job choices. The empirical methods used to test these theoretical insights are then introduced. This includes a description of the data used in the study.

Background information on South Africa is given in Chapter 4, with details on the health system in general, and the broad policy elements that can influence the choices made by nurses.

Five results chapters follow (Chapters 5 to 9). Chapter 5 describes in detail the empirical approach adopted to measure nurses' altruism. It also explores the determinants of nurses' altruism, while contrasting the findings obtained with nursing and economic students. Chapter 6 analyses the determinants of labour market nurses' choices in South Africa, using a discrete choice experiment designed to mimic the main choices faced by nurses. Chapter 7 assesses the relative impact of potential strategies to increase the uptake of rural posts by nurses, by means of another discrete choice experiment. It particularly explores the potential influence of altruism and other individual characteristics on the sensitivity to various incentives. Chapter 8 develops a model to model the short-term and long-term effects of HR policy interventions. Chapter 9 determines the cost-effectiveness of the various policy interventions, and explores the impact of nurses' heterogeneity of motives on the government's optimal strategy.

Finally, Chapter 10 brings together the main findings from the results chapters, considering them in relation to the literature and the conceptual framework. The methodological strengths and limitations of the thesis are also discussed. The chapter concludes by discussing policy implications, both for South Africa and for low and middle income countries, and areas for future research.

Chapter 2 - Literature Review

This chapter reviews several bodies of literature deemed pertinent to the research topic. It starts with an overview of normative approaches developed in labour economics to explain workers' labour supply decisions, and that can inform a study of nurses' job choices. It continues with an overview of the empirical literature on the determinants of nurses' labour supply decisions. This is followed by a presentation of theoretical and empirical literature underlying the potential role of pro-social motives on individual decisions, and their relevance to nurses' work decisions. Finally, it provides a review of the strategies that have been used in developed and developing countries to influence the recruitment and retention of health workers, particularly in rural areas.

2.1. Normative models of labour supply decisions

Labour economics has been one of the most prolific fields in economics, and as a result there are virtually countless models developed to study labour market decisions. However, much of the labour economics literature is concerned with specific problems (e.g. explaining unemployment, or the impact of taxation on labour supply) which are not directly relevant to understanding the motives driving nurses' job preferences in this specific context. Therefore, this section only presents specific normative models that are relevant to understanding the choices made by nurses regarding their jobs.

As outlined in the introduction, this work considers the short-term supply of nurses. First, this thesis is concerned with individual decisions made by nurses. Second, this work looks at job choices made by nursing students who have just completed their training; hence it does not consider decisions made by students to invest in nursing training. Consequently, the scope of this study excludes some areas that are important topics in the analysis of labour supply, but not pertinent to the specific problem considered here.

2.1.1. Neoclassical framework

The standard neoclassical approach to labour supply decisions is set in the context of a perfect labour market where jobs are homogenous and access to information is perfect. This framework posits that individuals make a trade-off between allocating their time to income-generating activities (work) and leisure. This allocation decision is informed by an indifference curve which indicates all the possible combinations of leisure and work that will give the individual a specific level of utility:

$$U = (H, L)$$

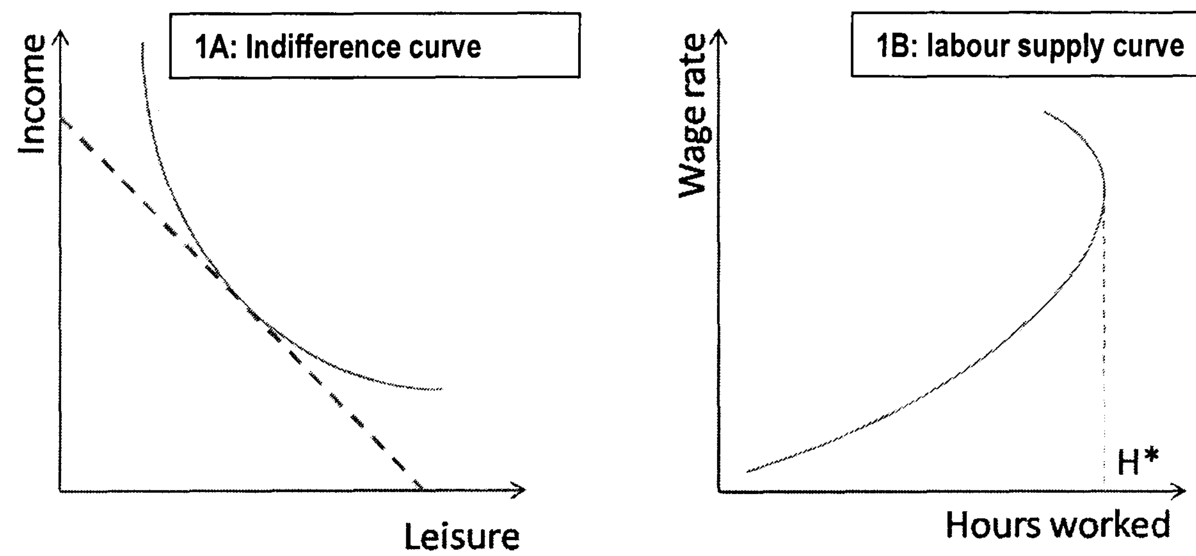
where H is the number of hours worked which allow the worker to consume a certain amount of goods, determined by a given wage rate, and L is the leisure time. The indifference curve in Figure 2.1A represents the various combinations of leisure and work that maximises the utility of the worker, at a given wage rate (i.e. the slope of the budget constraint). In this framework, the quantity of labour supplied by an individual H_i is therefore exclusively determined by pecuniary considerations, which are the wage rate (W) offered and other possible non-labour income I (e.g. non-wage income and spouse's income) that may enter in the budget constraint. A key corollary of this approach is that workers' utility from working can be written as:

$$U_L = (H_L, w_L) \qquad (1)$$

where $\partial U/\partial H<0$ and $\partial U/\partial w>0$.

For a higher salary rate, the worker is able to consume more goods for a reduced number of hours worked (income effect). Yet as the wage rate rises, the worker will substitute work for leisure, to increase his income as the opportunity cost of leisure has increased (substitution effect). As long as the substitution effect is greater than the income effect (as long as $H < H^*$), work is an increasing function of wage, and the labour supply curve is upward sloping to the right (see Figure 2.1B).

Figure 2.1: The neoclassical framework of labour supply



By the importance given to income and earnings-related incentives, this standard approach to labour supply decisions concludes that individuals choosing between different jobs compare the wages offered in each job (thanks to perfect information on the job opportunities on the labour market), and take the one that offers the higher wage rate. Consequently, the labour supply facing a firm seeking to employ workers is perfectly elastic (any attempt by an employer to cut wages will cause all existing workers to leave the employer instantaneously). This ultimately implies that there is a single wage in the economy for similar jobs.

Following the same framework, the occupational choice model considers that the decision to migrate is made as a result of the optimisation between job opportunities at home and better job opportunities overseas. That comparison accounts for the employment probabilities in their home country vs. the destination country. For example, nurses coming from countries where there is unemployment in the nursing labour market will tend to migrate to countries where there is a shortage of nurses, therefore improving their chances of finding a job (or their income for those who are employed, as countries with a shortage will, *ceteris paribus*, offer relatively higher wages).

2.1.2. Heterogeneity of jobs

The predictions of the neoclassical models are contradicted by much empirical evidence,. In particular, in many labour markets, including the nursing labour markets, a wide distribution of wages for comparable jobs can be observed. This is the reason why most of the developments in labour economics have tried to enrich this simplistic approach. The models presented below all seek to explain this wage dispersion, and in doing so they also provide new insights into the determinants of workers' supply decisions.

A. Human capital and job choices

Human capital refers to the knowledge and skills of an individual that allow him/her to perform his/her work adequately. Investment in human capital (through studies) leads to the accumulation of different skills, which in turn determine labour productivity, hence explaining the differences in salaries observed (Mincer, 1958). This model of investment in human capital developed by Becker to model the training decisions made by individuals (Becker, 1962), was extended by Ben-Porath to post-school accumulation of human capital (Ben-Porath, 1967). His model introduced the idea that workers could accumulate human capital throughout their working life, in particular through on-the-job learning.

Applied to the particular question of job choices, this model provides a refined perspective compared to the neoclassical approach. In the latter, individuals who have two job opportunities would systematically take the one with the better salary. In the perspective of a human capital model, individuals might choose a job with a lower salary if they anticipate that the human capital they will be able to accumulate with this job will increase their expected financial flows over their entire career.

This perspective is potentially relevant for the study of nurses' job choices, as different nursing posts might give access to varying opportunities for on-the-job training or continuing education programmes. For example, some positions in the public sector might give access to privileged training opportunities, such as the possibility to upgrade one's skills or to follow a course of subsidised specialised training.

B. Compensating wage differentials

Initially formulated by Adam Smith, the theory of compensating wage differentials provides another explanation for the wage differences that can be observed for comparable jobs (Smith, 1776). The starting point is that jobs are not really identical and usually differ in the working and living conditions they offer to workers:

> *"The wages of labour vary with the ease or hardship, the cleanliness or dirtiness, the honourableness or dishonourableness of the employment. Thus in most places, a journeyman tailor earns less than a journeyman weaver. His work is much easier. A journeyman weaver earns less than a journeyman smith, His work is not always easier by it is much cleaner (...). The most detestable of all employments, that of public executioner, is, in proportion to the quantity of work done, better paid than any common trade whatever".* Book I, Chapter X, Part one - Inequalities arising from the Nature of the Employments themselves (Smith, 1776)

Formalising the intuitions of Smith, Rosen showed that perfect labour markets ensure that net advantages of jobs must be equalised (Rosen, 1974, Rosen, 1986). This means that the wages proposed for a particular job will depend on two sets of job characteristics, desirable (Y) and undesirable (Z) ones:

$$W = f(Y, Z)$$

The theory of compensating wage differential predicts that $\partial w/\partial Z > 0$, and conversely $\partial w/\partial Y < 0$. This means for example that higher salaries are expected for areas where the cost of living is higher or for jobs with poor working conditions (disagreeability of working conditions, physical risks, emotional stress, etc.). Conversely, employers who provide good working conditions in urban centres where workers can enjoy a lot of amenities can propose lower wages.

This model also provides a theoretical justification for the wage gap sometimes observed between private and public jobs. Assuming that these two types of jobs only differ in their fringe benefits and stability (public employment providing job security and access to less costly pension plans), workers might accept lower wages in the public sector.

The compensating wage differential approach departs from the neoclassical framework in that it suggests that workers will not only consider salaries (in which case they would not mind the differences in other work aspects). This model therefore assumes that workers make their choices based on various job characteristics. Stated differently, workers not only compare the wages paid when making their decisions, but also take into account the utility of the alternative jobs, which is determined by different attributes. The utility derived from working can therefore be modelled as:

$$U_L = (w_L, H_L, Y_L, X_L) \qquad (2)$$

2.1.3. Heterogeneity of workers

In the neoclassical model, one of the assumptions is that workers are homogenous in their abilities and preferences. The human capital model already introduced the possibility of heterogeneous agents, with different skills. Other normative models have made a similar assumption and examined the consequences of this diversity for occupational choices. This section presents some of these models and explains their possible relevance for nurses' career choices.

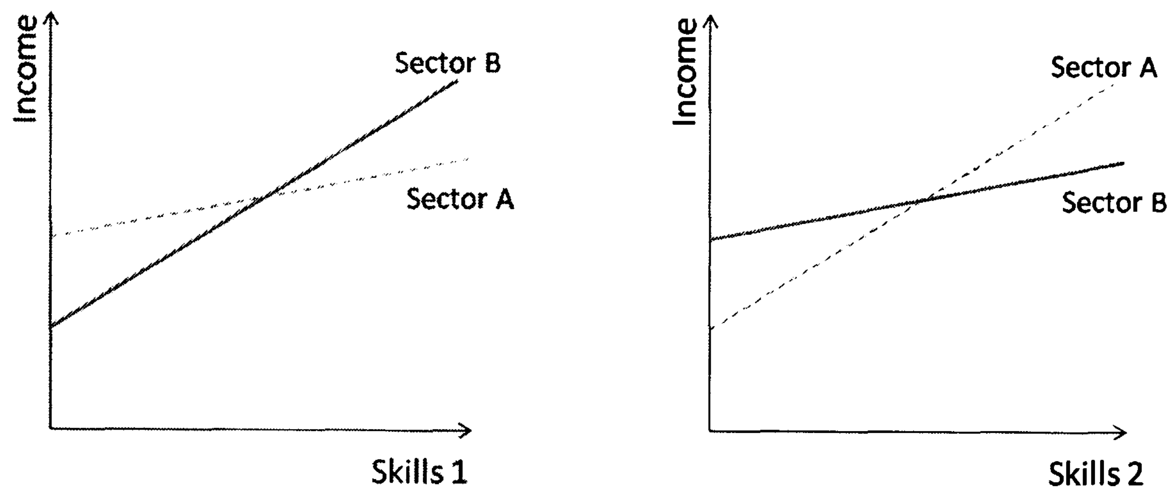
A. Heterogeneity in productivity and self-selection models

Some economists have explained the choices made between two types of professions or careers as the result of self-selection processes, rationally made by the individuals themselves, aware of their skills and comparative advantages. The seminal selection model developed by Roy provides a framework for analysing the impact of heterogeneity of workers' skills or comparative advantages (Roy, 1951). In practical terms, this model provides some theoretical basis for understanding that individuals gain by choosing the job that better fits their range of talents and skills.

The Roy model assumes that there are two types of workers, who differ in their skill endowment (they have a mix of two skills, 1 and 2). Workers are aware of the relative advantages their skill endowment provides them with regards to the returns they can expect in two sectors, A and B. (see Figure 2.2). In each sector, only one of their skills can be used at a time.

The model shows that workers automatically self-select rationally and choose the occupation that maximises their pecuniary returns. Workers with a comparatively higher endowment in skill 1 will choose sector B and workers with a higher endowment in skill 2 will choose sector A. In a perfectly competitive framework, the allocation of workers to the two types of employers is efficient in the sense that it maximises the total value of labour's product and income.

Figure 2.2: Comparative advantages in the Roy model



The framework provided by Roy has been widely applied to a wide range of self-selection processes: occupational choice (Dolton et al., 1989), female labour market participation (Heckman, 1974), the choice of industry (Heckman and Sedlacek, 1985), decisions to become an entrepreneur (Blanchflower et al., 2001, Lazear, 2005), or working for the public or private sector (Blank, 1985, Borjas, 2002).

Formally, these models underline that the utility derived from a particular job will also be determined by an individuals' characteristics, so that equation (2) can be further enriched:

$$U_{iL} = (w_L, H_L, Y_L, X_L, Z_i) \qquad (3)$$

where Z are individuals' skills and characteristics.

These applications are interesting in that they underline that workers will choose their occupation based on an assessment of their own skills and abilities, which can encompass a wide realm of abilities, not just cognitive ones.

B. Heterogeneity in tastes

This last section provides two examples of recent developments in economics that assume or justify why workers might differ in their tastes for job characteristics, while unlike the Roy model, they have not rooted this heterogeneity in productivity differences. Although both examples are not models of occupational choices, they provide some insight into the relevance of considering heterogeneity of tastes in a broad understanding.

The first example comes from the new economic geography literature, an area which focuses on the dynamics of spatial organization of economic activities. A model developed by Tabuchi and Thisse seeks to investigate the impact of the heterogeneity of workers' tastes on the spatial distribution of activities (Tabuchi and Thisse, 2002). In this framework, individual decisions to migrate from one region to another are not based on economic considerations, but on differentiated perceptions of regional differences:

> *"It seems highly implausible that all potentially mobile individuals will react in the same way to a given "gap" between regions. Some people show a high degree of attachment to the region where they are born; they will stay put even though they may guarantee to themselves higher living standards in other places."*

Their model goes on to explain how this heterogeneity in tastes acts as a dispersion force on economic activities, thereby providing some theoretical basis for some of the assumptions on the effects of economic development on migration. The assumptions are particularly interesting in the context of employment in a national health care labour market, where equivalent jobs are available in different regions. Besides, individuals who have a high degree of attachment to a region (because they were born there or their family resides there) are more likely to work there, even if they lack social amenities and obvious incentives (Brooks et al., 2002).

The second example is provided by the literature on imperfect competition on the labour market, and more precisely oligopsonistic or monopsonistic models[3] (Bhaskar et al., 2002, Manning, 2003). These models depart from the traditional framework in that they posit that firms face an upward-sloping labour supply curve, meaning that a reduction in wage does not necessarily lead to workers' resignations. Two main arguments have been advanced to explain the existence of monopsonistic labour markets: lack of employee information about labour market opportunities inducing job search costs[4] and individual heterogeneity in job preferences. The latter argument is further detailed by Bhaskar et al. (2002) as follows:

> *"Suppose that workers with identical skills and abilities have heterogeneous preferences over nonwage job characteristics. (...) Non-wage job characteristics include the job specification, hours of work, distance of the firm from the worker's home, and the social environment in the workplace."*

They continue their argument by using travel costs as an illustration of a literal or figurative reason why workers might have different preferences:

> *"This notion of transportation cost can be interpreted literally as the actual cost of travelling to and from work. However, it can also be interpreted as a subjective measure of the extent to which a worker prefers one set of job characteristics over another set. Whether it involves physical distance or psychic distance, a worker may be willing to "travel" to the further, less preferred, employer for a sufficient wage premium. The key insight here is that a worker in a preferred job may not immediately choose to leave an employer that slightly reduces its wage rate."* (Bhaskar et al., 2002)

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[3] A monopsony/oligopsony describes a market where there is only one / a few buyer(s) for the product of a large number of sellers.

[4] This relates to the prolific theory of job search.

The authors of these models show that they can effectively account for a number of empirical observations, that perfectly competitive market models are unable to explain (wage dispersion, ethnic and gender wage gaps, etc.).

The relevance of monopsonistic labour markets for the analysis of the nursing labour markets has been often underlined, some economic textbooks even making it the typical example of such markets (Sullivan, 1989, Hirsch and Schumacher, 1995, Bhaskar et al., 2002, Hirsch and Schumacher, 2005). This would therefore suggest that there are reasons to believe that nurses might have differentiated job preferences. Some might favour working for a private hospital, while others might prefer the working conditions of small clinics.

This review highlights the importance given by economists to economic motives to justify labour supply choices. Some of the models have been enriched by heterogeneity of individuals, but they have only focused on the study of traditional individual characteristics. In a sense, this overview confirmed that "*most economic models are based on the self-interest hypothesis that assumes that all people are exclusively motivated by their material self-interest*" (Fehr and Schmidt, 2000). Several prominent economists have emphasised that a concern for others is quite common (Smith, 1759, Becker, 1974, Samuelson, 1993), and a powerful source of motivation. There has been mounting evidence from economics and other social sciences supporting this heterodox view. The following section reviews this evidence and discusses its relevance to the study of health workers' job choices.

2.2. Altruism and workers' behaviours

This section is divided into three parts. The first provides an overview of the economic literature on altruism. The second summarises conceptions of alternative forms of motivations, and the last explains why these approaches are particularly relevant for health care providers.

2.2.1. Economic agents as altruistic individuals

A growing body of experimental games has demonstrated that individuals sometimes behave in a manner inconsistent with the maximization of their own monetary rewards, when this would affect the welfare of others[5]. For instance, a review of behaviours in experimental public good games[6] shows that participants contribute more than self-maximization would predict (Ledyard, 1995), while one study showed that half of all cooperation in public goods games is from people who understand free riding but choose to give anyway (Andreoni, 1995). In dictator games, where people are given an endowment to split between themselves and someone else, a large proportion of participants freely choose to allocate some of their money to anonymous recipients, while no mechanism or interaction incites them to act as such (Camerer, 2003).

As a result, a large body of literature has developed to explain such unorthodox behaviours, sometimes called "social preferences". Social preferences describe individuals' concern for others' well-being in addition to concern for one's own, and this concept encompasses four types of "other-regarding" preferences (Fehr and Fischbacher, 2002). The first relates to reciprocal fairness, and relies on strategic interactions and assumes that the desire to raise or lower others' welfare depends on the perception of others' fairness (Falk and Fishbacher, 1999, Falk et al., 2003):

> *"A reciprocal individual responds to actions that are perceived to be kind in a kind manner, and to actions that are perceived to be hostile in a hostile manner"* (Fehr and Fischbacher, 2002).

The second is inequity aversion and posits that individuals are concerned with minimizing disparities between their and others' benefits (Fehr and Schmidt, 1999, Bolton and Ockenfels, 2000):

> *"This means that they are altruistic towards other persons, i.e. they want to increase the other persons' material payoffs, if the other persons' material payoffs are below an equitable benchmark, but they feel envy, i.e. they want to decrease*

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[5] More information can be found on experimental economic games, their design, interpretation and limitations in Chapter 5.

[6] Individuals have an endowment *m* which they each must allocate between themselves and a public account. Each of the *n* members of the group earns α for each dollar allocated to the public account. By design, $0 < \alpha < 1$ so giving nothing is a dominant strategy, but $\alpha n > 1$ so giving *m* is Pareto efficient.

the other persons' payoffs, when the payoffs of the others exceed the equitable level". (Fehr and Fischbacher, 2002).

The third is spitefulness, and is not conditional upon a form of interaction:

> *"A spiteful or envious person always values the material payoff of relevant reference agents negatively". (Fehr and Fischbacher, 2002).*

Finally, unconditional altruism: people value the well-being of others positively, independently from any interaction with these others or any benefit to themselves. This does not necessarily imply a form of sacrifice (Andreoni et al., 2007), but in economic terms, it means that the well-being of others is valued positively. Formally, the utility of an individual i defined as:

$$U_i = (\pi_i, \pi_j)$$

where π_k are benefits enjoyed by individual *k*, and $\partial U_i / \partial \pi_j > 0$.

One of the questions debated by economists has been to understand the nature of such selfless behaviours, in particular whether these behaviours were purely disinterested, or whether "ulterior" (self-interested) motives were driving them (Andreoni et al., 2007). One of the central motives that potentially confounds "pure" altruism is the "*warm-glow of giving*" (Andreoni, 1990); the utility one gets from the act of giving with or without a particular concern for the interests of others: "*donors may value not only the benefits supplied by the organisation but also their own acts of charity*" (Rose-Ackerman, 1996). Alternatively, some view altruism as a signalling strategy of individuals who seek to receive social esteem and valuation. According to a model developed by Bénabou and Tirole (2006), individuals engage in altruistic activities to receive social esteem from others, or improve their prestige.

2.2.2. Nature and impact of intrinsic motivation

Psychologists and economists who have focused on individual motivations have drawn attention to the fact that individuals were not systematically motivated by economic rewards, and could find another endogenous source of motivation for performing an act (which may or may not benefit to others).

A. Definition of intrinsic motivation

Intrinsic motivation was first introduced by social psychologists in the 1970s (Deci, 1971), and has recently been adopted by economists seeking to explain behaviours that couldn't be accounted for in the neoclassical economic framework (Frey, 1997). Opposed to extrinsic motivation which comes from outside individuals and is triggered by outside rewards or incentives, intrinsic motivation comes from inside an individual and is generated by the satisfaction coming from the act of accomplishing a particular action. Unlike extrinsically motivated individuals who need incentives and rewards to counter the negative effects (marginal disutility) of making an effort, intrinsically motivated agents derive pleasure or greater utility from making these efforts:

> *"People do things by intrinsic motivation when they just enjoy doing them, such as (...) jogging for miles, climbing high mountains, spending hours solving crossword puzzles, contributing anonymously to a charitable organisation or working without compensation in a developing country's hospital" (Frey, 1997), preface.*

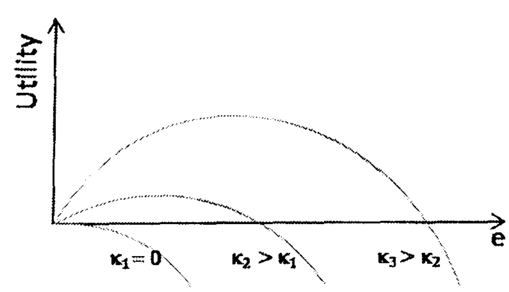
This definition underlines that intrinsic motivation goes beyond actions undertaken in a work situation. Formally, intrinsic motivation means that the impact of effort on the utility derived from working is defined as follows:

$$U_i = (w_i, e, \kappa_i e)$$

where w_i is the salary earned[7], e the effort produced and $\kappa_i > 0$ measures the degree to which a worker is intrinsically motivated by job *i*. Utility is usually decreasing in effort $\partial U_i / \partial e < 0$ but the presence of intrinsic motivation mitigates this effect since $\partial U_i / \partial \kappa_i e > 0$.

Figure **2.3** shows how the relationship between effort and utility will vary according to the level of intrinsic motivation.

Figure 2.3: Effect of intrinsic motivation on the utility of effort



B. <u>Sources of intrinsic motivation</u>

Three main reasons have been identified to explain the existence of intrinsic motivation.

The first resembles some of the economic models of altruism, if one considers that individuals derive utility from their effort and work in order to boost their self-esteem (Delfgaauw and Dur, 2007). This perspective directly relates to the social psychology literature, and in particular the human needs theory developed by Maslow (Maslow, 1954). In this conceptualisation, intrinsic motivation at work is achieved when work meets the self-esteem (or self-actualisation) needs of individuals – which are the highest in the hierarchy of needs.

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[7] Formally, w_i depends on the effort produced e.

Intrinsic motivation has also been explained by the existence of professionalism (Dixit, 2002) which explains compliance with certain norms. Wilson defines a professional as "*someone who receives important occupational rewards from a reference group whose membership is limited to people who have undergone specialized formal education and have accepted the group-defined code of proper conduct*" (Wilson, 1989 p. 60). Akerlof and Kranton have expanded these arguments and provided a broader framework explaining how individuals in a particular social context or work environment develop a form of intrinsic motivation (Akerlof and Kranton, 2000, Akerlof and Kranton, 2005). In their approach, individuals increase their utility when they perform actions that comply with the norms that form their identity. An individual's identity "*prescribes behavioural norms that circumscribe the life domains that are relatively more important for the sense of self*" (Russo and van Hooft, 2009). A professional identity can set norms dictating the appropriate proportion of time and effort to allocate to one's work, but also about the attitudes, decisions and behaviours. In the case of health care professionals, identity can prescribe that nurses or doctors should always act in the interest of the patient first, even if that means compromising one's interests.

Finally, some authors have postulated that workers can be intrinsically motivated by their job or actions because they contribute to some "*idealistic or ethical purpose*" (Dixit, 2002). This justification was developed by economists to explain the reasons why some people would opt for jobs in non-profit organisations or in the public sector over more lucrative offers in the for-profit/private sector (Bénabou and Tirole, 2006). Starting from the acknowledgment that "*an important distinction between a Government agency and a private company is that the former is instructed to pursue social welfare objectives while the latter is asked to maximize solely shareholder value*" (Dewatripont et al., 1999), economists have assumed that individuals involved in the supply of public goods or working for "mission-oriented" employers (Besley and Ghatak, 2005) derive a satisfaction from their work because it is doing some 'good' and helping others (Dixit, 1997, Dewatripont et al., 1999, Dixit, 2002).

In conclusion, it is interesting to see how the literatures on altruism and intrinsic motivation somehow merge into the literature on public sector motivation. The public administration literature specifically refers to 'Public Service Motivation' and defines it as a "*general, altruistic motivation to serve the interests of a community of people, a state, a nation or humankind*" (Rainey and Steinbauer, 1999) p. 20). In this perspective, the literature on altruism and intrinsic motivation overlap, as intrinsic (public) motivation is generated by the benefits derived by others from one's work. Altruistic individuals driven by a sense of public service provision are the "knights" described by Le Grand (Le Grand, 1997, Le Grand, 2003), rewarded by the act of providing a service to others through their job.

C. Consequences of intrinsic motivation

Theories of intrinsic motivation have underlined three important consequences of the existence of intrinsic motivation.

First, the existence of intrinsic motivation allows employers to pay lower salaries, as the utility generated by the intrinsic motivation compensate for a loss in salary. Economists have underlined how these developments are not true for all firms, but are particularly relevant for the public sector and can contribute to explain the persistence of public-private pay differentials. In this case, intrinsic motivation relates to the type of employer – i.e. belonging to a "mission-oriented" sector (Besley and Ghatak, 2005) – and can explain the heterogeneity of preferences highlighted in monopsonistic labour market models (Bhaskar et al., 2002, Manning, 2003). In the case of nursing, that can explain why they are ready to accept a smaller wage (Heyes, 2005). Economists have described two ways for public or mission-oriented organisations and intrinsically motivated individuals to match. According to some, firms may want to recruit the intrinsically motivated workers by setting low wages (Delfgaauw and Dur, 2007), but this approach will also attract less productive employees. For others, matching agents and principals with similar preferences and purposes is easier, and more closely represents a self-selection process of workers over occupations (or employers) with different attributes (Besley and Ghatak, 2005, Prendergast, 2007). For example, Deflgaauw and Dur show how altruistic workers self-select into the public sector, as contributing to the provision of public goods represents an essential source of satisfaction (Delfgaauw and Dur, 2008)

Second, intrinsic motivation can provide powerful incentives in situations where the self-interest hypothesis predicts the absence of any incentives. Consequently, intrinsic motivation has led to various extensions in the theory of incentives, as economists have sought to determine what would be an optimal incentive schemes for a principal dealing with motivated agents (Benabou and Tirole, 2003). A common finding is that intrinsic motivation lowers the marginal cost of effort; therefore in a principal-agent framework, principals can obtain a certain level of productivity from their motivated workers with smaller incentives than they would have to use with standard workers (Dixit, 2002; Besley and Ghatak, 2005; Delfgaauw and Dur, 2007 and 2008).

Finally, for some financial incentives crowd out intrinsic motivation (Frey, 1997), when they are perceived as controlling. Others have argued that monetary incentives can diminish the reputational value of pro-social actions (Bénabou and Tirole, 2006) or signal a task that is no longer seen as contributing to a greater good (Delfgaauw and Dur, 2007). Since the study by Titmuss (1970) which emphasized that paying for blood donation could have the unintended consequence of reducing voluntary contribution, there has been a growing body of empirical evidence demonstrating this crowding-out effect. For example, studying volunteers in Switzerland, Frey and Götte (1999) have shown that introducing monetary rewards can reduce the number of volunteers. Gneezy and Rustichini (2000) found that giving performance incentives to children collecting donations for a charitable organization was counter-productive. A study in Sweden found evidence supporting Titmuss' original claim as female students were less willing to donate blood when offered monetary incentives (Mellström and Johannesson, 2008).

2.2.3. The motivations of health care workers

This section builds upon different bodies of empirical and theoretical studies to illustrate why altruism and intrinsic motivation are particularly relevant for health care workers.

A. <u>Empirical studies</u>

First, there is broad empirical literature demonstrating the existence of altruistic intrinsic motivation amongst health care providers, which relates to a complex mix of the explanations highlighted above. Many surveys have identified altruistic motives amongst would-be nurses or doctors as a reason for choosing their profession. A study in the United States showed that most nursing students had chosen this career path because they wanted to "help others", and they felt that "being caring" or "compassionate" would help them in their jobs (Prater and McEwen, 2006). A similar study in the UK found that altruism was the most frequently cited reason for wishing to join a health care profession (Miers et al., 2007). In a study amongst high school leavers in South Africa, nearly 90% of those who said they wanted to start a career in nursing justified this choice by the fact that it offered an "*opportunity to care for others*" (Mkhize and Nzimande, 2007). At the same time, qualitative evidence regularly portrays nurses as a category of workers less likely to be influenced by or interested in monetary incentives, but much more by other-regarding sentiments (Kingma, 2003).

Second, studies of vocational motivation suggest that nurses' professional identity directly relates to altruism or others' well being (Kingma, 2003). This view relates to the concept of identity developed by Akerlof and Kranton (2000). The nursing literature has described the existence and role of this set of professional and moral values shared by nurses (Shaw and Degazon, 2008). Arrow argued that physicians' concern for patient welfare has developed to reduce the adverse effects arising from the information asymmetry between patients and physicians (Arrow, 1963). This perspective relates to the idea that health providers' training could aim to "*keep them from abusing their superior knowledge, by installing a sense of moral obligation towards patients into their norms and beliefs*" (Delfgaauw, 2007a).

Finally, a recent study trying to understand the underlying motives of altruism and intrinsic motivation amongst nurses confirmed the approach favouring the willingness to boost one's self-esteem or self-actualisation needs (Zysberg and Berry, 2005). In this case, altruism seems to emerge from the warm-glow effect described by Andreoni (1990).

B. Theoretical models

Considering altruistic health care workers is not uncommon in the health economics literature, and it has figured prominently in theoretical models of physician agency. Indeed, although mainstream models of physician agency follow the neoclassical model of the firm and consider the doctor as a supplier making decisions to maximise his profit, McGuire (2000) underlines that physicians have been considered early on to be good candidates for alternative theories, where the objective functions of the supplier incorporates non-selfish arguments. In his survey of the literature, McGuire highlights several ways that have been used by economists to model physicians' altruistic concerns for their patients: their utility function includes something valued by the patient, either the quality of the quantity of health care received, or the patient's utility itself. Models that have considered altruistic health care workers in the context of job choices are more uncommon.

The empirical literature suggests that nurses somehow self-select into a nursing career because they anticipate that the actions performed during their job will increase their utility. This perspective is true for all types of nursing jobs however, and does not say anything about how health care providers would choose between different employers (in particular public or private ones). Yet, both empirical and theoretical literature suggest that altruism and/or public sector motivation is likely to play a role in the job decisions made by nurses and other health care providers.

Two recent papers predict that altruistic doctors would choose public sector employers (this can be generalised to nurses).

In a model studying the effects of incentives on health care providers, Ma deviates from traditional models that assume that all providers are profit-maximisers, and instead develops a model where some doctors display altruism and do not seek to maximise their material payoffs. The model shows that altruistic physicians self-select into the public sector (Ma, 2007), because altruistic health providers value the services rendered to the patients more than the salary offered, and therefore don't mind the low-powered incentives of the public jobs.

In a similar paper assuming a distribution of altruism amongst physicians, it is shown that those who are the most concerned with their patients' well-being prefer working in the public sector over a private practice (Delfgaauw, 2007a). For the author, this choice stems from the difference in the type of patients seen in each sector, with richer patients seeking care in the private sector. Consequently, he demonstrates that altruistic physicians will prefer the public sector because they can have greater impact on patients' welfare in this sector.

2.3. Empirical approaches to studying nurses' job preferences

Three main approaches have been used to explore empirically the determinants of labour supply choices made by nurses. These include econometric estimations of labour supply functions, qualitative or quantitative investigation of the determinants of job satisfaction, and studies of the determinants of stated job preferences.

The objective of this section was to find key references and studies providing an illustrative overview of the evidence rather than a comprehensive one. In addition to existing literature reviews, a snowballing approach was used to identify further literature, by systematically checking the reference lists of the reviews and other most relevant journal articles. Finally, a complementary literature search was carried out at the end of 2009 to complement existing reviews and identify the most recent references. Details of the literature search can be found in Appendix 2.1.

2.3.1. Econometric models of labour supply

Following the neoclassical model of labour supply, the objective of several economic studies on nursing labour supply was to understand the influence of salaries on the decisions by trained nurses to offer their labour supply on the market, or to increase their number of hours (Shields, 2004). That nurses are mostly female also raised interesting questions in the neoclassical framework, and incited researchers to study the trade-offs between work and household activities, and the influence of household revenues.

The approach undertaken by these studies was to estimate regression models in which the dependent variable was either working hours or participation rates. Such analysis requires rich datasets, sometimes longitudinal (Askildsen et al., 2003, Rice, 2005), which explains why all studies in this literature have taken place in developed countries, and almost exclusively in the United States. Independent variables included salary and basic socio-demographic characteristics (gender, age, household or spouse's income, etc.).

Recent reviews of this literature (Antonazzo et al., 2003, Elliott et al., 2003, Shields, 2004) suggest a rather ambiguous picture of the determinants of nurses' labour force participation in developed countries. One suggests that the variety of results can be explained by the wide array of methods used to estimate supply functions, and the various econometric problems encountered and addressed in different manners (Antonazzo et al., 2003).

Despite this, three findings seem to emerge from this literature (Antonazzo et al., 2003, Elliott et al., 2003, Shields, 2004). First, the impact of salary on nursing labour supply is uncertain. Antonazzo et al. (2003) underline that even the more recent (and refined) econometric models cast some doubt over the role of salaries on labour supply decisions. When working hours are used as a dependent variable, the majority of studies find a positive association, though sometimes very weak or insignificant, and some studies show evidence of a backward bending labour supply function as suggested by the income effect depicted in Figure 2.1B. Salary is generally not found to be significantly related to labour force participation either. Second, two series of factors seem to be negatively associated with labour supply: the wage of the spouse (and household non-labour income), and the presence of children aged under five (while the presence of older children is much less clear). Finally, the age and the education of nurses do not appear to have been significantly linked to labour supply decisions.

In his review, Shields highlights two major shortcomings of this literature. The first concerns the inability of the studies to establish a robust causal effect between wage variations and labour supply, due to the lack of exogenous variations such as the ones provided by a natural experiment. The second relates to the *"lack of control for individual unobservable heterogeneity (e.g. motivation, ability and other personality traits)"* in nurses' decisions (Shields, 2004).

2.3.2. Analysis of job satisfaction and other work outcomes

Although the economic literature provides new insights into the determinants of labour supply decisions, its application to nurses remains very scant. This section presents findings from the empirical literature on job satisfaction from economics and other social sciences. Job satisfaction is a subjective construct imported from social psychology, measuring the *"degree to which employees have a positive affective orientation towards employment"* (Price, 1997).

A. <u>Economic literature</u>

Following the seminal studies of Hamermesh and Freeman, self-reported job satisfaction has been used by economists in empirical studies as a proxy measure of the utility derived from a job (Hamermesh, 1977, Freeman, 1978).

To address the criticisms formulated against the use of such self-reported measures, economists have underlined that they are correlated with observed choices made by workers, such as quitting one's job (Clark and Oswald, 1996). For example, in his original paper, Freeman showed how the probability of leaving one's job was a decreasing function of job satisfaction (Freeman, 1978). A similar relationship was found by subsequent studies (Kristensen and Westergård-Nielsen, 2004) while other economic studies found a correlation between turnover and job satisfaction (Akerlof et al., 1988, Clark et al., 1998). More recently a study showed how the different domains of job satisfaction were able to explain not only whether employees were actively looking for a job, but also to predict the type of employers and sectors where they were looking (Delfgaauw, 2007b).

Evidence on the determinants and influence of nurses' job satisfaction on labour supply outcomes[8] is very scant. Unlike some of the more general economic literature, studies on nurses' job satisfaction have been unable to study relationships between self-reported job satisfaction and quitting behaviours, due to the absence of adequate longitudinal datasets[9]. The most relevant study was carried out with nurses in the UK and showed a positive correlation between job satisfaction and intentions to quit (Shields and Ward, 2001).

B. Psychology and sociology literature

The nursing literature offers a large empirical body of evidence on the sources of nurses' job satisfaction and its correlates with a number of outcomes (absenteeism, intentions to quit, actual decisions to leave), based on models rooted in psychology and sociology. These empirical studies have relied on cross-sectional surveys to collect data on individual and job characteristics, and tools validated to measure job satisfaction (Mueller and McCloskey, 1990, Price, 1997). The methods used in this literature vary, only a small fraction using an index of job satisfaction in a regression model. The key findings from this literature are summarised below, based on several reviews (Lu et al., 2005, Hayes et al., 2006, Coomber and Louise Barriball, 2007).

Mainly rooted in two seminal psychology theories – the Human Needs theory (Maslow, 1954) and the Motivation-Hygiene theory (Herzberg and Mausner, 1959)[10] – the nursing literature on the determinants of job satisfaction (Lu et al., 2005, Hayes et al., 2006, Coomber and Louise Barriball, 2007) has explored the influence of a number of variables suggested as influential on job satisfaction. As a result, a wide range of factors have been tested, and those factors that were found to contribute to higher levels of job satisfaction for nurses can be divided into two groups. The first relates to traditional economic approaches as they can be seen as factors that increase the utility of workers through better present or future monetary returns (better salary, promotion

[8] Labour supply outcomes include outcomes capturing workers' mobility: quitting behaviour, intentions to quit, job turnover.

[9] Such studies require longitudinal datasets where job satisfaction is observed at *t*, and job turnover at *t+1*.

[10] The theory of Maslow identifies five levels of needs (psychological, safety, belongingness/love, self-esteem and self-actualisation) and by extension job satisfaction is then viewed in the perspective of need fulfilment. In contrast, Hertzberg identified two series of factors – factors intrinsic to the nature of the job which were motivators (achievement, responsibility, work itself) and external or "hygiene" factors which were potential sources of dissatisfaction (salary, interpersonal relationships, supervision, etc.).

opportunities, training, job security), less effort (lower workload/less demanding work), or better conditions. In the second group, psychological and organisational factors are more prominent (interaction with patients/workers, management style, praise and recognition, personal achievement).

Studying the relationship between job satisfaction and labour supply decisions, other studies in the nursing literature have mainly relied on the "turnover model" from the organizational sociology literature (Price, 1977, Price and Mueller, 1981, Hayes et al., 2006, Coomber and Louise Barriball, 2007). This model views nurses' turnover (decisions to quit) as the result of job satisfaction and organizational commitment[11], which are themselves influenced by various aspects of working conditions and individual factors. Empirical studies have found that job satisfaction is a good predictor of intentions to leave and sometimes of actual decisions to quit (Lu et al., 2005). In particular, a longitudinal study in an American hospital found that job satisfaction was negatively correlated with nurses' quitting decisions (Mueller and Price, 1990). In contrast, the few studies trying to link measures of absenteeism to job satisfaction were inconclusive (Lu et al., 2005).

Very few studies from developing countries were identified in these reviews. One of the reasons might be that studies from low-income settings have often used work motivation, which is a slightly different construct than job satisfaction, although both are closely related (Dolea and Adams, 2005, Willis-Shattuck et al., 2008). A similar distinction is made between "psychological" (management, recognition) and "materialistic" factors (income, career development or training opportunities, working conditions). However, the working conditions identified in this literature seem to be more important and capture some of the difficulties of health systems in low-income settings (poor infrastructure, lack of equipment).

C. Health systems literature

Due to the critical issue of staff shortage in rural areas, the health systems literature has produced a wealth of studies trying to identify which characteristics are associated with rural employment. These studies have used qualitative and quantitative methods, and have applied different approaches (using outcomes such as job satisfaction, intent to leave, or simply comparing job and individual characteristics between rural and urban post-holders). This literature has been well summarised by several reviews (Brooks et al., 2002, Lehmann et al., 2008, Grobler

[11] This literature distinguishes several constructs: job satisfaction, pay satisfaction, organisational commitment, and work motivation.

et al., 2009) and three series of determinants have been found to be associated with a greater likelihood to like or be in a rural position: individual characteristics, work-related factors and broader environmental characteristics.

Several individual factors were consistently found to be associated with working in rural areas. A systematic review showed that rural background was associated with rural practice in 10 out of 12 case-control or retrospective cohort studies (Laven and Wilkinson, 2003). The spouse's background (of rural origin or not) was also influential. Finally, health professionals who report altruistic values or involvement in volunteering activities were more likely to practise in rural areas (Dieleman et al., 2003, Wilson et al., 2009). In contrast, there has been mixed evidence on the association between gender and working in a rural area (Laven and Wilkinson, 2003, Wilson et al., 2009).

A wide range of unsatisfactory working conditions has been found to be associated with intention to leave rural areas or dissatisfaction at working in such places: low salaries, higher workload due to staff shortage, lack of clinical practice, poor infrastructure and working conditions, and professional isolation (Farooq et al., 2004, Wilson et al., 2009). However, although they remain marginal, some studies have emphasized the positive impact of factors such as prestige in small communities (Page et al., 1992, Siziya and Woelk, 1995, Dieleman et al., 2003) or better contact with patients (Dagnew et al., 1992, Dieleman et al., 2003) that might increase intentions to stay in a rural area.

Finally, this literature underlines the broader living conditions, and environmental factors such as poor quality of life, poor access to social amenities and infrastructures (in particular schools for children), and lack of job opportunities for the spouse, as reasons for dissatisfaction with being in rural areas (Eisenberg and Cantwell, 1976, Page et al., 1992, Agyepong et al., 2004, Tolhurst et al., 2006). All these reasons were underlined in the case of South Africa (Sankar et al., 1997, De Vries and Marincowitz, 2004).

In conclusion, findings from this varied body of literature underline the limitations of the empirical approach described in section 2.3.1, as they suggest that a wide range of individual, environmental and work-related factors are likely to influence the decisions made by nurses. By highlighting the importance of working conditions, they confirm some of the insights from the compensating wage differential model, while the influence of individual characteristics they underline tends to validate the theoretical studies highlighting the importance of heterogeneity of tastes.

2.3.3. Discrete choice experiments of job preferences

More recently, a third approach to studying the determinants of nurses' job preferences has been developed, using a stated preference technique called Discrete Choice Experiments (DCEs).

Originally, DCEs are a quantitative methodology for evaluating the relative importance of different product attributes that influence consumer choice behaviour (Louviere et al., 2000). This technique has its origins in the economic theory of demand, and especially in the work of Lancaster, who proposed that the demand for goods was effectively demand for a specific combination of product characteristics (Lancaster, 1966).

Rather than evaluating the decisions that workers have actually made, this methodology analyses the stated preferences of health workers for different job characteristics. In choice experiments, respondents are asked to make choices between hypothetical job descriptions, where each job description is defined by several characteristics called "attributes" (such as salary, hours worked, available equipment, type of administrative tasks, etc.). DCEs then use regression techniques to model respondents' choices as a function of the scenario attributes. The significance and magnitude of the regression coefficients indicates the relative importance of those attributes which statistically influence respondents' choices and the ratio of any two coefficients represents the rate of substitution between them. Performing regressions for different sub-groups of health workers can be used to reveal differences in their preferences. The investigation of stated preferences by means of DCEs has been used by economists in other fields, such as transport or environmental economics (Louviere et al., 2000), to study the determinants of choices that cannot be easily observed in the market or for which a market does not exist (van Soest et al., 2007)[12].

There are still only a small number of studies that have used this methodology to analyse the choices of health workers. A recent review identified 11 studies using DCE techniques (Lagarde and Blaauw, 2009), most of which have been used in developing countries[13], only three of which focused on nurses (Penn-Kekana et al., 2005, Mangham, 2007, Hanson and Jack, 2008).

Overall, existing DCEs on health worker preferences show that non-financial aspects are often more powerful than financial ones. Several aspects relating to quality of life (fewer hours per week and less after-hours work in developed countries; the provision of better housing and

[12] A more detailed presentation of the theoretical framework underpinning DCE studies is presented in Chapter 6. This chapter also explains in greater detail when the use of DCEs is justified, and it describes issues in design and analysis of DCEs.

[13] Four of these studies were from the United Kingdom. Other countries included Indonesia (Chomitz et al. 1998) South Africa (Penn-Kekana et al. 2005), Malawi (Mangham and Hanson 2008), Ethiopia (Hanson and Jack 2008) and Tanzania (Kolstad, 2008).

improved work conditions in developing countries) are positively valued by health workers in most countries. In developing countries, the importance given by health workers to education opportunities appears to emphasise the potential relevance of the Human Capital theory for occupational choices.

Unlike studies of job satisfaction, DCEs force respondents to make trade-offs, thereby revealing and quantifying their underlying hierarchy of preferences. Although increased salaries always feature as a key determinant of job satisfaction, studies based on traditional questionnaires have failed to provide evidence of the relative importance of salary compared to other job characteristics. In contrast, DCEs enable comparison of the relative value of job characteristics by computing the marginal rates of substitution (ratios of coefficients) between an attribute and salary. This provides an empirical test of the compensating wage differential theory. For example, a study on GPs in England found that they would require an annual compensation of £5,029 to work with highly deprived patients (Gosden et al., 2000).

DCEs also emphasise the existence of heterogeneity in workers' tastes, and the importance of investigating the preferences of different sub-groups. For example, a DCE from Tanzania showed that women were less sensitive to pecuniary incentives and more concerned with facility upgrading than men (Kolstad, 2010), while in South Africa nurses working in rural areas were more concerned about facility management than urban nurses (Penn-Kekana et al., 2005).

Finally, DCE studies proved particularly relevant for investigating the potential effects of interventions to influence job preferences. The more recent DCE studies provide a list of possible policies to influence health workers' job choices, particularly addressing staff maldistribution and encouraging them to take up positions in under-served areas. Using the respondents' responses to model fabricated scenarios, the authors computed the expected effects of such policies. For example, the study in Ethiopia (Hanson and Jack, 2008) showed that the provision of superior housing would increase the proportion of doctors willing to take up positions in rural areas by more than 250% (from 7.5% to 26.9%), while a reduction in time commitment to the public service would have a non-significant effect.

In conclusion, DCEs have confirmed the limitations of the econometric approach presented in section 2.3.1, as they have demonstrated that health workers make trade-offs between various job characteristics to choose a position, not just the salary. They have also underlined the existence of heterogeneous preferences amongst health workers.

2.4. Policy interventions to attract and retain health workers in rural areas

Because guaranteeing equitable access to health care to the population has been identified as a critical problem, governments in both developed and developing countries have tried to increase the number of health workers in rural areas. This final section reviews the literature on policy interventions that have been introduced both in developed and developing countries to attract health workers (not just nurses) to rural areas. This literature constitutes a logical policy application of the determinants of health workers' job choices.

This section relies mainly on recently published reviews, which were updated at the end of 2009 with a literature search whose complete details are provided in Appendix 2.1. This review does not seek to be comprehensive, but rather to provide an illustrative list of the array of policy levers that have been used. Some of the reviews identified a wide array of interventions (Sempowski, 2004, Henderson and Tulloch, 2008, Lehmann et al., 2008, Grobler et al., 2009), while others critically assessed the evidence of the effects of some of these policies (Sempowski, 2004, Grobler et al., 2009, Wilson et al., 2009). The bulk of this literature reports interventions in the United States, Canada and Australia.

2.4.1. Categorising policy interventions

This brief introduction highlights the links between existing policy interventions and the preceding sections that detailed the theoretical and empirical literature on the determinants of job choices. Since the supply of adequate human resources (HR) for health care services requires first training and then hiring health providers, HR policies can be divided into "upstream" and "downstream" interventions.

Downstream interventions pertain to policies that change the working conditions in rural jobs. These measures aim to retain staff already in post or attract some new health workers, by improving jobs in rural areas, through financial incentives or others.

Upstream interventions relate to the selection and training of future health professionals. They rely on the assumption that there are heterogeneous tastes for different jobs, and seek to select individuals who are more likely to like rural jobs. These measures can also try to influence individuals' tastes during their training (e.g. sensitising individuals to rural settings).

2.4.2. Downstream measures

Four major types of "downstream" interventions have been implemented: direct or indirect financial incentives, provision of education opportunities, interventions supporting the work of health professionals and regulatory mechanisms (see Table 2.1 for an illustrative list).

Direct financial incentives to attract health workers in under-served areas have been widely used, and have mainly taken two different forms. The most common strategy in developed countries has been to provide direct rural allowances to compensate health workers who chose to practice in under-served areas (Eisenberg and Cantwell, 1976, Kristiansen and Forde, 1992, Fournier, 2001, Sempowski, 2004). In developing countries, direct financial strategies of one sort or another have also constituted the majority of interventions, in the form of rural allowances (Adams and Hicks, 2000, Mauritius Ministry of Health and Quality of Life, 2003, Wibulpolprasert and Pengpaiboon, 2003, Schwabe et al., 2004, Koot and Martineau, 2005, Dambisya, 2007, Dovlo, 2007). Indirect financial incentives have been quite different in developed and developing countries. In high-income countries, governments have provided health professionals with housing (Hegney et al., 2002, MacRae et al., 2007) or financial help (tax-free grants, bursaries) with a commitment from health workers to work in rural areas (Eisenberg and Cantwell, 1976, Wilson et al., 1998, Sempowski, 2004). Similar measures have only been adopted in Thailand, with scholarships conditional on rural postings (Wibulpolprasert and Pengpaiboon, 2003). In other developing countries, the range of interventions has been wider. Some have provided free or subsidised housing (Lindelöw et al., 2004, Schwabe et al., 2004, Dambisya, 2007). Others have provided loan facilities (Koot and Martineau, 2005) or allowed quicker career enhancements. For example, in Mozambique health workers get a 50% bonus when calculating their years of service (Wibulpolprasert and Pengpaiboon, 2003, Lindelöw et al., 2004).

Other interventions have included the possibility of benefiting from various training opportunities to enhance workers' skills through formal training (i.e. degrees) or on-the-job opportunities (Mauritius Ministry of Health and Quality of Life, 2003, Wibulpolprasert and Pengpaiboon, 2003, Dräger et al., 2006).

Improving working conditions in remote areas has also been an objective for diverse policies. Direct measures have included allowing flexible arrangements (Mackintosh, 2003, Dovlo, 2007), or improving means of communication (Wibulpolprasert and Pengpaiboon, 2003, Schwabe et al., 2004, Dräger et al., 2006, Dambisya, 2007). Furthermore, some attempts have been made to increase the status of those working in rural areas (Wibulpolprasert and Pengpaiboon, 2003).

Several developed countries have also introduced indirect support measures by professional support to the staff sent to remote areas (Jones et al., 2004, Orpin and Gabriel, 2005).

Table 2.1: Categories and examples of downstream interventions, by type of countries

Intervention	Examples of developed countries that introduced the measures	Examples of developing countries that introduced the measures
Direct monetary incentives		
Financial incentives/allowance	New Zealand, USA, Norway, Canada	Namibia, South Africa , Zambia, Lesotho, Malawi, Mauritius, Thailand, Vietnam, Philippines
Indirect monetary incentives		
Fellowships/positions granted to staff working in rural areas preferably		Namibia, Tanzania
Loan forgiveness or repayment by service in rural areas	USA , Canada	Thailand
Career enhancement		Mozambique, Thailand
Housing provision	Canada, Australia	Thailand, Lesotho, Mozambique
Provision of free health care		Malawi, Mozambique
Loan facility		Zambia
Education measures		
Continuing education programmes/ privileged training opportunities	Canada	Kenya, Mauritius, Thailand
Support measures		
Professional (visits from senior colleagues) and/or psychological support	Australia, Canada	Thailand
Flexibility (part time arrangements, rotation between rural and urban areas)		Zambia, Malawi
Improved communication means (IT support)		Kenya, Lesotho, Thailand
"Social" recognition awards		Thailand
Coercive measures		
Recruitment of foreign health professionals	USA	Zambia, Mauritius, South Africa
Compulsory service in rural/underserved areas (before registration/specialisation), with or without buying out option		Russia, Mexico, Ecuador, Bolivia, Cuba, Dominican Republic, Nigeria, South Africa, Thailand, Namibia, Zambia
Service-requiring scholarships or student loans	Canada, Japan, USA, New Zealand	South Africa, Thailand

Finally, coercive mechanisms such as compulsory service in under-serviced areas, either before or after registration, or as a pre-requisite for specialization have been used to increase the number of health professionals in rural areas (Grobler et al., 2009). These strategies have been particularly favoured by developing countries which have also chosen compulsory strategies of mandatory placements in rural areas (Danielson, 1979, Ugalde and Homedes, 1988, Rubel, 1990, Asturizaga Rodriguez, 1996, Malaga, 1997, Sankar et al., 1997, Cavender and Alban, 1998, Maseka et al., 2002, Wibulpolprasert and Pengpaiboon, 2003, Reid, 2004, Dovlo, 2007). In developed countries (e.g. USA, Canada, Japan) compulsory rural placements have been typically linked to the provision of scholarships or student loans (Sempowski, 2004, Barnighausen and Bloom, 2009). Another regulatory measure has been to recruit and send foreign health workers to those areas in exchange for the recognition of their degrees (Volmink et al., 2006). This has been adopted on a very small scale by South Africa through bilateral agreements, involving the recruitment of doctors from Iran and Cuba, and nurses from India (Gilson and Erasmus, 2005).

2.4.3. Upstream measures

There have been two types of upstream strategies to attract health workers who would be more likely to work in rural areas: those selecting students and those trying to sensitise future health workers to rural areas during their training. Table 2.2 summarises some of these experiences.

Table 2.2: Categories of upstream interventions, by type of countries

Intervention	Referenced examples of high-income countries that introduced 'upstream' measures	Referenced examples of low- and middle-income countries that introduced 'upstream' measures
Selection		
Reserved entry or quotas for people from rural background	Australia, USA, Japan	Thailand, Mauritius
Scholarships for students with rural background	Australia, USA, Japan	
Sensitisation to working in rural areas		
Location of training sites in rural areas	Australia, Canada, Japan, Norway,	Thailand
Rotations in rural areas during training	Australia, Canada, USA	Thailand
Curriculum content (emphasis on rural/community medicine)	Australia, USA	
Role models encouraging practice of community (rural) medicine	USA	

In recognition of the limitations of reward systems, several countries have tried to encourage the recruitment of students more likely to be attracted by rural areas (Rabinowitz et al., 2000). Such strategies have aimed at selecting students with rural origins via quotas (Rabinowitz, 1983, Brazeau et al., 1990, Inoue et al., 1997, Laven and Wilkinson, 2003) or bursaries (Rabinowitz, 1983, Inoue et al., 1997, Laven and Wilkinson, 2003). Some authors have highlighted the limitations of these strategies, including the possibility of gaming through a late relocation to rural areas to qualify for the guaranteed quotas (Wibulpolprasert and Pengpaiboon, 2003). Other strategies have included the preferential selection of students with a stated intention to work in such areas (Rabinowitz, 1983, Volmink et al., 2006).

Many developed countries have also tried to increase the sensitisation of enrolled students to remote and disadvantaged areas. To that end, countries have purposefully located training sites in hardship areas (Magnus and Tollan, 1993, Inoue et al., 1997, Crump, 2002, Sullivan and Oreilly, 2002, Laven and Wilkinson, 2003, Hsueh et al., 2004, Lea and Cruickshank, 2005, Chopra et al., 2008), made rotations in those areas compulsory (Rabinowitz, 1983, Wilson et al., 1998), or increased sensitisation through curriculum content (Rabinowitz, 1983, Brazeau et al., 1990, Margolis et al., 2005, Wilson et al., 2009) or role modelling (Rabinowitz, 1983, Brazeau et al., 1990, Margolis et al., 2005). In contrast, very few developing countries have promoted the recruitment of students with stronger commitment to rural areas and/or exposed them to working in rural areas during their training (Chomitz et al., 1998, Wibulpolprasert and Pengpaiboon, 2003).

2.4.4. Evidence of effectiveness

A recent Cochrane review of the effects of interventions in increasing the proportion of health professionals practising in rural and underserved areas concluded that *"there are no studies in which bias and confounding are minimised to support any of the interventions that have been implemented to address the inequitable distribution of health care professionals"* (Grobler et al., 2009). Their conclusion was based on the absence of study that met their rigorous inclusion criteria, which would have ensured minimal bias in the results[14]. Yet, there is a growing recognition that other types of studies can provide rigorous evidence to inform debates on the usefulness and effects of health systems policies (Mills et al., 2008). This is the reason why a separate review was published that included all studies (typically longitudinal or multivariate analyses) that had not met the inclusion criteria of the Cochrane review, but still provided some evidence of the effects of interventions or of associations between individual characteristics and rural service (Wilson et al., 2009). The conclusions of that review are provided in Table 2.3.

According to Wilson et al. (2009) the programmes that seem to have obtained the best results have undertaken a mix of 'upstream' interventions, such as selecting rural students and training them in rural areas (Rabinowitz, 1983, Brazeau et al., 1990, Rabinowitz, 1993, Hsueh et al.,

[14] To be included in the systematic review, a study had to be a (cluster) randomised controlled trial, a controlled before-and-after study, or an interrupted time-series study.

2004). Students with rural origins or those who had trained in rural training institutions were often found to be more likely to work and remain in rural areas (Rabinowitz, 1988, Magnus and Tollan, 1993, Rabinowitz et al., 1999, Hsueh et al., 2004, Inoue et al., 2007).

Table 2.3: Summary of evidence strength

Category	Possible and actual interventions	Strength of evidence
Upstream measures		
Selection	Reserved entry or quotas for people from rural background / Scholarships for students with rural background	Good[a]
Sensitisation	Training centres in rural areas	Good
	Rural exposure during training	Moderate[b]
Downstream measures		
Direct financial incentives	Financial compensation	Moderate
Indirect financial incentives	Scholarship with rural service	Moderate
	Other interventions	Absent
Support measures	Time off	Weak[c]
	Professional support	Weak
	Family and lifestyle issues	Weak
Coercive measures	Compulsory rural service	Weak
	Rural service pre-requisite for specialisation	Weak
	International recruitment	Moderate

Source: (Wilson et al., 2009)
[a]Good quality: "*consistent findings from multiple studies (retrospective and/or prospective) performed in various settings, where the independent effect of the particular variable was confirmed through multivariate analysis*".
[b]Moderate quality: "*which was defined as 'consistent qualitative and/or quantitative findings from multiple studies and in various settings, but without multivariate analysis*".
[c]Weak quality: "*qualitative and/or quantitative findings that were inconsistent across studies or only reported in a single study*".

Systematic reviews of the evidence have underlined the low quality of evidence on the impact of financial incentives. Existing evidence suggests mixed results, in particular when buying-out options were available (Sempowski, 2004). Besides, potential success might have been linked to a combination of financial incentives and other interventions (Wilson et al., 2009), or to the existence of a high debt load amongst students (Sempowski, 2004).

There is some evidence of moderate quality suggesting that coercive measures can address recruitment issues in rural areas, but it remains questionable whether they can make a difference in the long run (Wilson et al., 2009). Some evidence shows that coercive strategies may actually be detrimental if community service is enforced in an unsupportive environment (Reid, 2001). There is also anecdotal evidence that such policies have often been undermined by corruption or by-passing strategies (Wibulpolprasert and Pengpaiboon, 2003). Similarly, recruiting foreign doctors seems to offer an effective short term solution to importing countries, but often initiates a domino effect in the exporting country, which is the reason why this strategy has not been promoted widely in developing countries (Wilson et al., 2009).

The paucity of evidence on the effects of HR interventions is met by an absence of evidence on their costs (and *a fortiori* their cost-effectiveness). None of the articles referenced here contains information on the cost of interventions. A specific search of the economic evaluation literature[15] was undertaken to verify the absence of relevant studies. Economic evaluations relating to HR in the health sector were exclusively concerned with staffing levels and staff mix, and all studies pertained to developed countries. No study was found that dealt with HR interventions addressing staff shortages. Only one study was found (Jung et al., 1991) that evaluated and costed a peer support programme to retain nurses in a hospital in the US, but it failed to carry out a proper economic evaluation.

Overall, the potential impact of policy interventions to redress the geographic imbalance between rural and urban areas remains unsatisfactory. One of the reasons is likely to be that measuring the impact of complex HR interventions is difficult, as many strategies require national policy changes and prevent the existence of a counterfactual (Mills et al., 2008).

Two other important questions for policy makers remain unanswered. First, policy-makers might be interested to know how different combinations of interventions could be effective – which is even more difficult to test. Second, for the interventions for which there are reasonable grounds to introduce them, such as financial incentives[16], many essential questions remain regarding their relative impact (e.g. what is the elasticity of labour supply for rural positions?), and their cost-effectiveness compared to other possible interventions.

2.5. Conclusions

2.5.1. Lessons from the normative literature

Starting from a neoclassical framework where agents offering their labour are only interested in maximising the monetary benefits they can derive from their job, the evolution of the labour economics literature has departed from these simplistic assumptions. More satisfying models have been introduced that show how jobs differ from one another by their characteristics, and how individuals derive utility not only from salary but also from good and bad working conditions.

[15] Using the Health Economic Evaluations Database (HEED), a broad search of the health economics literature was realised, using limited key terms in the title ("nurse", "doctor", "shortage", "staff", "personnel", "human resources").
[16] There is reasonable theoretical justification, as well as empirical evidence of moderate quality.

At the same time, recent developments in labour economics have sought to abandon the simplifying assumption of homogenous preferences amongst workers, and argued for a heterogeneity of tastes in labour market decisions that can be justified by non-economic preferences. Although most of these models fail to explain the nature and origin of these varying preferences, it is now accepted that different workers will be attracted by different types of jobs, leading to a wide dispersion of wages and working conditions.

The development of behavioural economic models has provided new insights into the determinants of individual behaviours, beyond the traditional emphasis on economic incentives. In particular, the role of altruistic motives and professional identity have been postulated to be a potential source of intrinsic motivation of workers. To the extent that these factors influence the importance individuals attribute to job characteristics, they have economic value since they may be sources of different job preferences among individuals.

2.5.2. Lessons from the empirical literature

The recent extensions of the normative literature on the determinants of individual behaviours, and the role played by altruistic motives or intrinsic motivation have not been directly applied to empirical studies of occupational choices. The economic empirical work on the determinants of nurses' labour market decisions has been dominated by the role of financial incentives in influencing behaviour. Yet there is evidence from a vast and varied empirical literature from developed and developing countries suggesting that if financial motives are important for job choices, other work-related and environmental factors matter as well. There is also evidence of heterogeneity in health professionals' career preferences.

A few conclusions emerge from the survey of the empirical literature on the methods used to study nurses' labour supply in relation to the study of South African nurses' choices.

The econometric evaluation of labour supply functions is inadequate for the study of South African nurses' job choices for two reasons. First, such research is not possible in most developing countries in general and South Africa in particular, because longitudinal data on nurses are not available, and labour market surveys that could provide information on nurses are not detailed enough (Statistics South Africa, 2008b). Second, this approach mainly focuses on participation decisions (participating or not, working part-time or full-time, etc.). It is not adequate for the study of choices made by nurses between different employment opportunities.

Unlike the traditional econometric approach which focused on the role of salaries and was grounded in the neoclassical model, the job satisfaction literature is more related to the theory of compensating wage differentials. The job satisfaction literature has studied and provided evidence of the role of a wide range of factors, such as personal work ethic, remuneration, working conditions and career opportunities. However, this literature is intrinsically limited in two ways. First, self-reported job satisfaction measures provide no quantified evidence on the relative importance of the different job characteristics in different contexts. Second, despite some convincing studies, self-reported measures of satisfaction cannot be equated to job choices made by workers (Levy-Garboua and Montmarquette, 2007), and there are examples of discrepancies between self-reported measures or intentions and actual choices. For instance, a recent study in Taiwan found a positive correlation between self-reported job satisfaction of nurses and their intentions to quit (Chen et al., 2008). However, three years later, job satisfaction was a poor predictor of actual quitting decisions.

The use of discrete choice experiments to study the job preferences of health workers presents a number of advantages. First, it provides a flexible framework to study the utility derived from a variety of job offers. In all studies, the range of levels was broader than those offered on the job market at the time of the study. In particular, the range of salaries was often widened, which allowed testing of the potential effects of an increase in remuneration. Second, DCEs help understand better the potential heterogeneity in tastes, as well as self-selection behaviours which are otherwise difficult to observe. Finally, this approach does not rely on existing datasets and therefore can be easily applied in a data-poor setting.

2.5.3. Identified gaps

Four gaps in the literature may be identified.

First, despite their increased recognition as key determinants of individual behaviour, very little attention has been given to the role of altruism in labour supply choices. More particularly, very little work has been done to investigate whether altruistic characteristics could contribute to choosing to work in the public sector or in rural areas.

Second, the few quantitative studies that have attempted to determine the preferences of nurses in developing countries have usually focused on a restricted number of job opportunities (e.g. usually public sector positions), potentially leading to biases. No quantitative analysis has been undertaken to understand the driving factors of nurses' career choices (private vs. public, domestic vs. overseas, urban vs. rural).

Third, despite a growing interest in HR issues, the design of policy interventions to address rural shortages rests mostly on evidence from developed countries. Quantitative evidence is needed to help policy-makers shape the policies that could be effective to redress the imbalance of the health workforce in developing countries.

Fourth, there has been no investigation of the cost-effectiveness of alternative policy options to address rural shortages. In particular, the comparison between 'upstream' strategies (selecting more suitable candidates) and 'downstream' strategies (improving working conditions) has never been made.

The present research seeks to address these gaps in the context of the nursing labour market in South Africa.

Chapter 3 - Study objectives and design

This chapter presents the theoretical framework used in this thesis, it details the hypotheses to be tested in the empirical analysis and describes briefly the empirical approach used. It is constructed as follows. The first section presents the objectives of this work, and details each of the sub-questions. The second section draws on the literature reviewed in the preceding chapter and provides an overview of the conceptual framework underlying this work. The third section provides a general outline of the empirical approach used and briefly explains the context of this thesis. The fourth section presents information related to the study population and justifies the empirical approach used. Finally, the last section briefly explains some of the ethical issues raised by this research and how they were addressed.

3.1. Study objectives

The work aims to investigate the determinants of job choices in the context of the nursing labour market in South Africa, in order to identify efficient policies to remedy the lack of nurses in rural areas. There are four specific objectives in this work:

1. To investigate the nature and determinants of South African nurses' altruism
   i. Are South African nursing students more altruistic than economic students?
   ii. What are the determinants of South African nurses' altruism?

2. To study the determinants of nurses' labour market preferences
   i. What are the preferences of new nurse graduates for the various opportunities offered to South African nurses?
   ii. What is the relative impact of financial and non-financial job characteristics?
   iii. Does altruism or public sector motivation affect nurses' career preferences?

3. To investigate the effectiveness of different interventions to attract nurses to rural areas
   i. What interventions are the most efficient to increase the uptake of rural jobs?
   ii. What is the impact of individual characteristics on the likely effectiveness of policy interventions?

4. To carry out an economic analysis of different policy interventions
   i. Which interventions to attract nurses to rural areas would be the most cost-effective?
   ii. Are upstream measures more cost-effective than downstream measures?

3.2. Conceptual framework

3.2.1. Rationale for a public intervention in the nursing labour market

The importance of human resources for the provision of health services has been underlined by policy initiatives (Joint Learning Initiative, 2004, WHO, 2006) and by ecological evidence of a positive correlation between the population density of health care providers in a country and the coverage achieved for cost-effective health interventions (Anand and Barnighausen, 2004, Speybroeck et al., 2006). In South Africa, concern over human resources has been a prominent theme in the transformation of the country's health system, and it remains a critical area where issues must be addressed to be able to provide good quality care to all populations in the country.

As detailed in Chapter 1, the long-term supply of nurses[17] is mainly driven by exogenous factors (statutory age for retirement, age distribution of the current nursing workforce, mortality rate) or regulatory decisions that can hardly be affected by the South African Department of Health[18] (Coovadia et al., 2009). The inadequate production of nurses by training institutions has resulted in an insufficient number of nurses currently available on the labour market to work. In addition, the distribution of this workforce between private and public sectors on the one hand, and rural and urban areas on the other hand, is particularly unbalanced. This double imbalance is especially detrimental in the more rural parts of the country where the more disadvantaged and vulnerable populations can only receive health care in public facilities[19] that suffer more acutely from the lack of nursing staff (Coovadia et al., 2009).

Redressing the unbalanced distribution of staff between rural and urban areas is a public health priority for the South African authorities. As a result of the wage rigidities in the public sector and national budget constraints, wages cannot be used to reach an equilibrium level that would contribute to address the unequal distribution of staff between rural and urban posts. Consequently, alternative public sector interventions are necessary to address this issue and two questions should be answered to help design potential future policies:

1. What individual characteristics are associated with a greater willingness to work in rural areas?

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17 Defined as the number of adequately trained nurses who are available to work as a nurse, as opposed to the short-tem labour supply, which pertains to the decisions made by existing (trained) nurses to participate or not in the labour market.

18 In particular, the capacity of the education system and the level of tuition fees depend on decisions made by the Departments of Education and Finance.

19 Private providers are not attracted to these areas because they are not profitable enough, mainly because populations are too scattered and poor to constitute a sufficient demand for expensive private health services. One exception is the presence of health care providers linked to and organised by mining companies, for their employees and their families.

2. What job characteristics are more likely to attract nurses to rural positions?

Answering the first question provides information shaping the design of upstream interventions, while responses to the second inform the design of downstream interventions (see Chapter 2).

To understand how individual and job characteristics affect individuals' labour market decisions, a model of occupational choice is developed, building upon the theoretical literature analysing labour supply decisions. The theoretical framework also incorporates behavioural economic theories of motivation.

3.2.2. A model of labour choices

The conceptual framework developed below focuses only on the individual decisions made by health workers when they choose a job. Therefore it excludes broader labour market issues, such as the determinants of the demand for health professionals, which would be relevant in a general study of health care labour markets and their functioning. A more focused approach has the advantage of making hypotheses more evident and easier to test empirically.

Further, this framework considers individuals who have already chosen to participate in the labour market, and are about to choose between different job options. Formally this means that it is assumed that job opportunities on the labour market offer salaries greater than the reservation wage w_0 of the representative agent. Considering the amount of theoretical and empirical literature (in particular on nurses) that has been concerned with the analysis of decisions to work or not, the perspective chosen here is quite restrictive. However, it is justified by the purpose of the study, which looks at choices between job alternatives. Further, considering the economic context in South Africa (see Chapter 4) this does not appear an unreasonable assumption for two reasons. Firstly, it is reasonable to assume that the reservation wage of the average graduating nurse will be quite low, considering the time and money invested in nursing training. Secondly, nurses' salaries are much higher than the average salaries offered on the labour market.

Following the compensating wage theory (Smith, 1776, Rosen, 1986), the utility derived from a particular job is determined by the job characteristics:

$$U_L = (e, w_L, Y_L, X_L) \qquad (3.1)$$

where w_L is the salary offered with job L, e is the effort provided to perform job L (this encompasses hours of work, as well as the cognitive and physical activities used to perform the job), Y_L are pleasant working conditions, and X_L unpleasant working conditions. For the moment it is assumed that the marginal utility of salary and pleasant working conditions are positive

($\partial U/\partial w>0$ and $\partial U/\partial Y_L>0$) while the marginal utility of effort and unpleasant working conditions are negative ($\partial U/\partial e<0$ and $\partial U/\partial X_L<0$). It is also possible to hypothesise that pleasant working conditions include training opportunities – the better the training opportunities, the greater the expected future financial returns.

When choosing between different job opportunities, individuals will compare the levels of utility provided by the various jobs, and choose the one that maximises their utility. If one follows the implications of the compensating wage theory, wages will perfectly reflect variations in working conditions, and maintain the same level of utility – i.e. salaries will increase with poor working conditions and decrease with good ones. Therefore, assuming that the effort required by nursing jobs is the same in all jobs, workers choosing between two jobs will end up comparing the wages, and choose the job offering the highest salary. This is the reason why the neoclassical theory predicts a perfectly elastic labour supply and a unique equilibrium wage.

However, the existence of wage rigidities due to labour union agreements, public sector wage scales or imperfect information on working conditions, means that actual wages will probably not reflect the equilibrium wages (suggesting that wages will not represent health workers' willingness to be compensated for job characteristics). Furthermore, it has been assumed that the level of utility derived from job L did not depend on individual characteristics.

The remainder of this section analyses the implications for job preferences when assumptions in this initial model setup are relaxed. First, sub-section 3.2.3 describes some of the key aspects of nursing jobs that create heterogeneity of job offers available in the labour market; then section 3.2.4 addresses the consequences of heterogeneity in health workers' tastes and characteristics.

3.2.3. Heterogeneity of nursing jobs

This section presents some of the key characteristics that are likely to distinguish nursing jobs from each other. This is not meant to capture all the possible characteristics that can differentiate jobs. Instead this section focuses on those attributes that are highlighted as important in the theoretical literature presented in Chapter 2, and relevant for the study of nurses' choices in developing countries (as underlined by the empirical work presented in section 2.3).

A. Public vs. private jobs

A first division can be established between jobs in public or private organisations. Economists and social scientists have emphasised how the public and private sectors usually differ in their purposes and incentives (Perry and Wise, 1990, Dixit, 1997, Dixit, 2002). Although one could argue that private and public health care providers are both contributing to an *"idealistic or ethical purpose"* (Dixit, 2002), and are both involved in the provision of a *"public good"* (Besley and Ghatak, 2005), major differences remain between both sectors. In fact, the definition provided by Dewatripont et al. in section 2.2.2 also applies to health care providers: a government agency *"is instructed to pursue social welfare objectives while [a private company] is asked to maximize solely shareholder value"*[20] (Dewatripont et al., 1999). This typically translates into divergent health financing characteristics. In the public sector, poorer population groups are often exempted from payment and taken care of, while they generally cannot afford care in the private sector, where patients are asked to pay out-of-pocket (or covered by a private health insurance they have taken). This is particularly true in South Africa where the private sector caters for the wealthier, healthier segment of the population (see next chapter).

B. Urban vs. rural jobs

A second distinction between nursing jobs that is particularly relevant for developing countries is whether they are in rural or urban areas. Indeed, rural or isolated areas are associated with an objective reduction in welfare due to greater distance to markets, restricted variety of goods and services, and worse access to infrastructures such as schools. This situation is true for most countries, but more acute in developing countries where recent evidence also suggests that there is a lack of subjective well-being (Fafchamps and Shilpi, 2007). Consequently, job opportunities in those areas are much less attractive to workers, as supported by empirical evidence from the health systems literature (see for example Lehmann et al. (2008) and overview in section 2.3.2). Furthermore, in most low and middle-income countries, positions in health facilities located in remote areas are also associated with poorer working conditions (for example there are more frequent shortages of medical supplies and drugs due to logistical difficulties on the supply chain, infrastructures are usually poorer because they can be less easily managed, and health workers suffer more from professional isolation). The utility of a job is therefore directly affected by the broader living conditions R_L offered by the region it is located in:

$$U_L = (e, w_L, Y_L, X_L, R_L) \qquad (3.2)$$

[20] This is particularly relevant for South Africa, where the main employers for nurses in the private sector, large hospital groups, are listed on the local stock exchange.

Typically in developing countries, $\partial U/\partial R_L < 0$ in rural/isolated areas and $\partial U/\partial R_L > 0$ in urban areas.

3.2.4. Heterogeneity of workers' tastes

When the model is extended to heterogeneous individuals, the utility derived from a job L is no longer expressed as in equation (3.1) but instead integrates a new parameter Z_i that represents the role of individual characteristics of worker i:

$$U_{iL} = (e, w_L, Y_L, X_L, Z_i) \qquad (3.3)$$

In the Roy model of self-selection, individuals choose between two types of jobs based on an assessment of their own abilities and characteristics (Roy, 1951). In the original model, individuals with different abilities will have a different productivity in the two sectors and earn different income. This framework can be extended to reflect how individual characteristics interact with job characteristics to produce different levels of utility for a worker. It is possible to extend this framework to assume that some of the inherent job characteristics described in section 3.2.3 above are going to interact with individual characteristics, so that job characteristics will be perceived differently by different individuals, thereby leading to different levels of utility. Here the consequences of workers who differ in altruism, and who differ in their preferences for job locations, are considered.

A. Altruistic health workers

Here, a first hypothesis is made regarding nurses' concerns for others. It is assumed that the more altruistic individuals will self-select into nursing. This does not mean that all altruistic[21] individuals will choose nursing (some might choose other professions), nor than only altruistic individuals will choose nursing. Indeed, self-centred people might also be attracted into nursing for economic reasons. However, it implies that on balance nursing students are potentially *more* altruistic than other students.

H1. Individuals who are more altruistic self-select into nursing studies.

[21] It is recognised that "altruism" is not a dichotomous characteristic. However, to simplify the language used, "altruistic individuals" is used interchangeably with "more altruistic individuals".

The assumption that health professionals intrinsically care about others is not unusual in economic models (Jack, 2005, Delfgaauw, 2007a, Ma, 2007). In practical terms, being altruistic means that one's utility is influenced by that of others:

$$U_i = (\pi_i, \pi_j) \text{ where } \partial U_i / \partial \pi_j > 0$$

For altruistic nurses, it means that the patient's utility is an argument in their own utility function:

$$U_{iL} = (e, w_L, Y_L, X_L, Z_i, \gamma_i(U_p - U_p^o)) \qquad (3.4)$$

where γ_i denotes the strength of a nurse's altruism; U_p is the utility provided to the patient by the nurse's presence (or action), which is an increasing function of quality of care received q and income y. Further, U_p^o is the "baseline" utility for a patient, that is the utility they derive in the absence of (altruistic) health worker. Finally, quality of care is assumed to be determined only by health care providers' efforts:

$$q = q(e)$$

Following the modelling proposed by Delfgauuw (2007a), altruistic nurses care about making their patients better off, that means $\partial U_{iL} / \partial \gamma_i (U_p - U_p^o) > 0$. It follows that altruistic providers are intrinsically motivated to make greater efforts than non altruistic providers (see Figures 2.3 in section 2.2.2 for a graphic illustration).

For a patient in the public sector, U_p^o is low (because patients are poor and cannot access good quality care). In contrast, a patient in the private sector always benefits from very good care, and his/her utility can only be improved by a decrease in the cost of care[22].

Following a framework similar to that of Roy (1951), and assuming that all other job characteristics are the same, altruistic individuals should self-select into the public sector, because they have a comparative advantage to work in that sector. Given their characteristics ($\gamma_i > \bar{\gamma}$ or at least $\gamma_i > 0$), their utility will be higher in the public sector than in the private sector, because they generate greater improvement in public patients' utility[23]. It is also possible to assume that nurses will be driven by a sense of public good motivation and distinguish between poor and better-off patients, by placing greater weight on the utility of poor patients than on the

[22] Delfgaauw (2007a) underlines that this difference in U_p^o between private and public patients is what determines the sorting of altruistic health professionals into the public sector.
[23] Deflgauuw (2007a) shows formally that altruistic providers can marginally improve the utility of public patients more than that of private patients. This is due to the fact they can only improve the utility of private patients by lowering the costs of treatment, which is a marginal improvement of rich private patients' utility lower than that of public patients who receive better care than they would otherwise receive.

utility of rich patients. Intuitively, this can only reinforce the results of the self-selection process into the public sector.

As a result of these individual preferences, the public sector has monopsony power over altruistic workers. This means that everything else being equal, altruistic nurses will accept a lower wage in the public sector as long as the utility gained from treating patients is greater than the utility lost in salary:

$$\gamma_i\,[(U_p-U_p^o)_{pu} - (U_p-U_p^o)_{pri}] \geq W_{pri} - W_{pu}$$

H2. Everything being equal, more altruistic nurses are attracted by jobs in the public sector

It follows that, everything being equal, altruistic providers will be attracted by jobs where their marginal impact on the patients will be greater. This means that within public sector jobs, altruistic providers should choose jobs where the marginal increase in the patients' utility $U_p - U_p^o$ is greatest. This means that altruistic nurses will favour positions in under-served areas where there are vacant staff positions. Indeed, in those areas patients are both poor and otherwise have no access to health services, therefore U_p^o(shortage) $<$ U_p^o(no shortage). Supposing that the quality of treatment provided only depends on the provider's effort, the marginal improvement in utility of patients in under-served areas will be greater than in other areas. It follows that altruistic nurses should be attracted to rural areas where the lack of staff is more critical.

H3. Everything being equal, more altruistic nurses are more attracted by rural jobs

However, relaxing some of the hypotheses of the models can mitigate those conclusions.

First, it has been assumed so far that jobs are identical expect for salary. Yet, working conditions are rarely equivalent, in particular between the private and public sectors in developing countries. In South Africa, private sector facilities are typically better equipped, do not suffer from shortage of drugs or medical supplies (see next chapter). As underlined in the empirical literature, all these elements negatively affect worker satisfaction (see section 2.3.2). If pleasant working conditions are equivalent between a private and public job, or if they are better in private jobs, then the marginal utility of working conditions themselves will be higher in a private job:

$$\partial U_{pri}/\partial(Y_L, X_L)_{pri} > \partial U_{pu}/\partial(Y_L, X_L)_{pu}$$

This means that the monopsony power of public providers is reduced, maybe to the extent that the lower utility generated by working conditions in the public sector is not compensated by the gain in utility derived from the public service mission, so that $U_{pri} > U_{pu}$ and nurses choose the private jobs.

> H4. More altruistic nurses will choose private jobs if working conditions in the public sector are sufficiently poor

This effect is particularly relevant for the decision made by altruistic nurses whether to choose a public job located in a rural area. Indeed, the loss in welfare generated by the location might be too high to be compensated by utility gains from altruism:

$$\partial U_{urb}/\partial(Y_L, X_L)_{urb} - \partial U_{ru}/\partial(Y_L, X_L)_{ru} > \partial U_{ru}/\partial(U_p - U_p^o)_{ru} - \partial U_{urb}/\partial(U_p - U_p^o)_{urb}$$

> H5. More altruistic nurses will choose urban jobs rather than rural ones, if working conditions in rural areas are sufficiently poor

Second, it has been assumed that quality of care provided is only dependent on the effort made by nurses. Yet, quality of care is typically affected by many factors (Wouters, 1991) , amongst which working conditions are essential. Indeed, a poor work environment that negatively affects a worker's utility also affects the quality of care provided. For example, lack of staff means longer waiting times, and lack of equipment or drugs means a poorer health service provided. Consequently the quality of care provided is an increasing function of the effort provided and working conditions:

$$q = q(e, X_L) \qquad \text{where } \partial q/\partial X_L < 0$$

Now, assume that working conditions are increasingly bad when going from the private sector to the public urban sector, and to the public rural posts:

$$\partial q/\partial X_{Lpri} < \partial q/\partial X_{Lurb} < \partial q/\partial X_{Lru}$$

This means that an increase in a patient's utility generated by a nurse is mitigated by the poor working conditions prevailing in the facility. As a result, this mitigates the "altruism" effect that is at play for altruistic individuals between private and public jobs, or between rural and urban jobs, since the marginal increase in the patient's utility U_p is affected negatively by the poor working conditions.

Intuitively, this indirect adverse effect reinforces the direct effect of bad working conditions described earlier by hypotheses H4 and H5.

B. Heterogeneity in locational preferences

Models from the new economic geography have underlined that people might have different preferences for locations (Tabuchi and Thisse, 2002), as individuals may appreciate differently the characteristics offered by varying regions. Some individuals might have developed an interest for activities that can only be done in certain areas (e.g. rural areas for individuals craving for outdoor activities vs. urban areas for culture-hungry people). Finally, it is easy to imagine how the proximity to one's family or emotional attachment to one's childhood region can be important for some individuals. Such examples can explain why some individuals will derive a marginal increase in utility from being in an area that objectively lacks amenities.

To explore this point, the following scenario is proposed: consider two jobs, located in two different regions 1 and 2. Objectively, region 2 has fewer social amenities and poorer access to infrastructure than region 1. However, region 2 provides access to other activities (e.g. hiking and other outdoor activities). Consider two nurses: nurse 1 from region 1 and nurse 2 is either from region 2 or is keen on outdoor activities. Providing all other job characteristics are the same, nurse 2 is more likely to choose a job located in region 2 than nurse 1, because she derives more utility from it:

$$\partial U_L/\partial(R_{2L}) > \partial U_L/\partial(R_{1L})$$

These differences in tastes may be captured by the compensating wage differences, as individuals will accept lower wages for areas they value more.

The health systems literature suggests that such heterogeneity of preference is often created by the origin of individuals (see section 2.2.2). Rural health professionals are less likely to be deterred by the living conditions offered in rural areas, and everything else being equal, the utility they derive from a job in a rural area is greater than that of an urban job.

H6. Nurses from rural areas are more likely to choose rural posts than other nurses.

The empirical approach described below was developed to test some of the hypotheses developed above, as well as to inform the design of policies to attract nurses to rural areas.

3.3. Overview of empirical approach

The work presented here is related to a project that was funded by the Department for International Development through the Consortium for Research on Equitable Systems (CREHS), and took place in several countries, including South Africa (Blaauw et al., 2007). As a result, the empirical approach used in this thesis was partly constrained by the decisions and study design defined by the CREHS project. The study design of this project is described below, and the resulting constraints are emphasised. The empirical approach adopted in this thesis is then detailed, in relation to the objectives presented in 3.1.

3.3.1. Overall design of the CREHS project

The CREHS project was designed to identify the factors attracting and retaining nurses in rural areas, and compare the findings from Thailand, Kenya and South Africa (Blaauw et al., 2007). One of the key features of the CREHS project was the decision to start a cohort study with nurses who were about to graduate and enter the labour market. Three reasons motivated this choice.

First, a prospective cohort was thought to limit the potential biases and problems inherent in cross-sectional or retrospective study designs. Indeed, to study recruitment and retention in rural areas, cross-sectional surveys may be biased as health workers working in rural areas are the ones who have chosen to remain in these jobs. Retrospective cohort studies, on the other hand, are often limited by difficulties in tracing sufficient numbers of the initial cohort with the obvious concern that those health workers that can be traced are likely to differ from those that cannot.

Second, a retrospective cohort was ruled out because there were questions about whether it would be ethical to obtain contact details from participants who would not have initially consented to be contacted.

Third, prospective data collection enables a better investigation of the dynamics of individual choices and their determinants. For example, recall bias is less of a problem when events, choices and justifications are more recent.

Although the project follows nurses over time and organises data collection at several points in time (see Figure 3.1), this thesis was built on baseline survey data only. Indeed, when the project started, it was not known whether the repeat surveys would actually happen, due to a lack of funding at the time. Consequently, the empirical approach was designed within the constraints determined by the baseline survey of the project. In particular, it meant that data would be collected from nurses approaching graduation, who would not be employed at the time of the survey (hence their actual preferences would not be observed).

Figure 3.1: CREHS study timeline

Date	Aug-Sep. 2008	2009	Feb 2010	Feb 2011
Study phases	Baseline Survey	Cohort Follow-up (quarterly updates)	Repeat Survey #1	Repeat Survey #2

3.3.2. Empirical approach of the thesis

This section briefly presents the empirical approach chosen to address each of the four objectives of the thesis. The tools used are only briefly mentioned here, and more details are provided in Chapters 5 to 9. Indeed, considering the variety of approaches used, it was easier to present each method separately and justify their use and development in reference to the appropriate literature. Table 3.1 summarizes the various sets of data used in this PhD, and provides some details on the data collection process.

A. Objective 1 - Investigating the nature and determinants of South African nurses' altruism

The first objective of the thesis is to determine the nature and determinants of nurses' altruism. Altruism has typically been measured in two different ways: with survey measures or by measuring the choices made in experimental economic games (more details on the advantages and limitations of each method can be found in Chapter 5). The latter approach has been argued to provide more reliable measures, since researchers use real monetary incentives, which are supposed to avoid "self-serving" biases. Consequently, it was decided to measure altruism by playing the 'dictator game' with all survey participants. At the same time, questions capturing other dimensions of public motivation and societal altruism were asked in a self-administered questionnaire. To compare the levels of altruism of nurses to a benchmark, it was decided to carry out the same games with economic students who are the usual participants in economic games.

B. Objective 2 - Studying the determinants of nurses' labour market preferences

In South Africa, there is no database or survey detailed enough to investigate the actual career choices of nurses. Therefore it was necessary to collect primary data to investigate labour market dynamics. As mentioned before, the survey respondents were not employed at the time of the CREHS baseline, therefore it was not possible to use actual decisions made in the labour market. Thus it was decided to use a Discrete Choice Experiment (DCE), presented in section 2.3.3 of the literature review, to investigate health worker preferences for existing labour market opportunities. One of the main objectives in the design of the choice experiment was to capture as accurately as possible the scope of opportunities offered to South African nurses (see Chapter 6 for a detailed presentation of the design).

C. Objective 3 – Assessing the likely effects of policy interventions to attract nurses to rural areas

In the absence of experimental or quasi-experimental evidence measuring the effect of a policy, economists have often used modelling techniques to estimate the likely effects of interventions. As explained in the literature review chapter, DCEs have been used by economists and researchers in marketing to predict the uptake of services or market shares. In the same spirit, a DCE was developed in the CREHS project to investigate to what extent some hypothetical policies, not currently offered to nurses, could attract new graduates to rural areas (see Chapter 7 for further details on the design).

D. Objective 4 – Investigating the relative cost-effectiveness of different policy interventions

Building on the measures of effectiveness of policy interventions derived from the choice experiment used in objective 3, a cost-effectiveness model was developed. This required the collection of two types of additional information. First, the cost-effectiveness analysis required the development of a model to estimate the likely effects of policy interventions in the long-term. To build that model, additional information was collected during interviews with relevant stake-holders regarding the dynamics of career choices (see Chapter 8). Second, secondary data were collected to estimate the cost of inputs used in various policy interventions (see Chapter 9).

Table 3.1: Summary of data sources

Tools / Data	Data collection process	Objective	Brief description	Use made of the data	Chapter where tools/data are presented in details
Experimental Economic game (dictator game)	During the baseline survey; First tool administered. In 2009 with a group of economic students.	To measure nurses' altruism	The dictator game was played with all respondents. It required them to choose how to divide R100 between themselves and a recipient; three different identities of recipients were given. An additional group of economic students was surveyed in 2009.	Objectives 1, 2, 3 and 4	Chapter 5
Labour market Discrete Choice Experiment	During the baseline survey; Third tool administered.	To capture the job preferences of nurses for the main job opportunities offered in South Africa	Labelled choice experiment presenting a series of 12 choices of 4 job descriptions (public rural – public urban – private urban - overseas). Each job description was made up of 5 attributes, covering the main characteristics of jobs (salary, place of work, education opportunities, population served, working conditions).	Objective 2	Chapter 6
'Policy' Discrete Choice Experiment	During the baseline survey; Second tool administered.	To measure the effect of different policy levers to attract nurses to rural areas	Labelled choice experiment presenting a series of 16 choice sets; each choice sets presented two different job descriptions one in a rural another in an urban location; each job description was made up of different variations of 7 attributes, with rural job characteristics encompassing various possible policy interventions.	Objectives 2 and 3	Chapter 7
Self-Administered questionnaire	During the baseline survey; Fourth and last tool administered.	To provide socio-demographic and attitudinal information about study respondents	Self-administered questionnaire entailing questions on the following areas: individual characteristics, education characteristics, questions on values and preferences (including altruism), attitudes towards living and working in rural areas.	Objectives 1,2, 3 and 4	Chapter 5
Cost data	Use of secondary data (documents from the Department of Health, real estate reports, etc.), interviews with stake-holders.	To cost the HR possible interventions to attract nurses to rural areas	Collection of data enabling to cost the various hypothetical policy interventions that could be designed using attributes of the 'policy' DCE*: such as the cost of a rented house; rural allowances, etc.	Objective 4	Chapter 9

3.4. Institutional setting and intellectual ownership

The initial development of this PhD emerged from several activities (literature reviews and development of tools) that were initiated or undertaken at the beginning of the CREHS project. I led the coordination and design of the CREHS project, and remained heavily involved in the various phases of the development of the project (data collection and analysis) until its completion in April 2010.

In terms of tool development, I proposed the use of experimental economics at a very early stage, and was solely responsible for the development of these tools within the project. Some other tools presented in this thesis (self-administered questionnaire (SAQ) and DCE 'policy') were developed specifically for the project and I played a key role in their design. Finally, some tools (DCE 'labour market' and some questions in the SAQ) were specifically designed to answer some questions raised in this thesis. Their genesis was independent from the project, but their administration 'piggy-backed' on the project.

In terms of data analysis, several situations should be distinguished. Some datasets (experimental economics) were analysed for this thesis and the project, where I was the only researcher responsible for their analysis. Other datasets were analysed under the project (by myself and others), and a different modelling was performed for this PhD (for the 'policy' DCE data). Finally, some data were solely analysed within this thesis (labour market DCE).

Table 3.2 below gives a summary of the various activities undertaken for the project, the PhD, and it summarises which activities were common to both.

Table 3.2: Summary of activities undertaken for the project and the PhD

	PhD only (ML)	**Both PhD and project**	**Project only**
Tools *developed for:*	DCE 'labour market'; Markov Model ; Cost-Effectiveness Model	Experimental Game (ML)	SAQs (DB + ML) DCE 'policy' (DB + ML)
Data *analysed for:*	DCE 'labour market' ; Markov Model ; Cost-Effectiveness Model	Experimental Game (ML)* DCE 'policy' (ML)* SAQ2 (ML)*	DCE 'policy' (ML +DB)**

Notes: the initials between parentheses denote the individuals responsible for the task mentioned. DB= Duane Blaauw; ML=Mylene Lagarde.

* the baseline self-administered questionnaire (SAQ1) will be used in the analysis of the DCEs and the experimental games to study the influence of individual characteristics.

** the analysis of the policy DCE undertaken as part of the project differed from that done from that of the PhD: different methods will be used and costing of policy scenarios will not be realised.

3.5. Study population

3.5.1. Population characteristics

The population study consisted of South African graduate nurses who were about to enter the labour market as professional nurses. Several reasons guided the choice of professional nurses instead of enrolled or auxiliary nurses. First, because of their broad skills and the orientation of the South African health system towards primary health care, professional nurses now form the cornerstone of the health system. Second, as explained before, there is a shortage of professional nurses in South Africa. Third, with their four-year training, professional nurses have a nursing degree that is recognised overseas, thereby offering them the possibility to emigrate. Other categories of nurse do not benefit from a similar international recognition of their skills. Finally, professional nurses also have the possibility to specialise which can give them more lucrative opportunities in the private sector or more responsibilities in the public sector.

For logistical and cost reasons it was not deemed possible to use a national random sample of graduate nurses. Instead, a multi-stage sampling strategy was used. Nursing colleges were first selected at random from rural and urban regions to present a diversified educational background. In South Africa, the North-West province is one of the rural provinces[24], while Gauteng is the most urban province. These two regions were therefore selected as the sample frame to choose the nursing training institutions.

The selection of nursing training institutions was not entirely random, as two additional criteria were used to select them. To capture graduates from the two main providers of training institutions in the public sector (see Chapter 4), it was decided to sample respondents from universities and nursing colleges in each province. Finally, the choice of nursing colleges was partly led by the number of students they trained. In order to obtain a sufficient sample size (see below), and without prior knowledge of the response rate that would be obtained in each institution, bigger institutions were favoured. Once selected training institutions agreed to participate in the study, and all final year students from these colleges were invited to participate in the study.

[24] The North-West province is also one of the provinces most severely affected by shortages of nurses in the public sector: see Chapter 4.

3.5.2. Sampling

Sample size considerations were based on the requirements for the analysis of DCE and experimental economics data.

For economic experiments, many studies have been carried out with less than 100 participants (Andreoni and Miller, 2002, Henrich et al., 2004b), although larger samples are always preferable. It was judged that the requirements in the DCE would be sufficient to obtain robust estimates in experimental economic games.

The sampling strategy was based on the requirements of the DCE initially envisaged for the project[25]. Following the recommendations of Hensher et al. (2005), the minimal sample size was estimated based on the predicted uptake *p* of the least popular alternative, in this case the rural job (see design of the DCE in chapter 7), as follows:

$$n \geq \frac{1-p}{pa^2}\left[\Phi^{-1}\left(1-\frac{\alpha}{2}\right)\right]^2$$

where a is the level of allowable deviation as a percentage between $\hat{p}$ and p ; $1-\alpha$ is the confidence level of the estimations such as $\Pr(|\hat{p}-p| \leq ap) \geq 1-\alpha$; and Φ is the inverse cumulative distribution function of a standard normal.

It was expected that rural jobs would be less popular than urban ones, but that the 'natural' imbalance would be redressed by some of the proposed new attributes in rural jobs. Therefore, we predicted that only 40% of respondents would choose the rural option. To estimate this proportion accurately with a 5% error margin, a minimal number of 224 respondents was needed (based on the assumption that each would answer 16 choice sets). A larger sample size was targeted, in order to carry out sub-group analysis. Anticipated groups of interest in the study mainly pertained to characteristics of their training and in particular whether they had been trained in a rural (North West) or urban (Gauteng) province. The origin of the students (rural or urban background) was also of interest, but in the absence of any preliminary information on students' characteristics, it was hoped that this would be partly captured by the sampling strategy based on the college. It was calculated that with a target sample size of 350 individuals, half from each group, it would be possible to estimate accurately the uptake of rural and urban posts for the

[25] At the time of the study design, the DCE developed solely for this PhD was not yet finalised.

whole population, and estimate the same proportions in the two groups with a reasonable confidence[26].

To sum up, a sample size of approximately 350 participants was targeted. A sample of 377 respondents was obtained, mainly due to a higher response rate than expected in selected training institutions. Data collection with final year students was conducted between July and October 2008.

Table 3.3: Summary of sample size per study site

Name of Institution	Date of fieldwork	Total number of students	Number of students surveyed	Response rate
Gauteng Province				
S.G. Lourens Nursing College (Pretoria)	28/07/08	79	71	90%
Ann Latsky College of Nursing (Johannesburg)	12/08/08	159	125	79%
University of Johannesburg	27/08/08	30	20	67%
Total Gauteng		**268**	**216**	**81%**
North West Province				
Mmabatho Nursing College	25/07/08	135	37	27%
Excelsius Nursing College (Klerksdorp)	23/09/08	99	73	74%
North West University (Potchefstroom campus)	13/10/08	19	9	47%
North West University (Mafikeng campus)	27/10/08	57	42	74%
Total North West		**310**	**161**	**52%**
Total		**578**	**377**	**65%**

26 It was calculated that with 175 individuals from each group, for the rural group, whose predicted uptake of rural posts was estimated at 40%, that deviation from that proportion would be at most 4.5%. For the urban group whose uptake of rural jobs was predicted to be 20%, the estimates would deviate from that proportion by 7.4% at most. These were judged acceptable risks, considering the budget and logistical constraints of the study.

3.5.3. Study population characteristics

Table 3.4 shows the main characteristics of the sample. A brief comparison of the main characteristics of this population and the general nursing population is presented in the next chapter.

Table 3.4: Demographic characteristics

Variables	Statistic description	Result
Sex (N=377)	% Male	14.3
	% Female	85.7
Age (N=374)	mean (sd)	31.0 (7.7)
Age (N=374)	20-24 years old	25.7
	25-29 years old	22.8
	30-34 years old	24.9
	>35 years old	26.5
Province where trained (N=377)	% Gauteng	57.3
	% North West	42.7
Training institution (N=377)	% University	18.8
	% Nursing college	81.2
Race (N=375)	% African	89.3
	% Coloured	2.9
	% White	7.7
Marital status (N=372)	Single	65.9
	Married	30.4
	Divorced / Widowed	3.8
Any children (N=377)	% Yes	61.0
Area where born (N=375)	% Very rural	11.2
	% Relatively rural	35.7
	% Urban town	37.6
	% Urban city	15.5
Mother's education level (N=364)	Primary	27.2
	Secondary	41.2
	Matric	13.2
	Post-Matric	18.4
Fathers' employment status (N=233)	% Father working	44.2
Mothers' employment status (N=319)	% Mother working	34.8

As expected for a nursing population, the proportion of male students was relatively low (14.3%). The majority of the study participants were black/African (89%), although the proportion of white students in universities was 32.4%, reflecting differences in socio-economic background between nursing college and university students. The mean age of the study members was 31 years, with a younger population in universities (whereas in training colleges, some students were late-comers into higher education). The majority of nurses (61%) already had children, and just fewer than 50% of study participants said they were from rural areas. Lastly, the table reflects the dire employment conditions in the labour market with less than 50% of their parents working at the time of the survey[27].

3.6. Ethical issues

Ethical approval was obtained in London from the ethics committee of the London School of Hygiene and Tropical Medicine (see Appendix 3.1), and in South Africa from the University of Witwatersrand in Johannesburg (see Appendix 3.2). Further research clearance was sought and obtained from the health authorities of the two provinces where the study took place.

To ensure that participation was completely voluntary, enrolment in the study happened in two stages. One of the research team members would present the study to students gathered in their training institution. A study information sheet was then handed out to them (see Appendix 3.3), and they could ask further questions. They were then informed that the study would happen the following day, and were invited to participate. They were also informed that they would not be able to join the study if they arrived late. The following day, nursing students who had decided to participate in the study were then formerly asked to sign a study consent form (see Appendix 3.4).

As a standard element of experimental economics, all games were played with real monetary rewards. The rationale of this feature of experimental economics is to increase the realism of the choice, and avoid the biases that arise with other traditional methods that ask hypothetical questions. Research participants did not know in advance of the existence of such monetary stakes, so that these payments did not constitute an inducement to take part in the study. These small payments were in any case not seen as an undue incentive given the time required to participate in the study.

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27 The high number of non-response is explained by the fact that many respondents had already lost one or both parents.

The research team took particular care to provide feedback to study participants and policy-makers. The main results of the overall study were fed back to all interviewees through a public website. Each time the website was updated with new information, study participants received a text message inviting them to consult it. In addition, some face-to-face meetings with study participants were organised during the follow-up in February 2010 and more information on the study findings was presented.

Findings have also been presented to other relevant policymakers through policy briefs and presentations in a meeting organised in May 2009. Results were conveyed to a wider audience of public health specialists during a conference in November 2009.

Chapter 4 - Context of the thesis

This chapter presents the overall context of the study in South Africa, with a focus on the different elements that are susceptible of playing a role in the job preferences of health workers in general, and nurses in particular. The first section presents the general political, economic and social situation in South Africa. It shows how the radical changes that occurred in this country in the 1990s have contributed to shape the socio-economic situation of the country today, which constitutes the broad contextual elements that shape individual behaviours in South Africa. The second section describes the health system in the country, with a focus on the major transformations that have occurred since 1994, as well as the problems inherited from the situation before 1994. The third section describes the regulatory and policy environment for the nursing profession, and depicts the main characteristics of the nursing population.

4.1. General background on South Africa

4.1.1. Brief historical background

The policy of apartheid (separateness) was officially introduced in South Africa in 1948, after the National Party won the national elections. That policy, enforcing strict race-based measures, allowed the development of different racial groups in their separate areas. Effectively, it divided the economy into a privileged white one, and an impoverished, predominantly unskilled and illiterate, black one (Thompson, 2001).

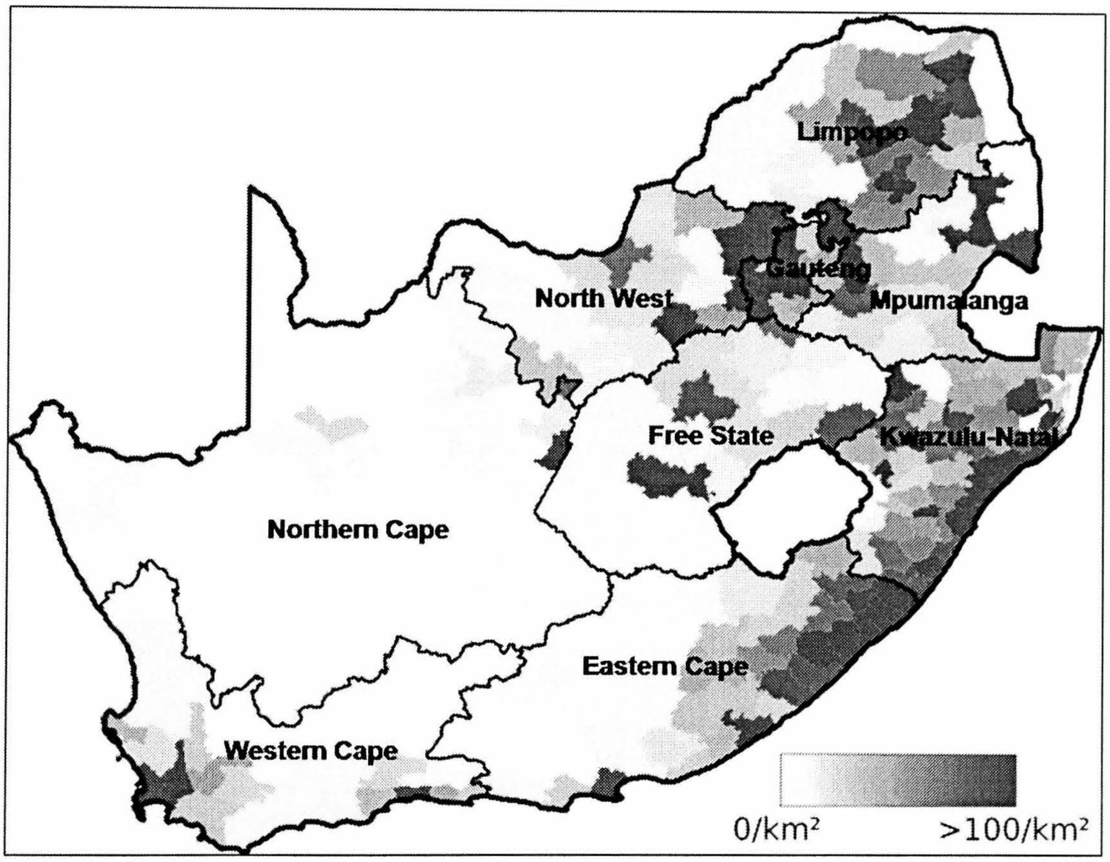
At the end of the 1970s, as domestic protest was growing and was only met by violent repression, but no sign of political resolution, the policy started to be widely criticised on the international stage. This led to political and economic sanctions being placed against the country in the 1980s, which contributed to the political and economic pressure that saw the unravelling of apartheid. In 1990, the white president Frederik de Klerk recognised the economic unsustainability of the apartheid system, released Nelson Mandela and unbanned the African National Congress (ANC) that Mandela led.

After South Africa held its first multi-racial elections in 1994, the newly elected ANC government tried to restore order to an economy harmed by sanctions, while also integrating the previously disadvantaged segment of the population into it. To achieve that objective, they embarked on the Reconstruction and Development Plan to improve social services including housing, education and health to blacks, for whom these services had seriously lagged behind in the apartheid years.

4.1.2. Socio-economic background

South Africa is a nation of about 48 million people of diverse origins. According to official population estimates (Statistics South Africa, 2008a), 79% of the population is black, 9.5% is white, 9% is coloured and about 2.5% is Indian or other Asian. Although eleven languages are recognised in the constitution, English is the most commonly spoken language in official and commercial public life, but it is only the fifth most spoken home language. Still reflecting the effects of the Apartheid regime where large numbers of people were concentrated in certain areas of the country, the population density varies widely across the country (Figure 4.1). According to World Bank estimates, 60% of the population lives in urban areas. The rest of the population is scattered over a large territory, so that rural population densities vary considerably across the country – they are highest in the former homelands and much lower in historically white-populated areas, especially in semi-arid western areas.

Figure 4.1: Population density in South Africa (by municipalities)



Source: http://en.wikipedia.org/wiki/Image:Population_density_ZA.svg based on Census data (2001)

With a Gross Domestic Product (GDP) per capita estimated in 2007 at US$5,915[28], or US$9,736[29] in Purchasing Power Parity, South Africa is classified as an upper middle-income country and has

[28] http://imf.org/external/pubs/ft/weo/2008/02/weodata/index.aspx World Economic and Financial Surveys IMF World Economic Outlook Database October 2008 Edition.
[29] The PPP estimate was calculated using the PPP estimates of country GDP and population provided by the World Bank (http://siteresources.worldbank.org/DATASTATISTICS/Resources/GDP_PPP.pdf and http://siteresources.worldbank.org/DATASTATISTICS/Resources/POP.pdf)

the biggest and most advanced economy in Africa. Although the average annual growth of the GDP has been positive since 2000, the wealth created has not been evenly distributed across the population, and it has not led to much job creation.

After 1994, the implementation of numerous welfare and social programmes, such as the Child Support Grant, is thought to have curbed the progression of poverty, which may have slightly decreased since the early 2000s (Friedman and Bhengu, 2008). However, the apartheid legacy is still very visible through economic inequalities. Strikingly, there has not been a significant change in inequalities measured by the Gini coefficient since the end of apartheid, and South Africa is still among the countries with the highest Gini Index (Bradshaw, 2008).

High unemployment is regularly cited as the most important constraint to both poverty reduction and accelerating growth in South Africa. Despite the growth South Africa has enjoyed since 2000, unemployment increased up to 2003, reaching levels that have remained steady at an estimated 31.2% (according to the narrow definition of unemployment as "*being able to and wanting to work and taking active job seeking steps in the four weeks prior to survey*") or 42.1% (following the expanded definition of unemployment: "*being eligible to work but not being employed*") in 2008 (Satistics South Africa, 2008b). Two things characterise unemployment in South Africa: it predominantly affects young and black people (Bradshaw, 2008), and unskilled workers. A recent study on human resources and labour market dynamics in South Africa highlighted the double curse of the labour market: a lack of skilled workers and concurrent high unemployment among the unskilled (Kraak, 2008). In this study, the lack of skilled workers was described as the inadequate response of educational output to the economic needs resulting from the robust economic growth that started in the 1990s.

Despite encouraging results on social development indicators since 1994, South Africa still displays large disparities in access to basic services. Although the situation has improved since the end of apartheid, access to basic services (health, education) is still limited for some population groups. To some extent, these living standards partly mirror the lack of economic opportunities of the most disadvantaged groups (CSDH, 2008). Although the percentage of the population with more than a primary education has increased from 63.5% in 2002 to 69.4% in 2007, only 9.8% of the population older than 20 years old has tertiary education, and 23.6% has reached grade 12 (Statistics South Africa, 2007). A key determinant of health, access to water and sanitation, remains limited in such a wealthy country. Although there has been considerable progress made since 2002, 21% of households still did not have access to piped water in 2007 (Statistics South Africa, 2007). The same year, 15.4% of households were still living in informal dwellings. Gauteng, Western Cape and North West are the three provinces with the highest percentage of households living in such housing, representing respectively 25.9%, 21.4% and 19.9% of their population. 8% of households had no toilet facilities in 2007.

4.1.3. Health profile

Despite its wealth, South Africa's population bears a high burden of disease and continues to recover from the disparities that resulted from decades of marginalization of the black population.

In 2008, the life expectancy at birth (52.2 years) was much lower than in other upper middle-income countries estimated in 1998 (71 years[30]) (Statistics South Africa, 2008a). The average under-five mortality rate of 67 per 1,000 was more than twice the average in upper middle-income countries (28 per 1,000). These poor indicators are partly due to the country's HIV/AIDS epidemic, which is one of the most severe in sub-Saharan Africa, affecting all sections of society. With a prevalence rate of 18.8% amongst adults aged 18-49 years (Satistics South Africa, 2008a), South Africa is the country with the highest number of HIV-positive people in the world (an estimated 5.35 million in 2008). Estimates show that at least 40% of the deaths in the country are AIDS-related (Bradshaw et al., 2004, Actuarial Society of South Africa, 2005, Anderson and Phillips, 2006). The HIV/AIDS epidemic has partly contributed to the increase in the proportion of deaths due to infectious and parasitic causes, which rose from 13.1% in 1997 to 25.5% in 2005 (Health Systems Trust, 2008b).

In terms of maternal health outcomes, the performance of South Africa is also poor compared to other upper middle-income countries. Maternal mortality is high, with estimates ranging from 150 to 400 deaths per 100,000 live births (Chopra et al., 2009a), against an estimated 91 deaths per 100,000 live births on average in upper middle-income countries (WHO, 2007), and a national MDG target in 2015 of 38 per 100,000. Besides, the national average hides important inequalities. For example, although there is a high level of utilization of antenatal care services and deliveries in health facilities, 27% of the poorest women in South Africa give birth at home (Penn-Kekana et al., 2004), with issues of quality of care and staff shortages identified as some of the causes of such poor performance (Parkhurst et al., 2005).

Only a few studies have explored simultaneously the various dimensions of inequality in health, where income, racial and geographic inequalities are intertwined (Blaauw and Penn-Kekana, 2002).

[30] http://www.worldbank.org/depweb/english/beyond/beyondco/beg_an2-3.pdf

There is an abundant literature showing the correlation between inequalities of income and inequalities of health status. Using data from a small survey in a health district in Western Cape, a study showed evidence of a large causal effect of income on health status, mediated by living standards and nutritional status (Case, 2004). A study on inequalities in maternal health showed that the average number of antenatal consultations for the poorest quintile was 5.2 compared to 8.6 visits for the richest quintile (Blaauw and Penn-Kekana, 2002). This study also showed that the poorest African women were 10 times more likely to deliver without a trained attendant than African women in the top quintile.

The effects of discrimination between population groups pre-1994 are still visible in inequalities across population groups. For example, the infant mortality rate among the black population is four times that of the white population (15.3 vs. 63.6 deaths per 100,000 live birth) (Bradshaw, 2008). Likewise, in 1998, black women had an average of 5.7 antenatal-care visits compared to 9.9 for Indian and 9.5 for white mothers (Blaauw and Penn-Kekana, 2002).

Because poorer populations live in rural areas, inequalities are also geographic, with the infant mortality rate in rural areas being 1.6 times as high as that of urban areas: 71.2 vs. 43.2 per 100,000 live births (Bradshaw, 2008). Similarly, while only 5.3% of women delivered without a trained attendant in urban areas, 23.6% did so in rural areas (Blaauw and Penn-Kekana, 2002).

4.2. The South African health system

4.2.1. Health system inherited in 1994

At the end of the Apartheid era, the South African health system was characterised by inequalities in coverage and quality of services, where white population groups were favoured, whilst certain geographic areas (rural areas, in particularly 'homeland' areas[31], and 'township' areas) were systematically under-funded (Ntsaluba and Pillay, 1998, Coovadia et al., 2009).

Mirroring the complex separate administrative structure of the Apartheid regime, the structure of the health system was characterised by inefficiency, with a duplication of administrative and clinical services (Coovadia et al., 2009). For example, there were four health departments, one for each of the population groups recognised by the regime[32], and a range of sub-national health authorities in the former four provinces and ten homelands. In terms of infrastructure, the 'separate development' ideology translated into separate curative and preventive care facilities.

Another characteristic of the public health sector before 1994 was that it was highly biased towards hospital-based, curative care (Coovadia et al., 2009). Public funding was also disproportionally spent on tertiary services benefiting predominantly the white population, concentrated in urban areas. With only 11% of public expenditure dedicated to non-hospital primary health care (McIntyre et al., 1995), primary care infrastructure and capacity had been systematically neglected.

Finally, by 1994, South Africa had a well-developed for-profit private sector, almost exclusively used by the white population (Coovadia et al., 2009). If initially private hospitals were mostly non-profit mission hospitals in rural areas and industry specific facilities such as on-site hospitals at large mines, the privatisation and deregulation policies undertaken in the 1980s led to a rapid growth of the private for-profit sector, heavily concentrated in urban areas. For example, by 1990 more than 60% of doctors (both generalists and specialists) were working in private practices (Rispel and Behr, 1992).

[31] Representing about 13% of the territory, these 10 geographic areas were established in 1951 by the Bantu Authorities Act for the purpose of concentrating members of designated ethnic groups, thus making each of those territories ethnically homogeneous as the basis for creating "autonomous" nation states.
[32] In 1950 the Population Registration Act classified the population into 'African', 'Coloured', 'Indian' and 'White' population groups.

4.2.2. Health system reforms since 1994

After the first democratic elections in 1994, there was a dramatic restructuring of the health department, followed by many reforms to try and make the health system more efficient, more equitable and accessible to the disadvantaged population.

To depart significantly from the past, the African National Congress referred to the equity spirit of the Primary Health Care principles proclaimed at the Alma-Ata Conference in 1978 in its key founding policy document, The Reconstruction and Development Programme (African National Congress, 1994): *"the whole national health service must be driven by the Primary Health Care (PHC) approach. This emphasises community participation and empowerment, inter-sectoral collaboration and cost-effective care, as well as integration of preventive, promotive, curative and rehabilitation services."* (African National Congress, 1994)

Soon after, the White Paper for the Transformation of the Health Sector in South Africa (Department of Health, 1997) provided the framework for the transformation of the health care system, with a special emphasis on equity and primary health care. While the former system was mainly focused on the role of hospitals, a new administrative structure was gradually introduced that was district-centred and emphasised the importance of, and access to, primary health services (Health Systems Trust, 2008b). A direct consequence of that policy was the implementation of a vast programme of construction and rehabilitation of health facilities, which started from the mid-1990s and resulted in the creation of more than 1,600 new primary level facilities (Health Systems Trust, 2008b). As a result a third (35%) of currently existing primary health care facilities have been built since the end of apartheid in 1994. The implementation of this PHC approach has translated into a greater reliance by the public health service on the nursing profession.

To abolish financial barriers to primary health services, user fees for children aged under six years and pregnant women were removed in 1994, and in 1997 user charges at all primary health care clinics were abolished (Wilkinson et al., 2001). If this policy resulted in significant increase in utilisation of public services, it also generated frustrations amongst health workers who were not consulted about the policy change, and had to face increased workload without adequate provision of supplies (Wilkinson et al., 2001, Gilson and McIntyre, 2005).

4.2.3. The duality of the South African health system

In 2005, South Africa spent more on health, measured as a percentage of GDP (7.7%), than the average upper middle-income countries (6.2%), even if this has declined from a level of about 8% of GDP throughout the 1990s. However, a large part of these expenditures are spent in the private sector (equivalent to 59% of all expenses, or 4.55% of GDP in 2005),

The private sector is a highly specialised urban sector which has continued to grow since 1994 (Health Systems Trust, 2008a), as shown by data suggesting that 40% of all doctors worked there by the end of the 1980s, but 66% of specialists and 62% of GPs by the end of the 1990s (Coovadia et al., 2009). This growth of the private sector has also increased the number of nursing positions in that sector. Funding of the private sector is operated through medical schemes, which are voluntary health insurance schemes run by private companies. Membership of medical schemes has become increasingly unaffordable for South Africans, as the increase in expenditures in the private sector has been followed by increases in premiums charged by medical schemes (McIntyre et al., 1995). 84% of hospitals in the private sector are under the control of three large hospital groups (Netcare, Medi-Clinic and Afrox/Life Healthcare), who seem to use their oligopoly power to avoid price competition with each other and charge excessively high prices (van den Heever, 2007). In contrast, health expenditure for the public sector only amounts to 3.15% of GDP even though public health care expenditure has grown at a higher rate than the GDP in the recent past (McIntyre et al., 2007).

These figures reflect the duality of the South African health system, where a well-developed private sector primarily caters for a minority of the population. In addition to the wealthier 15% of the population who are covered by the medical schemes, an estimated 21% of the population, who are not members of medical schemes, use the private sector and pay out-of-pocket (McIntyre et al., 2007). Consequently the remaining 64.2% of the population is entirely dependent on the public health sector for their health care services. Even with such optimistic assumptions on the use of private providers, the public-private disparities are substantial (Table 4.1).

Table 4.1: Distribution of health care resources between public and private sectors (2005)

	Private sector	Public sector
Population per general doctor	(243) 588*	4,193
Population per specialist	470	10,811
Population per nurse	102	616
Population per hospital bed	194	399

Source: (McIntyre et al., 2007)

* Data in brackets represents only medical scheme members (14.8% of the population); the main estimates assume that private GPs and pharmacists may be used by up to 35.8% of South Africans.

4.2.4. Working conditions

The literature in South Africa identifies five main series of factors that contribute to difficult working conditions in the public sector.

First, violence in the workplace is also often cited as an important factor of distress for South African health workers (Xaba and Phillips, 2001). According to a recent study (Geyer, 2004), South Africa was one of the countries with the highest prevalence of violence in the workplace of health care workers, with patients and their families being the biggest perpetrators. Verbal abuse by patients, as well as lack of respect from doctors, has also been reported in other studies (Mokoka, 2007, Breier et al., 2009).

Second, several studies have highlighted the indirect negative consequences of the HIV/AIDS epidemic on nursing staff. Research has highlighted nurses' hopelessness in front of the magnitude of the epidemic, and increased psychosocial stress resulting in low morale and burnout (Xaba and Phillips, 2001, Hall, 2004). Other studies have highlighted the increased risk of occupational exposure to HIV for nurses. These aspects have been cited as push factors that contribute to emigration abroad and/or deterring individuals from taking up nursing as a profession (Xaba and Phillips, 2001).

Third, lack of resources, insufficient equipment or poorly maintained buildings and equipment have also been regularly identified by nurses' demotivation or contributing to their departures (Hall, 2004, Mokoka, 2007).

Fourth, various studies have recently pointed to failures in the management of human resources (Coovadia et al., 2009). The rapid transformation of the health workforce has left insufficiently experienced managers to deal with complex transformations and dynamics in the public sector. Erasmus found that nurses' burnout and fatigue was directly caused by uncertainty regarding their role and job description (Erasmus 1995). This lack of managerial capacity, worsened by the shortage of staff in the public sector, has translated into problems of poor attitude, moonlighting and absenteeism.

Finally, several studies have underlined the disastrous consequences of under-staffing and high workload as driving factors of nurses' dissatisfaction (Hall, 2004). For example, high workload and low recognition (through perceived low remunerations) almost always rank first in the negative aspects affecting morale (Erasmus, 1998, Ehlers, 2003, Shisana et al., 2003, Erasmus and Brevis, 2005, Penn-Kekana et al., 2005).

This series of problems has led to increased levels of stress and burnout amongst nurses in South Africa (Erasmus, 1998, Xaba and Phillips, 2001, Ehlers, 2003, Erasmus and Brevis, 2005). For example, in a survey of 147 nurses in the public sector (Penn-Kekana et al., 2005), researchers found 40% of respondents declared that they dreaded the next day, 50% felt unmotivated and 40% intended to leave their job. While nurses regularly mentioned they were satisfied with the nature of their work as a nurse, they frequently complain about their working conditions, which made them feel powerless and frustrated (Hall, 2004).

To finish, it is important to note that the duality of the health system highlighted in section 4.2.3 is also reflected in differences of working conditions. A recent study investigating the relative job satisfaction of nurses in the private and public sectors showed that nurses in the private sector were significantly more satisfied with most aspects of their work, compared to their colleagues in the public sector (Pillay, 2009). The greatest differences in satisfaction levels were found for safety at work, resource availability and workload respectively.

4.3. Nursing in South Africa

4.3.1. The nursing profession

In 1997, the White Paper for the Transformation of the Health System in South Africa was the first official document to set out the direction for the development of the health system, and it listed training and the development of health personnel as a key priority.

A major rationalisation of nursing education followed the general restructuring trend in the education system after 1994. This involved the development and definition of new curricula for nursing education. In line with the National Qualification Framework, established to upgrade the South African education and training systems to international standards, the South African Nursing Council (SANC) set new standards for the education and training of nurses in South Africa. Today, to obtain professional registration from SANC, nurses must follow nursing education and training at one of 95 public and private nursing training institutions[33] accredited by the SANC.

[33] "*Nursing education in South Africa takes place in a particularly complex education and training terrain that includes universities and technikons (now universities of technology), public stand-alone nursing colleges, nursing schools attached to public hospitals, private colleges run by the major hospital groups, private colleges attached to old-age homes and private colleges that train for profit.*" Breier et al. 2009 (p.12)

The rationalisation of nursing education led to the distinction between two main categories of nurses: Professional or Registered Nurses (PN or RN) on the one hand, and Enrolled Nurses (EN) and Enrolled Nursing Auxiliaries (ENA) on the other hand[34].

There are two ways of becoming a Professional Nurse[35]. Either nurses have passed a four-year programme, or ENs and ENAs have upgraded to professional nurses after a two-year bridging programme. This bridging programme can be offered by private as well as public nursing education institutions, but the four-year programme is offered by public institutions only (universities and public nursing colleges). In public institutions, nursing students are paid throughout their studies, as they work in health facilities.

The Nursing Act No 33 of 2005 introduced new regulations describing the scope of practice of nurses, and created new categories of nurses: professional nurse, professional midwife, staff nurse, auxiliary nurse and auxiliary midwife. The revised scope of practice meant to reflect a new approach to the nursing profession, where PNs ought to be better prepared for primary healthcare settings and trained to practise comprehensively (Breier et al., 2009). Some have also noted that the shortage of human resources in the country has led to expand the nurse's scope of practice through this Act.

4.3.2. Distribution of nurses

According to the SANC register in 2007 there were 103,792 registered PNs, and registers from the South African Nursing Council indicates that between 1998 and 2007, the total number of registered PNs increased by 6.9%, (see Appendix 4.2). However, these data are not entirely reliable, as they are not regularly updated. A recent study estimated that only about 80% of these nurses were still active (Breier et al., 2009). Still, even with such optimistic figures on the number of active nurses, the density of professional nurses in the South African public sector since 2000 has decreased by 3%, from 120.3 per 100,000 population in 2000 to 116.6 per 100,000 population in 2008[36] (Appendix 4.3). This is the consequence of the slow annual growth rate in the number of nurses, failing to match the higher population growth over the same period.

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[34] This study focuses on the first cadre of nurses.

[35] *"Registration on the SANC register entitles one to be called a registered nurse (RN) or professional nurse (PN). These terms are often used interchangeably, but the strict distinction is that the term 'professional nurse' should be used only for those who have been through a four-year programme that includes training in community nursing, midwifery and psychiatric nursing as well as general nursing. A nurse who has completed a bridging programme is qualified to practise only general nursing. In some contexts such nurses are referred to as registered rather than professional nurses."* Breier et al. 2009 (p.13)

[36] The decline in the nurse-to-population ratio is even bigger if one goes back to earlier years. For example, in 1998, there were 149 nurses per 100,000 population.

Table 4.2 provides evidence of the public-private imbalance (Health Systems Trust, 2008a). In the most urban areas, Western Cape and Gauteng provinces, the proportion of nurses working in the public sector is hardly one third. Conversely, in the most rural province, Limpopo, the majority of nurses work for the public sector, which supplies the bulk of the health services in those remote areas.

Furthermore, SANC data reveal that nurses are inequitably distributed across the different provinces (see Appendix 4.3). With the lowest density for the nursing population, the North West province has 0.6 times fewer nurses than KwaZulu Natal, which is a particularly densely populated and urban province. These figures understate the extent of the geographic imbalance of the nursing population, as they only report statistics about nurses in the public sector. Since a large proportion of nurses work in the private sector, almost exclusively located in urban area, inequalities in the geographic distribution of nurses are even greater.

Table 4.2: Evolution of the proportion of Professional Nurses registered with the SANC, working in the <u>public sector</u>

	EC	FS	GP	KZN	LP	MP	NC	NW	WC	South Africa
2002	41.9%	42.4%	30.2%	49.4%	82.1%	54.2%	47.7%	47.8%	30.9%	42.5%
2003	49.3%	42.3%	29.5%	49.8%	79.1%	58.3%	51.2%	46.4%	29.3%	43.0%
2005	54.5%	49.9%	28.4%	49.0%	76.4%	56.5%	50.4%	47.0%	28.9%	43.9%
2006	53.2%	49.8%	28.0%	48.5%	75.3%	56.4%	50.5%	45.8%	29.5%	43.5%
2007	54.3%	48.3%	26.7%	50.1%	73.0%	56.1%	56.4%	42.5%	30.6%	43.5%

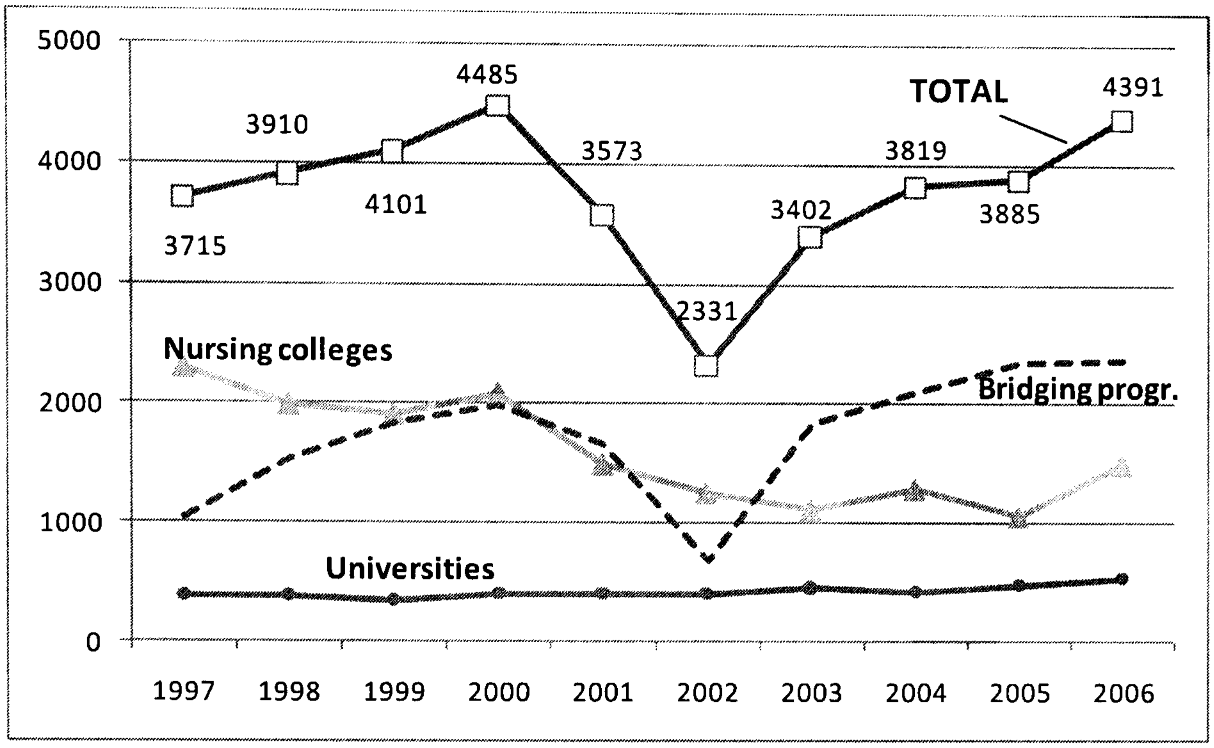
Notes: **EC:** Eastern Cape **FS:** Free State **GP:** Gauteng **KZN:** KwaZulu-Natal **LP:** Limpopo **MP:** Mpumalanga **NC:** Northern Cape **NW:** North West **WC:** Western Cape
Source: data from http://www.hst.org.za/healthstats/101/data

4.3.3. The production of nurses

Figure 4.2 below shows that between 1996 and 2007 the number of Professional Nurses graduating increased by 18%, from 3,715 to 4,391. However this figure hides contrasting evolutions. The increase in the number of professional nurses is essentially due to the expansion of the bridging programme, and to a lesser extent to the increase of production by universities (from 387 to 475)[37]. Conversely, there has been a steady fall in the number of nurses trained by nursing colleges, with a 35% decrease between 1997 and 2006.

[37] It should be noted that the content of nursing training in universities slightly differs from that of nursing colleges. Indeed, it provides students with a less clinical, more theoretical training. As a result, nursing graduates from universities are likely to be more tempted to opt out of general nursing, and pursue careers in academia or private pharmaceutical companies.

Figure 4.2: Number of Professional Nurses trained (1997-2006)



Source: http://www.sanc.co.za/stats/stat_ts/Output%201998-2007%204YP_files/frame.htm

Recent studies suggest that limited capacity of nursing institutions is the key bottleneck to a greater production of nurses (Mkhize and Nzimande, 2007, Breier et al., 2009), as training institutions have to turn down the majority of applicants. This fall in the capacity of nursing colleges has been explained by two problems. First, the rationalisation of nursing education (see 4.3.1) led to the merging and restructuring of nursing colleges, which translated into a reduction in the number of available spaces. Second, nursing colleges have suffered from being funded from provincial health budgets, and not the Department of Education (unlike universities). As a result, nursing college budgets were never shielded from budgetary cuts happening in provincial health budgets (Daviaud and Chopra, 2008).

As a result of the decline in the production of nurses in the public sector, private hospital groups and private hospitals have trained a higher number of ENs and ENAs (they are not accredited to train PNs), so that in 2006 70% of ENs and 78% of ENAs had been trained by private institutions (Breier et al., 2009). This growing role of the private sector has raised concern over the quality of training sometimes provided and the level of fees charged (Breier et al., 2009).

Having underlined the issues in human resources in several documents without never crafting a coherent response, the Department of Health finally showed some commitment in April 2006, with the publication of the National Human Resources Plan for Health (Department of Health, 2006). That document set strategic goals for addressing the shortage of health professionals through increased production. For professional nurses, it proposed to bring the annual production from an estimated 1,896 (in universities and nursing colleges) to 3,000 by 2011 (a 58% increase). At the same time, the annual production of ENs and ENAs was supposed to increase to respectively 8,000 and 10,000 by 2008. However, to date no specific step has been taken to act on these recommendations.

4.3.4. Emigration

The flow of nurses leaving South Africa to work overseas is a widely publicised phenomenon often cited as the reason for the shortfall of nurses in the country.

In general, South Africa has relatively high rates of emigration, in particular of its white population, towards Anglophone countries[38]. The brain drain of skilled workers started before 1994, and has continued on the same trend after that date (OECD, 2003). Primary reasons given by South African emigrants are concerns over violence, poor economic growth, decline in quality of life in their home countries and attractive opportunities overseas (Rogerson and Rogerson, 2000, Oosthuizen, 2005, Breier et al., 2009).

Table 4.3: Summary of study findings on the presence of South African nurses overseas

Study	Estimated number	Category	Applicable years	Data sources
Stock of nurses overseas				
(Clemens and Pettersson, 2007)	4,844	Professional Nurses	2000	Census data of recipient countries
(OECD, 2003)	6,844	nurses and midwives	2001	Employment and population surveys, census data
(WHO, 2006)	13,496	n/a	2004	n/a
Flow of nurses emigrating				
(Statistics South Africa, 2003)	842	Nursing professional	1999-2003	Self-declared nursing professional emigrants
SANC cited in (Breier et al., 2009)	14,462	n/a	2001-2004	Verification of transcripts by destination countries

n/a: not available

In 2003, based on migration statistics for nurses from 1990 to 2001, a study showed that before 1997 less than 1% of the nursing workforce was leaving South Africa, and that this proportion had slightly grown after this date, with a peak at 2.1% in 1999 (Hall and Erasmus, 2003). The authors of the study predicted that this proportion would remain between 1 and 2% each year. Several studies have tried to estimate the extent of international migration of nurses, and its effect on the workforce of source countries. All studies point to the difficulty of estimating the flow of nurses

38 According OECD estimates from 2001, countries with a large number of South African immigrants are: the United Kingdom (141,405), Australia (79,425), United States (68,290), Canada (37,680) and New Zealand (26,061). OECD Database on immigrants and expatriates http://www.oecd.org/dataoecd/18/23/34792376.xls

precisely, and researchers usually have to triangulate various data sources (Stillwell et al., 2003). Table 4.3 below summarises the data obtained from several studies on South African nurses[39].

Factors associated with the context of and life in South Africa have proved to be important driving factors for emigrant nurses (Oosthuizen, 2005). In addition, factors associated with the health sector have been identified as pushing nurses away from South Africa (Oosthuizen, 2005): poor working conditions (heavy workload and lack of resources), lack of career opportunities, lack of respect for the nursing profession and of support from managers, low salaries leading to the inability to provide good education to one's children.

While there is virtually no data available on the flow of returning South African nurses, there have been private initiatives attempting to attract them back home such as the "Homecoming Revolution"[40], an association providing different services to returnees to facilitate their homecoming. Different private hospital groups have used this association to try and attract South African nurses working overseas (Breier et al., 2009).

4.3.5. Policy interventions in the public sector

Although several early policy documents identified human resources as a key bottleneck for health care delivery in South Africa, the general framework for HR has been essentially shaped since 2000 by initiatives taken by the Department of Public Service and Administration (DPSA) (Health Systems Trust, 2006).

In a study by the DPSA, it was noted that between April 2001 and March 2002, the South African public service had lost more than 50,000 staff, corresponding to a turnover rate of 8% (Department of Public Service and Administration, 2006). The health sector was identified as one of the worst affected sectors, with a turnover rate of 24.7% for non-nursing health professionals and 10.7% for nurses (Department of Public Service and Administration, 2006). Following this report, the government adopted in 2002 a "Scarce Skills Development Strategy for the Public Service", which was soon followed by a Scarce Skills Policy Framework for the Public Service aimed at providing guidance to technical departments in the development of scare skills programmes.

The translation of the Scarce Skills Strategy in the health sector (the Scarce Skills Policy Framework for the health sector) proved challenging. The introduction of differentiated

[39] Many studies present figures on the total number of foreign health workers, not breaking down between nurses and doctors for example.
[40] http://www.homecomingrevolution.co.za/

allowances for different categories of health workers performing their jobs in similar areas (doctors receiving a top-up of 18-22% of their salaries, medical technicians, physiotherapists and psychologists receiving 12-17% and nurses between 8-12% of their salaries) was perceived negatively by nurses, who felt that their job was less valued by the health authorities (Geyer, 2004).

To respond to the lack of nurses in the public health sector, the 2005 Nursing Act introduced the idea of mandatory "community service" for nurses. This measure was enforced for the first time in 2008 when the Department of Health made it compulsory for all nurses to complete one year of community service in a public health facility, before they could fully qualify as professional nurses. In practice, graduate nurses express their wish for particular posts, but the final decision is made by the Department of Health. As a result, about 2,000 newly graduated nurses served in the nine provinces in 2008 (see Appendix 4.1).

In 2007, the DPSA finalised a collective national agreement on a new remuneration system for a wide range of civil servants, known as the Occupation Specific Dispensation (OSD). Having lost many civil servants to the private sector, the intention behind this initiative was to improve the government's ability to attract and retain skilled employees through better remuneration. Two categories of health professionals were concerned by this agreement: medical doctors and nurses. The agreement, implemented in March 2008, led to a 24% increase in entry level salaries for Professional Nurses in general nursing, which took effect retrospectively, from July 2007 (Department of Public Service and Administration, 2008).

Finally, on the international scene, South Africa has played a significant role in supporting the development of a code of ethical recruitment of health professionals for members of the British Commonwealth, and in 2002 the South African Department of Health developed a policy on Recruitment, Employment and Support of Foreign Health Professionals. It emanated from a regional agreement in Southern Africa and was aimed at ensuring that South Africa would not participate in the brain drain affecting other low- and middle-income countries. Instead, this policy encouraged the setting up of government-to-government agreements, to better control the movement of health professionals. As a result, South Africa has recruited health workers (mostly doctors) from other countries, such as Cuba, Iran or Tunisia, through government-to-government agreements (Couper et al., 2006).

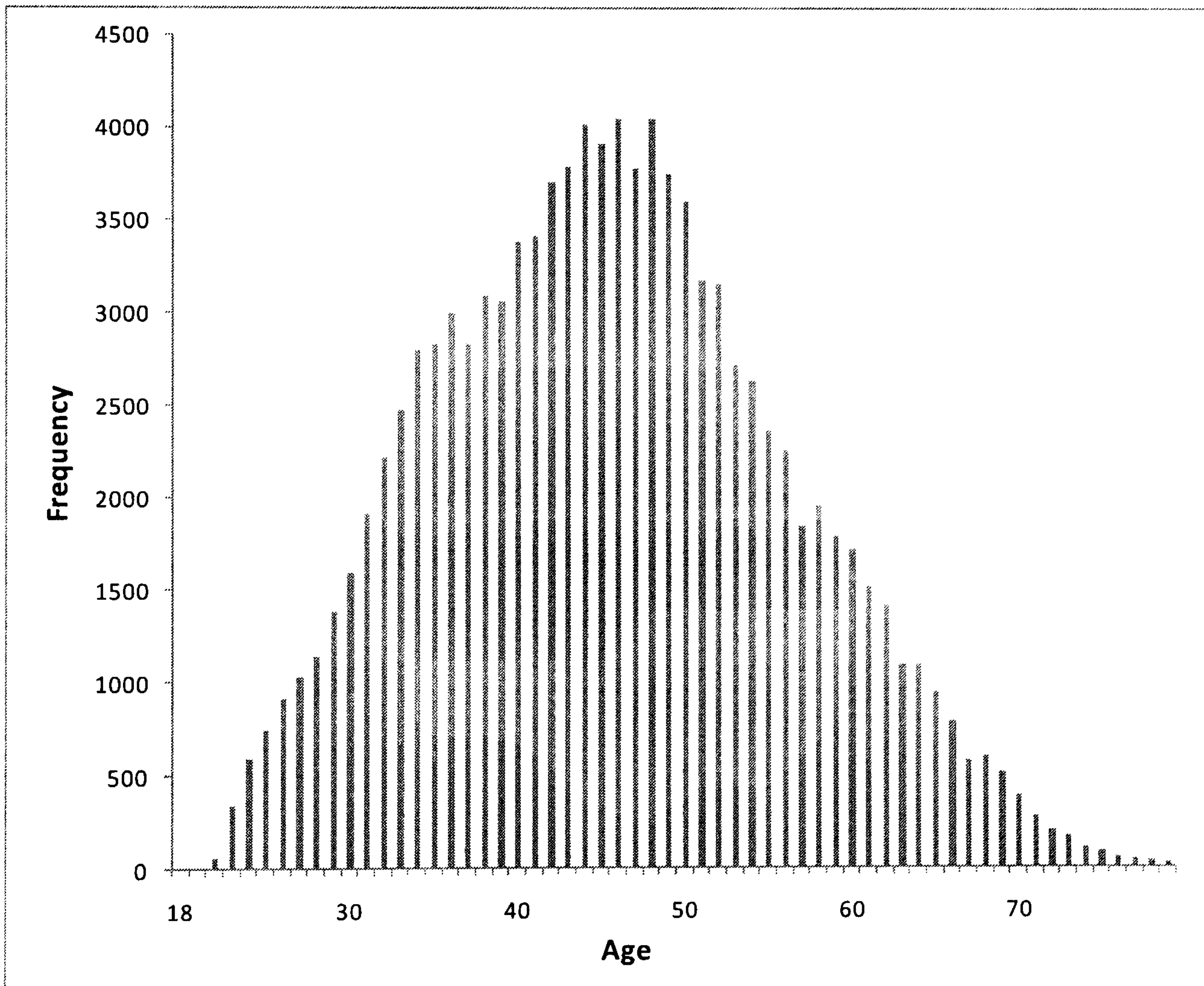
4.3.6. The nursing population

A. Age profile

More than two decades ago, a study (Cilliers, 1984) warned that if nothing changed, health care planners should anticipate a shortage of professional nurses from 2005 when the median age of professional nurses could be expected to exceed 50 years of age. That study forecasted that the majority of nurses would retire between 2010 and 2015.

According to data obtained from the SANC, the nursing population average age is just above 45 years old. Figure 4.3 shows that the great majority of nurses is over 40 years old, meaning that 74% of the nursing population is expected to retire by 2035 (statutory age for retirement in South Africa is 65 years old).

Figure 4.3: Distribution of the nursing population by age group

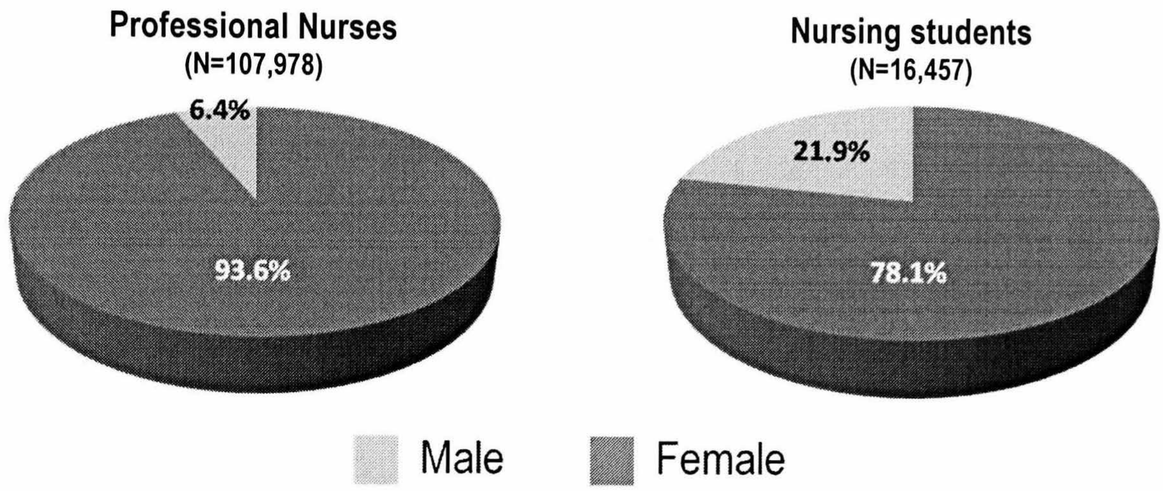


Source: data obtained from the South African Nursing Council, cited in http://www.info.gov.za/aboutsa/health.htm#Statutory

B. Gender profile

As shown by Figure 4.4, more than 90% of all categories of nurses on the registers of the Nursing Council are female. However, according to the SANC in 2008 more than 20% of nursing students (studying the four-year programme) were males. To explain this discrepancy, it has been suggested that males were attracted to nursing studies by bursaries and student salary offered in many institutions, but that they did not intend to pursue a career in nursing (Breier et al., 2009).

Figure 4.4: Distribution of the nursing population by gender, 2008



Source: http://www.sanc.co.za/stats/stat2008/Distribution%202008xls.htm

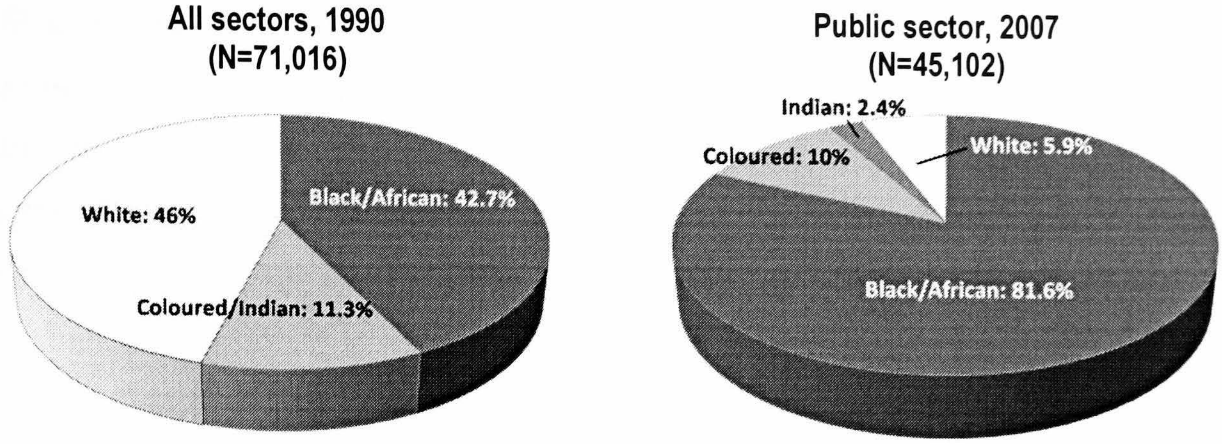
Surprisingly, a higher proportion of males (9%) is found in the lowest nursing cadre, the nursing enrolled auxiliaries (see Appendix 4.4).

C. Racial profile

Unlike black doctors who remained a tiny minority of the overall medical profession, black nurses were trained during the Apartheid regime in response to a serious shortage of nurses (Coovadia et al., 2009), so that in 1990, they represented 42.7% of the nursing population[41]. As a result of the opening of education to the black population after 1990, in 2007 black nurses represented about 82% of public sector Professional Nurses (see Figure 4.5). Although racial breakdown of the private nursing workforce is not available, it is probably not as unbalanced, with a higher proportion of white nurses recruited to take care of wealthier patients (Breier et al., 2009).

[41] However "*until the 1970s, [black nurses] could not nurse white patients or have white subordinates and, until 1986, had lower salaries than did white nurses*". Coovadia et al., 2009 p.829

Figure 4.5: Evolution of the breakdown of the nursing population by group population



Source: Breier et al., 2009

D. Prevalence of HIV-AIDS

In 2004, the prevalence of HIV amongst health workers from a representative sample of public and private facilities was 15.7% (Shisana et al., 2004). A more recent study (Connelly et al., 2007) in two public hospitals in Gauteng showed that nurses had the highest prevalence rate of all health workers (13.8%). It also showed that a high proportion was eligible for antiretroviral therapy, but not all had access to it. The direct effect of HIV/AIDS on nursing supply is therefore considerable, but the exact impact of that phenomenon is difficult to estimate without further data. It is also likely that the prevalence of HIV in the nursing population disproportionally affects the younger categories of nurses, between the ages of 15 and 49 (Shisana et al., 2004).

4.4. Conclusion

This brief presentation of the general situation in South Africa highlights the conditions faced by nurses on the labour market.

On the one hand, nurses are in a favourable position, supplying labour in short supply in difficult economic times. On the other hand, the socio-economic inequalities in the South African society, the gravity of health problems of the population, as well as the multiple challenges faced by a health system in transition contribute to form a very difficult working environment for the nursing labour force.

In addition, it is essential to keep in mind the double inequity in the provision of health services in South Africa, which fuels inequalities in the health care system. First, the inequitable geographic distribution of nurses has a detrimental impact on the access to health care in remote and rural areas. Second, the majority of nurses who work in the private sector only serve a minority of the population.

Finally, the brief description of the nursing population suggests that the study sample (see Table 3.3) is broadly representative of the main socio-demographic characteristics of the general nursing population. The study population comprises fewer men than the general nursing population (14.3% vs. 21.9%), the average age of both populations is comparable (30 years on average for the general nursing student population[42] vs. 31 years old for the study population), and, as in the general nursing population, most of the study participants were black (89%).

42 http://www.sanc.co.za/stats/stat2006/Age%20stats%202006_files/frame.htm

Chapter 5 - Exploring nurses' altruism

5.1. Introduction

As detailed in section 2.2.2, evidence suggests that positive attitudes towards others can provide powerful incentives in situations where the self-interest hypothesis predicts the absence of any incentives. Similarly, material incentives have been shown to be ineffective when they are not compatible with social preferences (Frey, 1997, Frey and Jegen, 2001).

Chapter 2 presented theoretical evidence explaining why concerns for others are potentially relevant to the analysis of job decisions made by health workers. It was underlined that a diverse empirical literature has confirmed the importance of such types of motivation, including vocation ('helping the community') and altruism ('serving others') (Brewer et al., 2000, Le Grand, 2003, Perry et al., 2009), while studies on nurses suggest that professional identity directly relates to vocational and altruistic motivations (Kingma, 2003, Miers et al., 2007), and that nurses are less likely to be influenced by, or interested in, monetary incentives (Kingma, 2003).

However, study of the influence of such motivational factors faces methodological difficulties to capture and measure those "social preferences". Social scientists have traditionally used surveys, asking questions that seek to capture either past actions demonstrating some altruism or underlying facets of the notion of altruism (see for example the Self-reported Altruism scale (Rushton et al., 1981)), or asking respondents to state how closely they relate to statements showing empathy or concerns for others (see for example the NEO Personality Inventory for altruism (Costa and McCrae, 1992)). However, because altruism is a socially desirable and positively valued behaviour, self-reports on altruistic behaviour or feelings of empathy are prone to self-presentation effects. Therefore survey instruments have been criticised for the fact that they may not give a true representation of individuals' values, but rather reflect to a certain degree the "*purchase of moral satisfaction*" (Kahneman and Knetsch, 1992).

This is the reason why economic experiments have recently been promoted as measurement tools for social preferences (Camerer and Fehr, 2004). In an experimental economics setting, individuals are asked to make choices for real money. The presence of actual incentives is thought to lead individuals to reveal their true behaviour, and control or limit self-presentation biases.

This chapter uses experimental economic games to measure nurses' altruism in South Africa and explore its determinants. It also seeks to compare and contrast these measures with those obtained with traditional survey instruments, and to measures of altruism obtained from the traditional subjects in experimental economics (economic students). This component of the research is based on the analysis of a classic economic game, the dictator game. Additional individual information collected at the same time is also used in the analysis of experimental results.

Before the tools used are presented and analysed, it is useful to first clarify some of the principles and standards used in experimental economics. Therefore section 5.2 discusses the principles that guide the use of experimental economics, and provides a survey of some of its applications. Section 5.3 then presents the tools used in the present work, and the methods used to analyse them. Finally, the results are presented in section 5.4 and discussed in section 5.5.

5.2. What is experimental economics?

5.2.1. Principles of experimental economics

A. Characteristics of experimental economics

Experimental economics is the use of controlled, 'scientifically 'designed experiments (also called games) to investigate decision processes under 'laboratory' conditions, where the experimenter defines the set of prices, budget, information, and actions available to participants, thereby measuring the influence of these factors on individual behaviour. One of the key features of experimental economic games is the use of real monetary incentives to elicit decisions. Reporting the differences between the behaviours of individuals playing for tokens or real money, Smith suggested that hypothetical rewards were "*more erratic, unreliable and easily satiated*" than money (Smith, 1962, Smith, 1976). Incentivising subjects with real financial stakes has become the norm in experimental economics, as opposed to experimental psychology for instance.

Economic games have long been used to test the basic assumptions about the preferences of economic agents, on which hinges most economic theories (Fehr and Fischbacher, 2002). The veracity of these assumptions is not observable empirically, as only the resulting choices made by agents are observed. Therefore experimental economists have designed simple games to identify and measure preferences in a controlled environment, very similar to that of a laboratory (Ensminger, 2001, Charness and Rabin, 2002). For example, the dictator game is one of a series of experiments that has been developed to test whether individuals behave as utility-maximisers (i.e. choosing options that maximise payoffs). This experiment involves two players. The first, "the proposer" (or dictator), determines an allocation of some endowment (determined by the experimenter). The second, the "recipient", simply receives the remainder of the endowment not kept by the proposer for himself. And individual behaving according to the assumptions of standard economic theory is expected to keep all the endowment for himself.

In order to create a controlled environment, the parameters of the experiments are meticulously calibrated. Every experiment is defined by its "environment" and "institution" (Vernon, 1994). The environment consists of the monetary incentives (usually initial endowments) and rules (or parameters of the game) that will determine the cost of exchange or decision. The institution defines the information initially available to participants, the rules governing the possible exchange and its enforcement. For example, in the dictator game, game parameters will determine the initial amount of endowment given to player one, and how that may be split between them and the other player, while different institutions might disclose none or some information about recipients (see for example Van der Merwe and Burns (2008) where the name of recipients is disclosed), or providing more or less privacy to dictators to make their choices – see Frey and Bohnet (1995).

B. Characteristics of the design of economic games

In experimental economics, "*the way in which an experiment is conducted is unbelievably important*" (Camerer, 2003). Indeed, experimental economists have established clear conventions to ensure the transparency of experiments – for example, authors are usually asked to provide their raw data and game instructions with their publications. Here, the main choices of the design of experimental economic games are briefly reviewed and the typical conventions are stated.

In terms of implementation, the game instructions are the cornerstone of the design of economic experiments. Scripts detail the rules to be applied during the experiments (process) and make clear to participants how each choice or sequence of choices will lead to particular payoffs. Besides, developing clear scripts that experimenters can follow meticulously enables precise replication of the experiment conditions. It guarantees for example that the verbal cues and other information that might influence decisions (examples given, criteria for answering participants' questions, etc.) are the same for all participants.

Anonymity is another typical feature of economic experiments. Because knowing who the game is played with (or against) is likely to influence the decisions made, in particular if there are interactions after the game is played, economic experiments usually try to create 'anonymity' – making it impossible for participants to know who they are playing with. This condition no longer holds if the actual objective of the experiment is to test the influence of partial or full information given to participants about the other players. For example, some researchers conceived a trust game in South Africa where they gave information about participants' race and showed that revealing racial identity has a significant impact on decisions (Haile et al., 2004).

As noted earlier, economic experiments always use real monetary incentives. The fundamental assumption behind this characteristic is that all players have a comparable marginal utility for money in the games (Smith, 1976, Camerer, 2003). The question of the size of the payoffs and influence thereof is no longer as debated as it once was, since a number of studies have shown that large variations in stakes have led to very modest effects (see a review in (Camerer, 2003)). Therefore even if there is no rule as to what the right level of incentive is, in developing countries, a common practice has been to make sure that on average players will gain one or two days worth of income in a game (Barr, 2001, Barr et al., 2003).

Finally, economic experiments normally follow a "between-subject" design (Camerer, 2003). This means that different participants are tested in different treatments. However, differences in the results obtained across treatments can then be confounded with systematic differences across individuals allocated to different groups. The alternative, "within-subject", design where the same subjects are subsequently exposed to different treatments (thereby serving as their own control group), has rarely been used, probably for fear that successive treatments might alter individual behaviour through heightened sensitivity or learning processes (Camerer, 2003). However, several authors have recently used an approach close to the within-subject design, sometimes termed the "strategy method", where they ask repeated questions to the same subjects. Amongst other things, this method has produced richer individual datasets (see more details on that approach in section 5.3).

5.2.2. Applications of experimental economics

Economic experiments have mainly been used for three purposes.
First, economists have used lab experiments to "test" existing or new theories, testing conclusions and/or assumptions. By comparing the predicted outcomes of the theory to the experimental observations, one can test the predictive power of competing theories. Alternatively, experiments allow researchers to test the extent to which the assumptions on which a theory is built are adequate. For example, the dictator game has been used to test one of the basic assumptions made by the homo economicus model of individual behaviour – utility-maximisation. If individuals were only concerned with their own economic well-being, proposers (acting as "dictators") would keep the entire endowment to themselves and give nothing to the other player. In the same spirit, economists have used experiments to assess the impact of different

environments or institutions on the predictive power of a theory or assumption, in order to refine theories. The literature on social preferences and the various forms of other-regarding preferences is one example of such use (Rabin, 1993, Andreoni and Miller, 2002, Charness and Haruvy, 2002, Charness and Rabin, 2002, Charness, 2004).

Second, experimental games have been used extensively to assess the relative advantages and effects of regulatory mechanisms. When applied to policy issues, games are usually tailored (and designed) to fit real-world situations, so that they can provide simplified models of an economic environment where participants are invited to make decisions based on real monetary incentives that mimic the ones faced in reality. Therefore they allow the measurement of the relative effectiveness of various regulation mechanisms on different outcomes. Interesting examples include an experiment in the field investigating the embezzlement behaviour of health workers and potential regulatory mechanisms (Barr et al., 2003); or a game designed to measure the relative effects of different determinants of corruption (Abbink et al., 2002).

Finally, experimental economics has recently been used as a measurement tool for values such as altruism (Eckel and Grossman, 1996, Bettinger and Slonim, 2005, Fowler, 2006, Andreoni et al., 2007), trust (Glaeser et al., 2000, Carpenter et al., 2003, Haile et al., 2004, Holm and Danielson, 2005) or preference for equity or fairness (Visser, 2002, Gowdy et al., 2003). Altruism has typically been measured as the proportion of money sent by the decider in the dictator game. Trust has been measured by the proportion of money the first player in a trust game agrees to send to the second player, in the prospect that this second player will return a proportion. When experimental games have been used as measurement tools of social preferences, the constructed measurements have usually been used in association with other data, to test whether the social preferences measured constituted predictive variables of actual behaviours. In Peru, Karlan (2005) examined whether behaviour in trust games predicted repayment of loans to a group lending micro-finance program.

5.2.3. Experimental economics 'in the field'

Some of the critiques addressed to experimental economics have focused on its incapacity to speak to 'real' issues, especially due to the artificiality of the conditions used and the particular nature of the usual participants.

The vast majority of economic experiments have taken place in the laboratories of American universities, with economics or business students being used as participants. The limitations of this practice have been emphasised in the literature (Carpenter et al., 2005, Carpenter et al., 2008). A few attempts have been made to improve the 'external validity' of behavioural experiments by running them with "real" subjects (Cardenas and Carpenter, 2008). For example, non-standard pools of subjects have included fishermen (Carpenter and Seki, 2006), workers in a factory (Barr and Serneels, 2004,) or health workers (Barr et al., 2003). Such economic games, which reproduce the classic elements of a lab experiment with non-standard subjects, have been termed "artefactual field experiments". By comparing this type of experiment to those set in conventional labs, researchers seek to inform the external validity of lab experiments traditionally using students, which may not be informative concerning the behaviour of the population.

The focus of the experiments in wealthy countries has also raised questions about the possibility to generalise results from such particular context to other settings, where values and norms might be different. This is certainly one of the reasons why the growing body of experiments implemented in developing countries has centred on the elicitation of social preferences and underlying values (Roth et al., 1991, Carpenter et al., 2003, Carter and Castillo, 2003, Gowdy et al., 2003, Ensminger, 2004, Greig and Bohnet, 2005, Holm and Danielson, 2005, Johansson-Stenman et al., 2005, Schechter, 2007), sometimes in very remote societies (Henrich et al., 2001, Henrich et al., 2004b).

The standard pool of participants in experimental economics has also been considered to be biased (Levitt and List, 2007). Indeed, the bulk of the literature draws conclusions from behaviours of participants who have volunteered to participate in experiments. Not only are they often aware of the discipline (and therefore of the presence of monetary stakes), but they also constitute a population of well-educated volunteers, whose characteristics and behaviours may systematically differ from those of other groups, as suggested by some studies (Fehr and List, 2004, List, 2005).

Despite these caveats, Levitt and List (2007) underline that experimental and traditional observations of behaviours are complementary and that "*lab experiments can then be used to learn qualitative insights about pro-social behaviours.*

5.3. Designing experimental economic games

5.3.1. Study population

The games were played in South Africa with two population groups:

- The first group was composed of the 377 final year nursing students who took part in the study described in Chapter 3;
- The second group was composed of 55 third-year undergraduate economic students in their second semester, from two universities in Johannesburg (the University of Johannesburg and Witwatersrand University).

None of these students had previous exposure to game theory, behavioural or experimental economics.

5.3.2. Experimental design

In this research, economic experiments were used to measure different facets of nurses' altruism. Tools and instructions were pre-tested in South Africa in November 2007. The following sections present the rationale and details of the experiments implemented.

To construct simple measures of nurses' altruism, the dictator game was chosen, with nurses playing the role of allocators (or dictators). This game is supposed to elicit the preference for altruism of allocators. As the game is free from strategic considerations or reciprocity (recipients ignore the identity of their potential generous donors), allocators' only motive for sharing the initial endowment is the propensity to value positively others' well-being. In this study, subjects were free to choose one of eleven possible ways to split R100 (see Figure 5.1 below). This payoff was chosen with reference to the daily wage of a young nurse[43]. All study participants were about to graduate and would then earn R96,000/year (about R260/day). As the nurses were also participating in a second game where the stakes were higher, the R100 stake seemed to be a good compromise, which also allowed eleven splits easy to pay with the available denominations in Rands.

The objective was to measure the strength of nurses' commitment towards their patients, therefore framing was desirable to improve the external validity of these measures.

[43] See earlier sections explaining that this is the usual stake used in economic games in developing countries.

Figure 5.1: Experimental game response sheet

STUDY NUMBER:

TASK 1

For each question (A, B and C), circle the number of the option you choose

A		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11
	You get	*100%* R 100	*90%* R 90	*80%* R 80	*70%* R 70	*60%* R 60	*50%* R 50	*40%* R 40	*30%* R 30	*20%* R 20	*10%* R 10	*0%* R 0
	Another student gets	*0%* R 0	*10%* R 10	*20%* R 20	*30%* R 30	*40%* R 40	*50%* R 50	*60%* R 60	*70%* R 70	*80%* R 80	*90%* R 90	*100%* R 100
	YOU CHOOSE:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

B		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11
	You get	*100%* R 100	*90%* R 90	*80%* R 80	*70%* R 70	*60%* R 60	*50%* R 50	*40%* R 40	*30%* R 30	*20%* R 20	*10%* R 10	*0%* R 0
	A patient gets	*0%* R 0	*10%* R 10	*20%* R 20	*30%* R 30	*40%* R 40	*50%* R 50	*60%* R 60	*70%* R 70	*80%* R 80	*90%* R 90	*100%* R 100
	YOU CHOOSE:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

C		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11
	You get	*100%* R 100	*90%* R 90	*80%* R 80	*70%* R 70	*60%* R 60	*50%* R 50	*40%* R 40	*30%* R 30	*20%* R 20	*10%* R 10	*0%* R 0
	A poor person gets	*0%* R 0	*10%* R 10	*20%* R 20	*30%* R 30	*40%* R 40	*50%* R 50	*60%* R 60	*70%* R 70	*80%* R 80	*90%* R 90	*100%* R 100
	YOU CHOOSE:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**

Adopting a similar approach as Branas-Garza (2006), different framings of recipients were used, to differentiate nurses' altruism towards different types of recipients, described by a few general characteristics: anonymous (fellow) students, patients, and poor persons. Three reasons drove these choices.

First, the fellow student framing was chosen to provide a benchmark in the game. Indeed, this conforms to the traditional anonymous beneficiary of most dictator games (DG) played in the literature. This framing was therefore meant to provide a "baseline" and control for variability in results as a consequence of the manipulation of key factors (Camerer, 2003), here the information given about recipients.

Second, there is evidence that donations to recipients in DG increase with a sense of usefulness (Eckel and Grossman, 1996) or the understanding that recipients need it (Branas-Garza, 2006). While the "poor" framing was an obvious "needy" recipient, it was less clear how respondents would view patients, and to what extent they would view them as more or less needy than fellow students or poor persons.

Finally, these three framings were chosen to test the following two hypotheses:

- *Ceteris paribus*, the patient identity triggers more altruism than the traditional fellow student;
- Altruistic donations in dictator games are also linked to an element of financial need, meaning that the "poor" framing generates more generosity than the other two.

To produce individual measures and minimize the cost and length of the experimental session[44], as well as the risk of contamination that could occur with several rounds and several payoffs, the procedural design used response functions (Barr et al., 2005, Brandts et al., 2006). This means that each participant had to decide for all three framings which allocation they would make, knowing that they could be paired with any of three different recipients. The identity of the recipient would be determined at the end of the game. Following Brands et al. (2006), one of the three identities was randomly selected through a lottery process, and determined the actual payoffs to be made to the dictators and to the recipients, according to the choices made by the participants for the selected framing. Participants knew in advance that their payoffs would be determined by the choices they had made for any one of the recipients. This was particularly emphasised in the instructions.

[44] Given that experimental games were administered at the same time as all the other baseline tools, it was judged important to find ways to neutralize as much as possible any "fatigue" effect of participants.

5.3.3. Experimental procedures

Due to constraints originally imposed by the ethics committee of the University of Witwatersrand, all individuals were first invited[45] to participate in a study about job choices, which would involve different instruments including a "decision-making" task. In the information sheet or the explanation, no mention of the financial stakes in the games was made. If they wanted to join the study, they were invited to show up on a set date and time, in a pre-determined classroom. The word 'experiment' or 'game' was never used either. This was done to avoid the behavioural biases noted by Frohlich et al. who pointed out that if participants to the dictator game viewed it as a game, their main motivation would then be to earn money (Frohlich et al., 2001).

On the day of the study, the experiment was conducted in a classroom. Participants were told that the first part of the data collection would involve a simple decision task where real money would be used (the introductory script to the experimental session can be found in Appendix 5.1). Participants were told that they were not allowed to discuss their choices with each other, and enough space was left between them to prevent communication. In order to ensure anonymity towards the experimenter (and all researchers), the experimental subjects were asked to report a study number on their response sheet.

An envelope containing a response sheet (Figure 5.1) had previously been put on their table. The instructions of the game were read out loud to participants by the experimenter, who followed a detailed script (see in Appendix 5.1). Instructions were phrased as neutrally as possible, as the use of language has been shown to be important (Kahneman et al., 1986, Forsythe et al., 1994). Following these studies, verbal precautions were used to avoid biases: no reference was ever made to a "game" or an "experiment", and participants were invited to "divide" the money (R100) they were "allocated" between themselves and another person. Because the tools were used in three different countries (and two languages), an effort was made to phrase instructions in English that ensured a straightforward translation. As in a cross-country study of bargaining experiments (Roth et al., 1991), this led to less abstract and technical terms than sometimes used in standard experiments from developed countries in university labs. The experimenter explained that the recipient could be any one of three different persons (another student, a patient or a poor person who would be paid later, and would remain anonymous. Anonymous meant that would not learn anything about the recipients, and recipients would never know anything about their "benefactors". Participants were explained that, although their responses were recorded for the

[45] This was imposed by the Ethics Committee to avoid the students feeling compelled to participate to the study.

three possible recipients, payment would be made to only one of them, as determined by a random drawing at the end of the experiment (see below).

To ensure easy comprehension of the rules by all (in particular the final random drawing procedure), the experiment was explained with a visual support (a PowerPoint presentation) which detailed two examples (see Appendix 5.2). To establish the credibility of the financial stakes, the money used to make the payments was shown repeatedly and emphatically to participants during the instructions (i.e. piles of bills were displayed). This was the result of lessons learnt in the pilot study, where participants had initially failed to believe that the game was going to be played for real money. Finally, although this may not have prevented scepticism or doubts, experimenters reiterated on several occasions that the payoffs would also be paid to the recipients.

At the end of the game, participants witnessed that three different pieces of paper, corresponding to the three different recipient identities, were put in the box. The experimenter then asked that one of the participants drew blindly one of the three papers that had been put in a box. They were told that a researcher would put in an envelope their corresponding gains, and would then pass those envelopes on to the other researchers in the classroom.

Payments to the study participants were made on the day; a researcher would calculate the payoffs while the other tools of the study were being administered, and put each individual payoff in a sealed envelope marked only by the individual study number. At the end of the data collection, each study participant was given the sealed envelope corresponding to their individual study number. Payoffs to recipients were made later through donations to different institutions. Money was used to contribute to scholarships for students, to health care projects for patients and poor populations.

5.3.4. Additional data collection

This section briefly recalls some of the tools already described in Chapter 3 that were introduced in the data collection in order to analyse and investigate the responses from the experimental economic games.

To analyse the determinants of altruism, individual information was collected on a number of standard characteristics (gender, age, parents' profession, background, etc.), but a number of attitudinal questions were also inserted specifically to measure their correlation with experimental measures of altruism. Three dimensions were of particular interest:

- individual-level measures of altruism or other-regarding concerns

- societal-level measures of values and attitudes towards poverty and the government's role
- individual measures of vocational motivation (related to nursing)

Although the use of validated instruments for each of these dimensions would have been preferable, this was discarded for two reasons. First, we could not find a validated instrument that had been developed for the context of developing countries, where altruistic behaviours might differ from those identified in industrialised countries. For instance, in the self-report altruism scale (Rushton et al., 1981) respondents rate the frequency with which they have engaged in behaviours such as "buying charity Christmas cards", "giving a stranger a lift in [one's] car" or "donating blood". This would not be particularly relevant in the context of South Africa and therefore the validity of the tool might be compromised. Second, using a validated tool would have increased dramatically the length of the data collection. For example, the same self-report altruism scale asks respondents how often (on a five-item scale) they have engaged in twenty behaviours. Following Carpenter and Myers (2007), a more ad hoc approach was adopted: a series of survey questions were taken from the World Value Survey, the British Social Value Survey and the self-altruism scale, with the objective of testing the correlation between survey and experimental measures of social preferences. Additional questions relating to nursing professional ethics (frequently used in the nursing motivation literature) were inserted in the self-administered questionnaire (see Appendix 5.3).

Finally, in each study site, two focus group discussions were organised at the end of the session. Participants were asked to comment on the tasks they had done, and in particular were invited to explain how they had made their decisions during the dictator game.

5.4. Methods used in the analysis

5.4.1. Constructing experimental measures of altruism

The dominant interpretation of the dictator game in the literature on experimental economics is that the money relinquished by respondents playing the role of dictators in a dictator game can be interpreted as a measure of their altruism.

In the dictator game played with three different framings, three measures of altruism (A_1, A_2 and A_3) were computed, with

$$A_j = q_j$$

Where q_j is the proportion of money given up to recipient *j*, with *j*=1 when the recipient was the fellow student, *j*=2 when the recipient was the patient and *j*=3 when the recipient was the poor person. These measures were computed for nursing and economic students in South Africa.

The first step in the analysis of a dictator game usually involves a descriptive presentation of the results through two aspects:

- The average proportion of the initial endowments relinquished by the dictators;
- The distribution of choices over all the possibilities given to players.

These descriptive results are presented for all three frames and for the two different types of student populations (nursing and economic). A Mann-Whitney test is used to compare the distributions of responses across populations.

5.4.2. Multivariate analysis

A. Model specification

The empirical approach can be summarised as follows:

$$A_{ij} = \beta X_i + \delta Z_i + \mu_i$$

where the dependent variable A_{ij} denotes the measure of individual i's altruism for framing *j*, as presented earlier. Explanatory variables are made up of vectors of socio-demographic characteristics (X_i) and measures of individual values (Z_i), while μ_i is a vector of residuals.

A Tobit was used to estimate the model, in order to correct for the censored nature of the dependent variable[46]. The analysis involved estimating separate Tobit models for each framing. Subsequently, a random-effects Tobit regression model was used to compare results across the three framings for three reasons. First, it allowed the simultaneous analysis of all three decisions in the same model, thereby testing the influence of the framing effect. Second, it provided a rigorous test to examine the difference between the determinants of altruism across the three framings. Finally, the random-effects specification accounted for serial correlation between the three consecutive choices made by respondents.

For all model specifications, the approach was to estimate a full model first, which included the large set of explanatory variables (see below). Then reduced forms were estimated, and a parsimonious form was retained based on goodness-of-fit measures (Chi^2). Only the restricted models are presented in the result section[47].

[46] There are lower and upper limits of the amount that can be shared with the recipient.
[47] Full model estimates were consistent with restricted model estimates.

B. Explanatory variables

Constructing attitudinal and value variables

As mentioned before, the questionnaire contained 30 questions relating to individual motivating factors, professional nursing ethics, societal values and altruism (see Appendix 5.3). Principal Component Analysis (PCA) was used to reduce the number of variables to be used in the analysis and to construct proxy variables summarising the main underlying concepts captured by the attitudinal questions. Based on an analysis of the variance between variables, this technique helps identify some underlying construct in the variables, and produces proxy variables (the factors or components) summarising these constructs. Six variables were constructed based on the first component of the PCA run on different groups of variables. Table 5.1 summarises these variables, explaining their overall meaning and the variables on which they were based. For each one, Cronbach's alpha[48] is also reported. A more detailed report of the PCA results (explaining and justifying the choice of the first components) can be found in Appendix 5.4.

Other demographic characteristics

There were very few priors on the direction of influence of socio-demographic characteristics or attitudinal characteristics on decisions in the dictator game (see Appendix 5.5). Most of the assumptions were based on results obtained from previous experimental literature (Camerer, 2003). This provided a selection of socio-demographic variables to test in the multivariate analysis of the determinants of decisions in the dictator games.

Table 5.1: Proxy variables constructed with PCA for attitudinal variables

Variable name	**Meaning**	**List of variables included** *(except if stated otherwise, responses were provided on a scale of 1 to 6 to express agreement with the statements provided)*	**Cronbach's alpha**
rural	Attitude towards rural lifestyle – the higher the score the more positive people feel towards rural lifestyle.	1. "Working in rural areas is not stressful at all". 2. "Quality of life in rural areas is very good". 3. "The lifestyle you have in rural areas appeals to me". 4. "The social life in rural areas is enjoyable". 5. "Living in a city is stressful".	0.7039
nursing	Vocational motivation – a high score is associated with a greater sense of professional ethics	1. "I chose my profession to help others". 2. "I always wanted to be a nurse". 3. "I am proud to tell people that I am a nurse".	0.5645

48 A statistical measure of the internal consistency of an index, comprised between 0 and 1.

extrinsic	Extrinsic motivation – people with a higher score will be particularly sensitive to extrinsic motivating factors	1. "I chose my profession because I can earn money". 2. "I chose my profession because other people value it". 3. "I chose my profession because I can always find a job". 4. "You can earn more money when you work in a rural area". 5. "You can obtain advancement in your career quickly if you choose a rural position".	0.4771
welfare	Societal value (welfare state) – a higher score reflects the belief that the state should be responsible for the welfare of its citizens	1. "Ensure that everyone is provided for". 2. "Provide a job for everyone who wants one". 3. "Provide health care for the sick". 4. "Provide a decent standard of living for the old". 5. "Provide a decent standard of living for the unemployed". 6. "Give financial help to university students from low-income families". 7. "The government should help the poorest"	0.6724
pro-poor	Societal value (pro-poor) – the higher the score the more people agree with pro-poor and redistributive policies	1. "The government should spend more money for the poor, even if it leads to higher taxes" 2. "Cutting welfare grants would damage too many people's lives" 3. "Redistribute income from the better off to those who are less well-off" 4. "Most important thing for government to do "To get people to claim social grants and other benefits to which they are entitled"	0.3617
conservative	Negative judgment towards the poor – a high score reflects a more conservative view of social policy, which emphasize self-reliance and individual responsibility	1. "Around here, most unemployed people could find a job if they really wanted one" 2. "Many people who get social grants don't really deserve them" 3. "If social grants and other benefits weren't so generous, people would learn to stand on their own feet" 4. (poverty is) "Because of laziness or lack of will power"	0.6027
altruism	Altruism – a high score shows a greater propensity to act generously, for the benefit of others.	1. "Helping others with my time or money is very important to me". 2. "Personally assisting people in trouble is very important to me".	0.5376

5.4.3. Results

A. <u>Descriptive results</u>

This section shows the key descriptive results summarising the decisions made by nursing and economic students in South Africa in the dictator game.

First, average donations made by nursing students presented in Figure 5.2 are highest for the poor framing (53.3%), but are identical for the student and patient framings (34.2% and 37.7%).

Second, looking at the whole distribution of decisions made (see Figure 5.3), there is a marked difference between decisions taken for the student frame and those relating to the other two recipients. While the 'student' distribution is left-skewed - which denotes that nurses have kept most of the money for themselves- there is a clear slip toward more altruistic behaviours (giving away 50% or more) with the patient and poor frames.

Finally, despite the observed differences in the three frames, they all present the same mode – at the equal split (see Figure 5.3). This is an unusual finding, which highlights a concern for fairness in the dictator game, and contradicts the utility-maximising assumption.

Figure 5.2: Average share of the initial endowment given by nursing and economic students to recipients (with 95% CI), by student groups, for each type of recipient

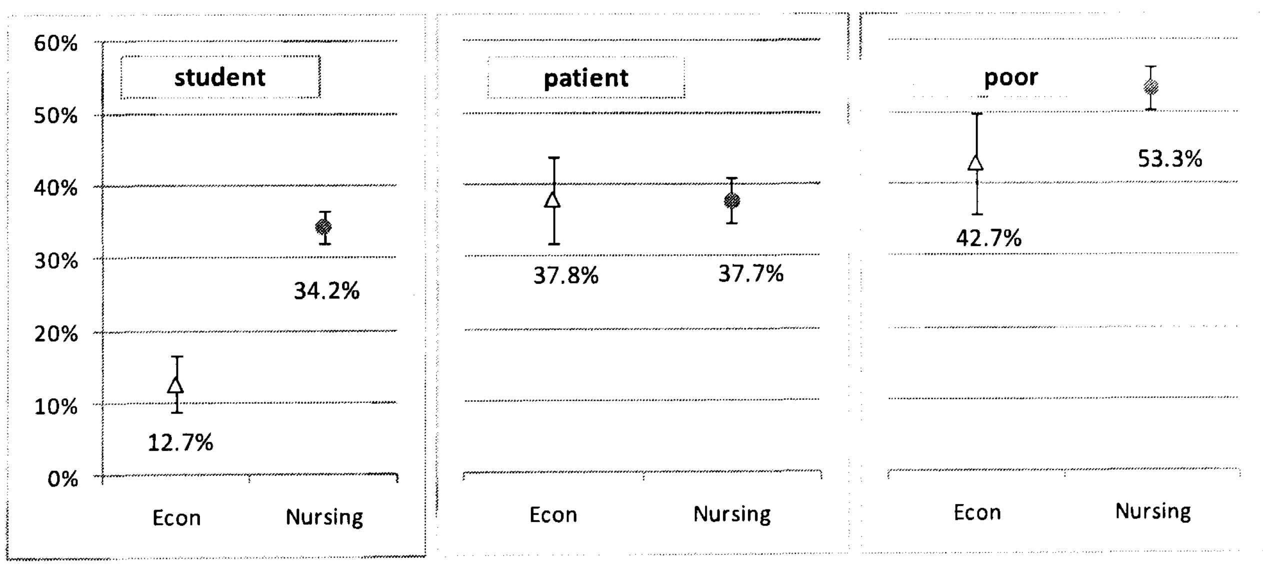


Figure 5.3: Distribution of choices in the dictator games played with South African nursing students with the three frames

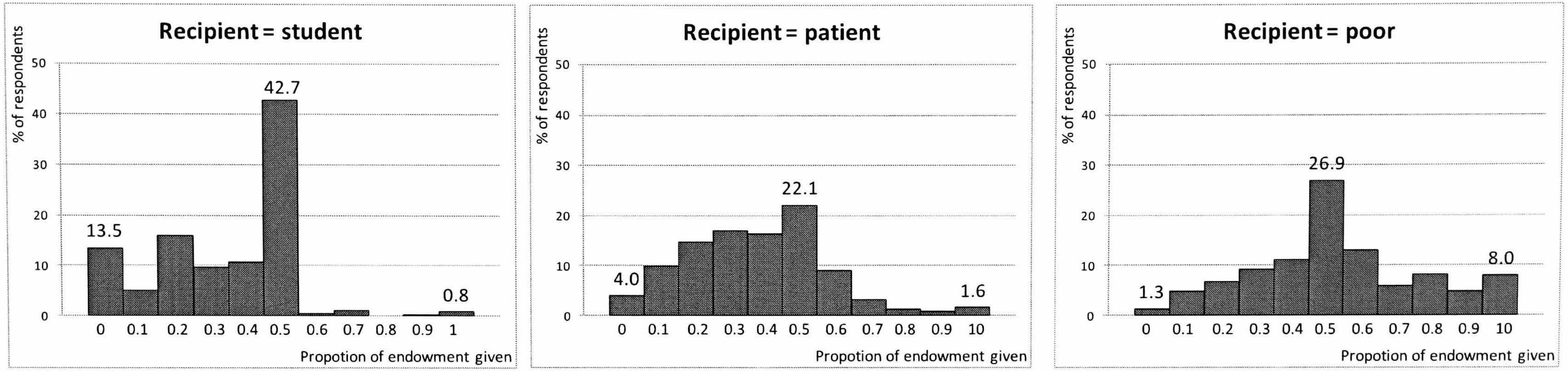
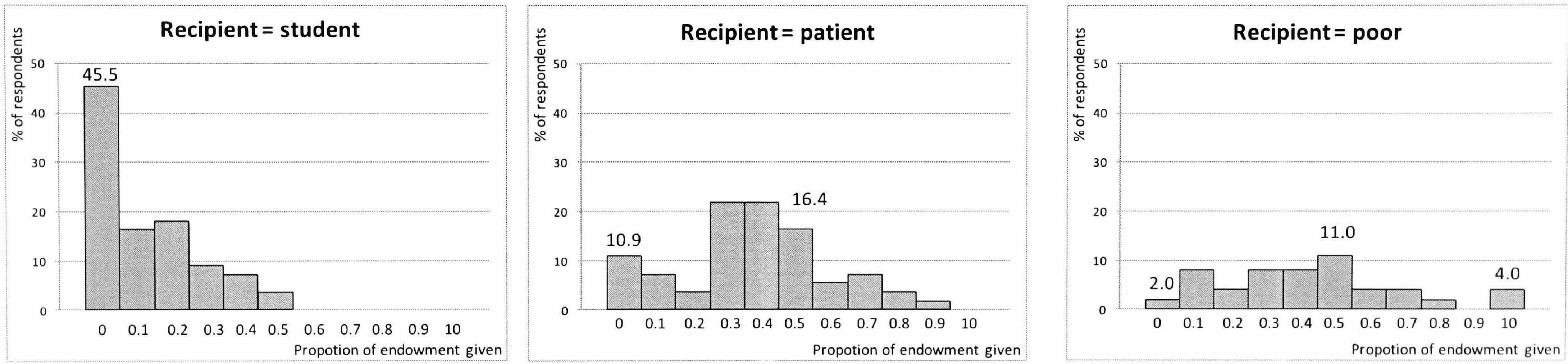


Figure 5.4: Distribution of choices in the dictator games played with South African economic students with the three frames



B. Comparing South African nursing and economic students

Three facts emerged from the basic comparison of the decisions made by nursing and economic students in the DG.

First, economic students were much less generous than nursing ones towards then other student and the poor person (Figure 5.2), as clearly demonstrated by the comparison of the two cumulative distributions (see Figure 5.5 and Figure 5.7). It is particularly striking with the student framing, where the majority of economic students (45.5%) chose to keep everything for themselves, while an equal proportion of nursing students (42.7%) chose to share half of their endowment. A formal comparison of distributions (with a two-sample Mann-Whitney test), confirmed the difference between behaviours of economic and nursing students for both frames ($p<0.000$ for student frame and $p<0.0035$ for the poor frame – see Appendix 5.6). 3

In contrast, there is a surprising similarity of results obtained for the patient frame in the two populations (Figure 5.6). The mean donation was identical for economic students (37.8%) and nursing students (37.7%), and although the mode of the distribution is different, overall the two distributions are not significantly different ($p<0.61$ – see Appendix 5.6).

Finally, despite the differences observed, the donations made by economic students conserve the same linear progression in donation, underlining the perceived 'deservingness' hypothesised in section 5.3.2.

Figure 5.5: Cumulative distributions of "student" dictator games played with economic and nursing students

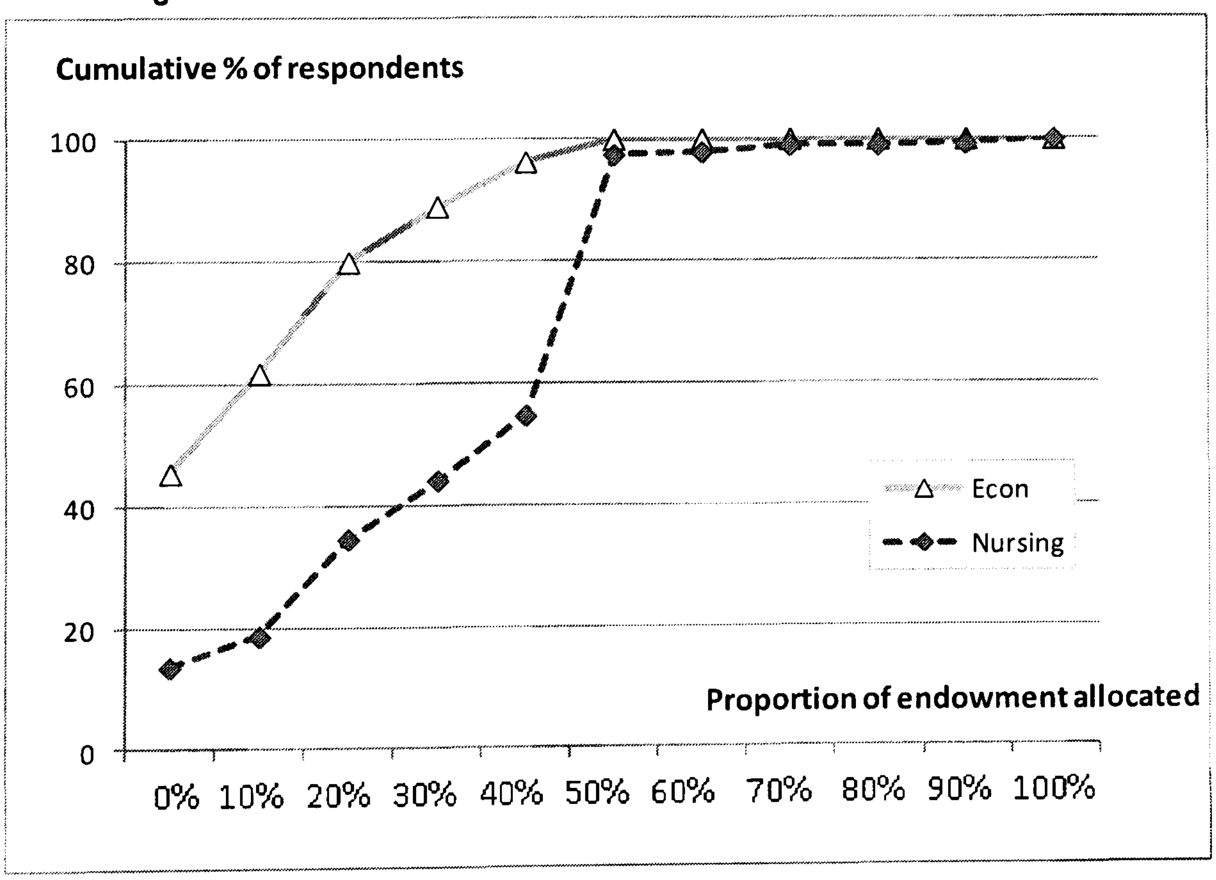


Figure 5.6: Cumulative distributions of "patient" dictator games played with economic and nursing students

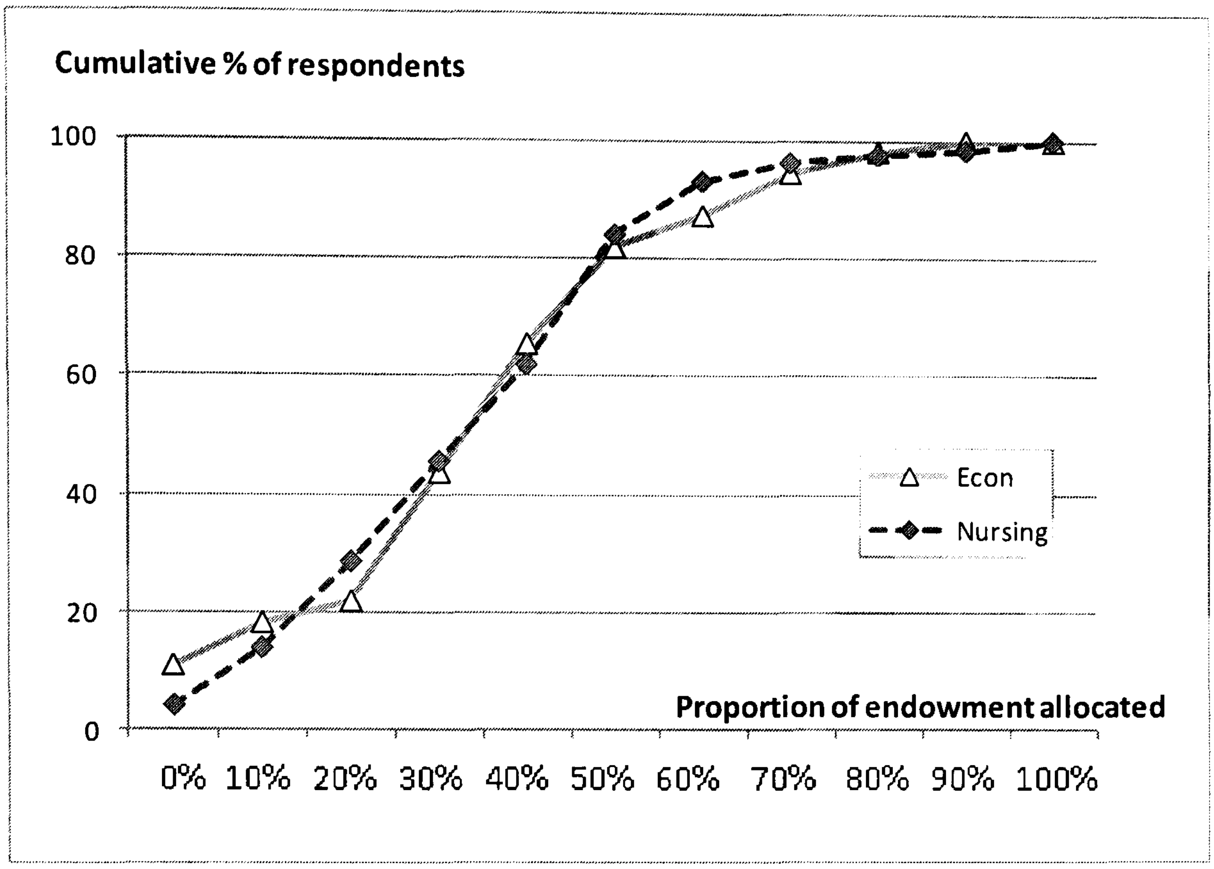
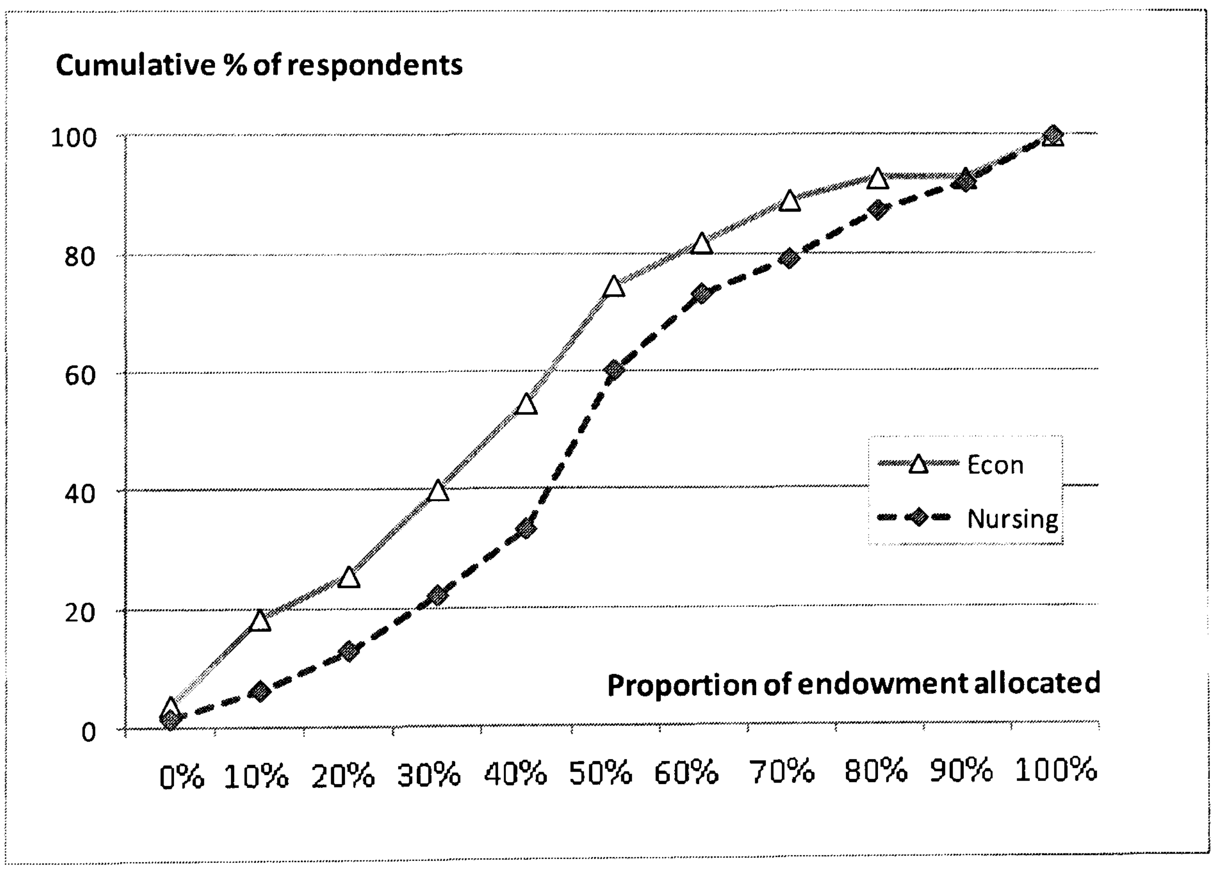


Figure 5.7: Cumulative distributions of "poor" dictator games played with economic and nursing students



C. Qualitative results

Focus group discussions held after the data collection with two groups of nursing students in each site helped understand the motivations of decisions made by the participants. A few findings arise from the analysis of the transcripts of these discussions.

First, many participants seemed to detach themselves from the relatively abstract framing of the experiment and contextualised the decisions to make to cope with the task. They relied on a much clearer and precise identity:

> *"There was a patient with a very sad story and she had a child she was adoption, and she actually didn't have the money to buy formula for the baby. So I thought wouldn't it be nice if I had 100 Rands for that patient so you can buy her baby formula."*
>
> *"There is a ward for cancer children, so i was thinking more of those children."*
> *"I was reminding of the patient that I nursed before, when I was working in a rural area. I was thinking of that person."*
>
> *"I made a scenario for each question."*

Second, to justify their decisions, the dictators appealed to a wide array of moral motivations, referring to recipients' needs or lack thereof. For example, to justify a large gift, participants appealed to moral motives such as "helping the poor" or giving to those who can make a better use of the money than themselves:

> *"I suppose my moral led me to give a poor person the entire 100 Rands, because in the back of my mind i was thinking 'what would my mother think if I did give the poor person nothing?' "*
>
> *"With the poor person, you know, I was thinking " on the streets, nothing to eat, nothing to drink."*
>
> *"I thought of what my feelings would be if I had a patient and I had 100 Rands and I thought what my feelings would be if I gave him less than what I'd keep."*
>
> *"Some people are poor by choice, but here I was thinking of those who can't really do anything about the situation. They are not poor by choice. "*

On the other hand, to justify a split of the money more advantageous to themselves, they highlighted that the recipient did not need the money, or that the responsibility to help them financially lay with someone else (e.g. the government):

> *"For the poor, they don't have the need for the money most of them; if you give them money, they always drink it or waste it, so I just give them 20 Rands."*

Finally, to justify a small gift to the patients, they underlined that they were already doing a lot for the patients through their work, and did not need to do more:

> *"If 100 Rands is the health budget and it's going to be how much is going to nurses' salaries and how much is going on equipment and that kind of things?"*

"For the patient I'd give less [than the student] because they are already taken care of, they get something from the government."

"I had to make sure that the patient doesn't get my money. "
"I didn't give anything to the patient because if we give them help, they will have more money than us... the patients, they have care, they have food, they have a bed, they have everything! I didn't feel that I give more money to the patients because I felt that the government is already doing it."

"I am the one who have the needs, to help the patients. To give those patients more, I must think about myself before I can think about them. I must be fit before I can give help, you see."

"I was thinking "let me make some money" because the patient, he gets his own subsidies from the government."

Although there was no evidence of a particular causal link between the decisions made and the explanation provided, it seems as though, when playing the game, dictators ascertained and took into account the social (Hoffman et al., 1996) and/or moral (Aguiar et al., 2008) distances that separated themselves from the recipients.

D. Multivariate analysis

To understand how socio-demographic and other individual factors influence the choices in the dictator game, both bivariate and multivariate analyses were performed. Results of the bivariate analysis can be found in Appendix 5.7. Three main findings arise from the study of determinants of altruism across the three framings in the multivariate analysis, as presented in Table 5.2.

First, some socio-demographic variables seem to be meaningful in determining the choices made in the dictator game. More altruistic decisions are associated with older age, being a white person (the coefficients for white are significant at the 10% level for the patient and poor framings), and having studied in the more urban province (Gauteng). It is likely that the latter two variables capture a relatively wealthier socio-economic background, which could not be precisely measured with any other variable. In addition, although the coefficients are not significant at the 5% level, male nursing students tend to be less generous than their female colleagues.

Table 5.2: Coefficient estimates from three different Tobit regression models, showing the determinants of individual altruism

	Model 1 (recipient=student)			Model 2 (recipient=patient)			Model 3 (recipient=poor)		
	Coeff.	Standard errors	P-value	Coeff.	Standard errors	P-value	Coeff.	Standard errors	P-value
Constant	**0.219*** **	**(0.045)**	**(0.000)**	**0.358*** **	**(0.043)**	**(0.000)**	**0.430*** **	**(0.052)**	**(0.000)**
Aged 25 to 29y.[aged less than 25y.]	**0.085* **	**(0.036)**	**(0.020)**	0.010	(0.034)	(0.762)	0.017	(0.042)	(0.693)
Aged 30 to 34y.	**0.085* **	**(0.038)**	**(0.026)**	0.028	(0.036)	(0.441)	0.039	(0.044)	(0.379)
Aged more than35y.	**0.184*** **	**(0.041)**	**(0.000)**	0.051	(0.039)	(0.193)	0.060	(0.048)	(0.215)
Male	-0.033	(0.035)	(0.347)	-0.056	(0.034)	(0.102)	-0.065	(0.041)	(0.118)
White	**0.131* **	**(0.055)**	**(0.017)**	0.077	(0.053)	(0.146)	0.118	(0.065)	(0.067)
Does not have children	-0.001	(0.029)	(0.975)	-0.003	(0.028)	(0.922)	-0.028	(0.035)	(0.423)
Gauteng	0.020	(0.027)	(0.449)	**0.060* **	**(0.026)**	**(0.021)**	**0.124*** **	**(0.032)**	**(0.000)**
Born in a rural area	0.023	(0.026)	(0.379)	0.002	(0.025)	(0.924)	-0.007	(0.031)	(0.827)
Studied at university	0.030	(0.036)	(0.405)	0.031	(0.035)	(0.377)	0.064	(0.043)	(0.134)
Nursing was not 1st choice	-0.024	(0.030)	(0.424)	**-0.069* **	**(0.029)**	**(0.017)**	0.015	(0.035)	(0.660)
Altruism	0.013	(0.010)	(0.183)	**0.022* **	**(0.010)**	**(0.023)**	**0.024* **	**(0.012)**	**(0.040)**
Conservative	**-0.022* **	**(0.009)**	**(0.016)**	-0.005	(0.009)	(0.546)	-0.013	(0.011)	(0.221)
Welfare	0.015	(0.010)	(0.153)	**0.025* **	**(0.010)**	**(0.012)**	**0.032** **	**(0.012)**	**(0.009)**
Extrinsic	-0.006	(0.010)	(0.540)	-0.008	(0.009)	(0.360)	-0.016	(0.011)	(0.163)
Nursing	-0.005	(0.011)	(0.663)	-0.009	(0.011)	(0.419)	0.001	(0.013)	(0.932)
Observations	354			354			354		
Sigma	0.211***			0.205***			0.250***		
Log-likelihood	-20.83			26.04			-54.21		
Log-L (null)	-45.15			5.497			-76.34		
Chi2	48.65			41.08			44.24		

*** p<0.001, ** p<0.01, * p<0.05

Note: for the age dummy variables, the reference category is indicated in brackets.

Second, although they are not systematically significant, all value and attitudinal variables are correlated in the expected direction with choices made in the dictator game:

- Individuals who agree more with conservative values and are more sensitive to extrinsic motivating factors tend to give, whatever the framing;
- Being more altruistic and in favour of welfare policies is associated with a greater generosity.

Finally, the characteristics that are significant determinants of altruism seem to differ slightly across the three different framings. Age is only significant for the student framing where older students appear more generous towards their peers, while a nurse who didn't choose nursing as a first study choice would give less to the patient, but that would not be a decisive factor for other recipients.

In order to compare formally the determinants of altruism across framings, a pooled analysis using a random-effects model to account for individual effects was carried out. Findings are presented in Table 5.3.

Unlike what the comparison of average results showed, the individual-based multivariate analysis shows that more needy or deserving recipients generate greater altruism – nursing students give much more to poor people than to patients, and more to patients than to fellow classmates.

Table 5.3: The determinants of altruistic behaviours in the three framed dictator games played by South African nursing students – results from a random-effects Tobit model

	Coefficients	Stat. sig.	Standard errors
Constant	**0.218**	***	**(0.047)**
Framing effect (base: student)			
Patient	**0.142**	**	**(0.052)**
Poor	**0.214**	***	**(0.052)**
Interaction terms between individual characteristics and the student framing			
Aged 25 to 29y.[aged less than 25y.]	**0.085**	*	**(0.038)**
Aged 30 to 34y.	**0.086**	*	**(0.040)**
Aged more than35y.	**0.185**	***	**(0.043)**
Male	-0.035		(0.037)
White	0.131	*	(0.058)
Does not have children	-0.000		(0.031)
Gauteng	0.020		(0.028)
Born in a rural area	0.022		(0.027)
Studied at university	0.032		(0.038)
Nursing was not 1st choice	-0.024		(0.031)
Altruism	0.013		(0.011)
Conservative	**-0.022**	*	**(0.009)**
Welfare	0.014		(0.011)
Extrinsic	-0.005		(0.010)
Nursing	-0.005		(0.012)
Interaction terms between individual characteristics and the patient framing			

Aged 25 to 29y.[aged less than 25y.]	0.010		(0.037)
Aged 30 to 34y.	0.028		(0.039)
Aged more than35y.	0.050		(0.043)
Male	-0.057		(0.037)
White	0.078		(0.057)
Does not have children	-0.003		(0.031)
Gauteng	**0.059**	*	**(0.028)**
Born in a rural area	0.001		(0.027)
Studied at university	0.031		(0.038)
Nursing was not 1st choice	**-0.068**	*	**(0.031)**
Altruism	**0.022**	*	**(0.010)**
Conservative	-0.005		(0.009)
Welfare	**0.025**	*	**(0.011)**
Extrinsic	-0.008		(0.010)
Nursing	-0.009		(0.012)
Interaction terms between individual characteristics and the poor framing			
Aged 25 to 29y.[aged less than 25y.]	0.016		(0.037)
Aged 30 to 34y.	0.038		(0.039)
Aged more than35y.	0.059		(0.043)
Male	-0.065		(0.037)
White	**0.117**	*	**(0.057)**
Does not have children	-0.028		(0.031)
Gauteng	**0.122**	***	**(0.028)**
Born in a rural area	-0.006		(0.027)
Studied at university	0.063		(0.038)
Nursing was not 1st choice	0.014		(0.031)
Altruism	**0.024**	*	**(0.010)**
Conservative	-0.013		(0.009)
Welfare	**0.032**	**	**(0.011)**
Extrinsic	-0.015		(0.010)
Nursing	0.001		(0.012)

*** $p<0.001$, ** $p<0.01$, * $p<0.05$

The rest of the results of the pooled model confirm the previous results:

- The older the individuals, the more generous their decisions are in the dictator game with the student frame.
- More generous donations to all three recipients are associated with certain individual characteristics – being white and from Gauteng – that probably capture a wealthier socio-economic status.
- Those nursing students who chose nursing reluctantly are clearly less interested in the welfare of patients, while a greater professional ethics does not seem correlated with greater concern for patients;
- Altruistic decisions in the dictator games are associated with survey measures capturing social and ethical values, such as altruism or pro-poor social views.

5.5. Discussion and conclusions

5.5.1. Summary of key findings

This is the first study that measures the altruism of nurses and compares the results with another group of participants.

South African nursing students showed more generosity than economic students. However, there is a clear exception when generosity is measured towards patients; in that case, the decisions made by nursing and economic students in South Africa are virtually identical.
Interestingly for nursing as well as economic students there seems to be a clear hierarchy of needs or "deservingness" (Branas-Garza, 2006, Carpenter et al., 2008) between students, patients and poor people. However, this hierarchy is not so clear for nurses in South Africa, who allocate an equal amount to patients and fellow students.

This is the first research to use experimental economics combined with survey data to compare the nature and determinants of nurses' concerns for others, including patients, and explore its link to vocational preferences. Findings suggest that different socio-economic characteristics affect the choices made in experimental games, while correlations between decisions made in games and survey measures of intrinsic motivation and societal values confirm that behaviours in economic games are likely to be driven by complex moral and social motivations as well.

5.5.2. Discussion of results

A. <u>How do the results compare to other studies?</u>

Previous findings from economic experiments have shown that the outcome of a dictator game (DG) changes considerably depending on the type of information provided to the participants. The DG presented here with the student frame is comparable to standard experiments, where, although participants are supposed to ignore who they will be paired with, they know recipients are fellow students. Several such experiments were carried out with economic students showed that the majority of participants (usually about 60%) didn't allocate anything to respondents (Hoffman et al., 1994, Hoffman et al., 1996) and the average contribution was about 10% (Hoffman et al., 1994, Eckel and Grossman, 1996, Hoffman et al., 1996, Bolton et al., 1998). Although other differences in experimental conditions may have influenced the results[49],

[49] In particular, the present experiment didn't enforce a double blind procedure as strict as the one used in some of these other studies (where each individual makes his decision in an isolated box). However, in the present setting,

economic students in South Africa have made comparable average donations (12.7%), with the majority of participants keeping the whole endowment for themselves. These results also concur with the ones obtained by researchers who played the DG with undergraduate students from the University of Cape Town (Van der Merwe and Burns, 2008) and found that the mean offer was 15%.

In contrast, South African nurses were significantly more generous towards their peers (mean offer of 34.2%). These results were statistically equivalent to those obtained in Kenya and Thailand (nurses gave respectively 36.4% and 36.5%), where the same study was also conducted with nursing graduates (see Appendix 5.8 for all results from these two countries). These results suggest that, compared to economic students and most other subjects who have taken part in dictator games, those who chose nursing as a career have a more generous and altruistic attitude towards others. Overall, these findings tend to validate hypothesis H1[50] that held that more altruistic individuals are likely to self-select into the nursing profession.

With the patient and poor recipients, experiments reported here used two "moral" framings. Such designs have been used in a few studies to allow moral motivations such as fairness and altruism to play a prominent role in the decisions (Eckel and Grossman, 1996, Branas-Garza, 2006). When dictators were informed that their donation would be given to the Red Cross (Eckel and Grossman, 1996), 31% of them gave part of the money, 17% gave half, while 10% gave the full amount. In the study by Branas-Garza, where participants were told that their donations would buy medicines for developing countries, 74.6% gave away everything, while only 3% kept all for themselves (Branas-Garza, 2006).

The results of the DG present new insights into the driving factors of altruistic concerns. The influence of socio-demographic characteristics has been relatively under-researched in the experimental economics literature, with studies often not controlling for a large range of parameters n(partly due to the lack of variance in study population's socio-demographic variables) . A survey of different experimental games[51] by Camerer pointed out that "*demographic variables generally have weak effects on (...) dictator behaviour, although they are often significant, and always intriguing*" (Camerer, 2003). There were mixed results from dictator games and similar experiments as to whether or not women were less selfish than men (Camerer, 2003). The results obtained in South Africa concur with that ambiguous effect; although the coefficient

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respondents could make their choice anonymously from others, and the experimenter who collected the respondent sheet was different from the one putting the money in the envelopes

[50] "Individuals who are more altruistic self-select into nursing studies".

[51] Camerer surveys not only results from the dictator games, but also those from the ultimatum and trust games.

on male was systematically negative, it was not found significant. The more selfish behaviours observed in young participants (or children) in other studies (Harbaugh and Krause, 2000, Benenson et al., 2007, Carpenter et al., 2008) are also partly confirmed here, as older participants were found significantly more generous than young ones in the student framing. The effect of participants' affluence has never been tested in experimental games, therefore it is difficult to confidently attribute the significant effect of white and Gauteng to that effect. However, the positive effect of being white on the size of offers in the DG was also found in the other South African DG reported in the literature (Van der Merwe and Burns, 2008).

Very few studies have compared results with similar population groups in different settings or countries. A study that carried out dictator games in various small societies on different continents showed that community level factors seemed to have a greater explanatory power of the variety of results observed than individual differences (Henrich et al., 2004b). They concluded that distributional norms and altruism were likely to be driven by local phenomena and economic conditions. In contrast, the results presented here from South Africa showed a strong similarity those obtained with comparable participants in Kenya and Thailand (see results presented in Appendix 5.8), despite some fundamental socio-economic differences across countries. The reason for such similarity might lie in the more altruistic norms shared within the nursing community, which might transcend national differences.

Finally, the experiments here show some strong differences between nursing and economic students. This finding echoes the importance of subject pool differences (Levitt and List, 2007) and the limitations of drawing general conclusions in the lab from experiments run with economic students. Similar differences have been found in other settings where the dictator game was played with different subject pools. Economic students were found more selfish compared to members of the population in DG (Carpenter et al., 2008), while the significant impact of gender and age found in the general population was not found amongst students (Gueth et al., 2007). Yet, in both of these studies, the differences in findings might have been linked to the homogenous socio-demographic profile of student populations in developed countries. The differences found between two student populations probably suggest not only that economic students' behaviour are not representative of the broader national population, but also that they might not even be representative of other students' groups, where different social and moral norms might prevail.

B. Interpreting decisions in the dictator game

The aim of these experiments was to measure nursing students' altruism or concerns for others. The idea that donations in the DG quantify individual altruism stems from the standard neo-classical assumption that individuals should seek to maximize their own benefits and be selfish. Yet, although donations do occur in these experiments, identifying the dictators' *reasons* for giving has often been debated, as only the outcome of the game is usually observed. Several hypotheses have been debated to explain these deviations, and what the decisions made in the dictator game actually capture.

Hoffman et al. (1996) account for the increased donations observed in non-anonymous DG by pointing to the decreased "social distance" which they define as "*the degree of reciprocity that subjects believe exists within a social interaction*". According to Bolton et al. "*dictators might be motivated to give a gift for one or more of many reasons: e.g., a sense of moral obligation, pleasure derived from giving, to demonstrate kindness*" (Bolton et al., 1998). The underlying assumption holding these theories together seems to be that the decision to allocate more or less money relates to "*an expectations phenomenon*", not "*an autonomous private preference for equity*" (Hoffman et al., 1996). There is evidence showing that individuals adhere to broader social norms, which expect a particular behaviour from them (Boyd and Richerson, 1992). The existence of such social norms, which vary according to groups, has been evidenced by different studies. The results presented here suggest that there is a relatively homogenous norm across countries within the nursing community, as to what behaviours are "right" towards a poor person or a student. This is particularly striking when compared to the much less generous donations made by economic students in South Africa. These differences suggest that the "nursing norm" (across South Africa, Thailand and Kenya) is stronger than the South African norm, and might explain some of the differences observed.

Extending the notion of social distance and social norms, some authors have recently argued that what motivates dictators is a sense of moral obligation, conveyed by the moral distance that separate them from the recipients. Carpenter et al. (2008) underline that more generous behaviours in behavioural games are often associated with a greater degree of "deservingness" of recipients. For Aguiar et al. (2008), when the moral distance is null, the dictator feels she "*ought to donate all or part of her resources according to her level of well-being*". Therefore, more than just altruism, behaviours observed in the dictator games reveal the relative adherence to a social norm, which itself conveys a sense of moral obligation towards the recipients. Drawing on Aguiar et al.'s concept of moral distance, one can analyse the differences in attitudes between the nursing and economic students towards patients as a differential in the moral distance, or the degree of moral obligation that they feel they have towards recipients (Aguiar et al., 2008). While economic students can only contribute to the well-being of patients within the context of the game, nursing students are providing time and efforts to attend to patients. This might explain why the greater generosity of nursing students observed for the student and poor framing is not observed in the patient framing. On the other hand in the patient DG, South African nurses were significantly less generous than their Kenyan and Thai counterparts who took part in the same study as the one described here[52] (see Appendix 5.8). This raises some concerns about some social norms or lack of moral motivation that could exist in the nursing community in South Africa. Far from being some anecdotal finding, these results find some echo in the health services literature that has highlighted how nurses abuse and treat patients badly (Jewkes et al., 1998, Thomas et al., 2007, Chopra et al., 2009b). What is more concerning is that those findings come from a population of nurses who are about to enter their professional lives, and that they already display less concern for patients in South Africa compared to Kenya and Thailand. Indeed, the greater moral distance could be associated with a prolonged exposure to difficult working conditions and violence in the workplace (Jewkes et al., 1998). But as most of the nursing students from the sample have had little work experience, this assumption does not necessarily hold.

5.5.3. Limitations

One of the objectives of this research was to use experiments to provide a quantitative measure of participants' altruism. However, several critiques have been made against experimental economics, and in particular its fundamental assumption that claims that insights and measures obtained "in the lab", with abstract rules and controlled environment, can be extrapolated to the "real world". It has been argued that several factors could systematically differ in the lab from the real world and affect the behaviours observed under experimental conditions (Levitt and List, 2007).

First, the lack of anonymity between subjects and experimenters, and between subjects themselves (Hoffman et al., 1996), is a potential source of over-estimation of the occurrence and magnitude of pro-social behaviours. In the games played here, although the experimental procedure was designed to guarantee anonymity, this may have not been achieved for two reasons. First, participants might have felt that experimenters would be able to know their choices

[52] Whilst South African nurses gave on average 37.7% of their endowments, Kenyan nurses gave 46% and Thai nurses gave 47.8%.

based on their study numbers. After all, those study numbers were displayed on the students' desks, and it was indeed possible to link some faces to some study numbers. Although this might seem a little far-fetched, this setting undoubtedly protects participants' anonymity less than does the secret ballot procedure used by Hoffman et al (1996)[53]. Anonymity between subjects may also have been compromised by the physical proximity between respondents in the classroom, which could not have completely prevented respondents to look at each other's responses.

Second, the fact that participants are under the scrutiny of experimenters may affect their decisions. A vast literature from psychology has underlined that study participants are likely to modify their behaviours because when they are observed and scrutinized (Harrison and List, 2004) (i.e. the "Hawthorne Effect"). This effect could be particularly serious when there is a moral element in the behaviours observed, which is the case when one focuses on the existence and magnitude of social preferences (Levitt and List, 2007). The framing of the experiments held in this study probably even increased that potential bias. Yet anonymity in the decisions, albeit imperfect, was supposed to limit that bias.

Third, the very context in which experiments are embedded might exert influence participants to perform in a way they would not in everyday life. If the various elements of a game – the stakes of the game, the way rules are presented or worded, the general context of where and why the game is played, etc. – are, to some extent, controllable by the experimenter, the general understanding and context of the game is not. Explaining the variety of their results in different settings, Henrich et al. (2004a) show how behaviours in games are shaped by social norms and interactions. Unbeknownst to the experimenter, participants will bring their own experiences and past interactions to interpret the rules and play the game. A typical illustration of this was given by the "contextualisation" explained by participants in the focus group discussions. It is unclear to what extent this effect may have compromised the expression of "true" altruism.

In addition to these generic limitations, the results obtained in the DG reported here may have been compromised by two aspects: they may have doubted either the fact that it was going to be played for real money, or the existence of actual recipients to their offers.

The first point was raised quite strongly during the pilot, and a number of measures were taken to ensure that subjects believed that the monetary stakes were real. For instance, experimenters systematically displayed the money that was ready to be put in the participants' envelope. Although no systematic question was asked to all subjects to investigate whether or not

[53] In their design, participants are called one after the other, given an envelope containing a number of notes, and sent behind a large cardboard box at the back of a room to decide what they want to leave in the envelope and what they keep for themselves.

they had taken the task seriously, feedback from focus group discussions suggests that the large majority of them believed that payoffs were real.

Furthermore, it was critical that participants believed that another real person's payoffs were indeed dependent on their decisions. To ensure that they did, in the majority of games used in experimental economics, all players (here dictators and recipients) are physically present in the experimental lab or the same venue, or procedures are set up to ensure that participants believe the existence of the recipients (for example, by asking participants to put the money in a sealed envelope and writing the name and address of a person randomly drawn from a phone book – (Koch and Normann, 2008)). In this experiment, a different protocol was followed, and it is possible that survey participants did not believe that their decisions would actually have some real outcome for others. However, since this problem is likely to skew the behaviours towards more selfishness, the high donations observed provide evidence that participants most probably believed that the games were for real.

5.5.4. Implications of the results

This section focuses mainly on the implications of the results for further research. Indeed, at this point of the analysis, implications for policy are not straightforward. First, it is unclear whether altruism can be modified or whether it is a fixed personality trait. Evidence from the dictator game literature suggests the former, as the older subjects are in DG the more generous offers they make. If altruism can therefore be shaped, by life and experience, there might also be scope to make nursing students more altruistic, for example through appropriate curriculum emphasising caring attitudes. Second, if altruism cannot be modified or altered, the question remains to decide whether the government should favour the selection of more altruistic individuals. This is discussed in greater detail in the final chapter of the thesis, in light of the rest of the findings.

The results obtained in the experiments presented here are generally supportive of the behavioural economic hypothesis that individuals take others' welfare into consideration, and confirm the importance of institutions in distribution games (Bardsley, 2008, Carpenter et al., 2008). In addition, the differences obtained in different countries (South Africa vs. the other two countries for the patient framing) and different groups (economic and nursing students), as well as the effects of individual factors on the decisions made, emphasise the difficulty of generalising findings from particular subject pools in specific contexts (Carpenter et al., 2008). This should call for more caution in the interpretation of experimental results that are mostly obtained from economic students from developed countries.

These results also have broader implications for experimental economics. As Eckel and Grossman point out:

> *"It is received wisdom in experimental economics that abstraction is important. Experimental procedures should be as context-free as possible, and the interaction among subjects should be carefully limited by the rules of the experiment to ensure that they are playing the game we intend them to play. For tests of economic theory, these procedural restrictions are critical. As experimenters, we aspire to instructions that most closely mimic the environment implicit in the theory, which is inevitably a mathematical abstraction of an economic situation. We are careful not to contaminate our tests by unnecessary context"* (Eckel and Grossman, 1996).

Experimental economists are usually reluctant to frame the games, as difficulties or biases can arise due to differential interpretation between individuals of the proposed "framing" (Levin et al., 1998, Rege and Telle, 2004). If not a different interpretation, there was most certainly here a different appreciation or meaning of the different framing for economic and nursing students. But far from ruling out the interest of using framed experiments, the present study underlines their usefulness to explore the social norms of different groups in relation to their direct environment. In fact experimental methodology provides a very useful tool to explore the importance and consequence of context, and of social norms. The development of behavioural economics has evolved to take social and psychological factors into account in the study of economic decision making. This is particularly true for the investigation of the concern of others in decision-making, and, in the context of experimental economics, social factors can only be introduced by abandoning some degree of abstraction.

5.6. Conclusion

This analysis of the nature and determinants of nurses' altruism in South Africa represents the first step in the exploration of the determinants of career choices.

The evidence presented here suggests that the generosity of nurses in dictator games might be a sign of self-selection of altruistic individuals into nursing (hypothesis H1) or of a particular altruistic norm in the nursing culture. The results also highlight that there is a large distribution of behaviours within the study population, and that some individuals are typically more generous than others. The dictator game provides a useful quantitative measure of altruistic concerns towards others, which seems validated by the correlations obtained with survey measures of pro-social behaviours. In the next chapters, this construct is used to explore the impact of altruism on career choices.

As mentioned in Chapter 2, to date, all empirical research on nursing labour supply choices has only focused on the study of traditional individual characteristics (Antonazzo et al., 2003). Yet the recent developments in behavioural economics have started to challenge the merits of this narrow vision and its ability to help one understand the underlying motives at play in individual choices. One of the assumptions of this thesis is that social preferences, defined as individual concern for others, are powerful incentives that drive individual choices on the labour market. To test that assumption, experimental economic games and classic survey tools capture the underlying values and pro-social concerns of nursing graduates. The next step of this research consists of investigating the determinants of nurses' stated job preferences, and in particular to explore the link between these preferences and altruistic and pro-social values.

Chapter 6 - The determinants of nurses' job preferences

6.1. Introduction

In South Africa, the shortage of nurses in the health system has been to some extent highlighted by routine statistics (Health Systems Trust, 2007, Health Systems Trust, 2008b) and case studies (Hall, 2004). However, there is no detailed longitudinal dataset on the career paths of nurses that enables a quantitative analysis of job choices such as the ones carried out in developed settings (Shields, 2004). One of the objectives of this thesis is to contribute to addressing this gap, through the investigation of the job preferences of South African professional nurses when they are about to enter the labour market.

However one of the challenges of this task is the difficulty of observing actual labour market decisions. Usually data collected on decisions made by nurses in the labour market fail to illustrate the alternative job offers that were turned down, limiting our understanding of job choices. In the South African context, after graduation nurses have to complete a one-year compulsory service in the public sector, which means that their decisions regarding job choice cannot be immediately observed. Consequently, this research set out to develop a choice experiment that would mimic the opportunities available in the labour market after nurses graduate.

First introduced in transport and environmental economics, stated preference techniques, such as Discrete Choice Experiment (DCE), have become a popular method to model choice behaviour in health economics, and determine the driving factors of preferences that are not observable in the market. Broadly speaking a DCE applied o job preferences presents a series of hypothetical job choices to respondents, each job being made up of a series of attributes (i.e. job characteristics). In this chapter, the choice experiment is used to:

- evaluate the job preferences of newly qualified nurse graduates
- examine the determinants of the labour market choices made by nurses, and in particular the extent to which pro-social concerns or altruism affect them;
- predict the future labour market choices of the nursing graduates in the sample.

This chapter is organised as follows. Section 2 presents a detailed account of the methods used to develop the discrete choice experiment. Section 3 describes the econometric models used to analyse the data collected. Section 4 reports on the descriptive and multivariate results. The last section discusses the results in the light of relevant literature, and examines their implications for research and policy.

6.2. Design of the choice experiment

Louviere et al. (2000) indicate that the design of choice experiments should satisfy four criteria:
- *cognitive complexity:* that the experiment should not represent too complex a task for respondents, avoiding fatigue and boredom;
- *market realism*: that the choices presented in the experiment, and the experiment itself, should be as realistic and close as possible to the choices made in real life by respondents;
- *identification*: that the design will allow a correct estimation of the utility function;
- *precision*: that the parameters in the analysis will be estimated with enough precision.

These four principles guided the design of the choice experiment. The first two were used to identify the appropriate type of experiment and the choices of adequate attributes and levels, whilst the last two led the experimental design.

6.2.1. Identifying the characteristics of the experiment

A. <u>Labelled vs. generic choice experiments</u>

Definition

Labelled stated choice experiments differ from unlabelled or generic experiments in two ways.

In an unlabelled experiment of job preferences, alternatives in choice sets are described as 'Job A', 'Job B', 'Job C', etc. To date, all the choice experiments on health workers' job preferences have been generic (Lagarde and Blaauw, 2009). In these experiments, participants were presented with two job descriptions, each defined by various features, such as salary, workload, location, facility, etc. In contrast, labelled experiments are designed to study two or more named alternatives, where the name given to each alternative conveys meaningful information to respondents. In a classic example of a labelled experiment from the transport sector (Hensher et al., 2005), respondents had to choose between travelling by bus or with their own car. Each mode of transport was also characterised by other features (time, cost, etc.).

The second difference between generic and labelled experiments is that the latter usually include different attributes or levels across alternatives (i.e. alternative-specific levels or attributes). In the transport example (Hensher et al., 2005) different levels of travel times were included, according to the transportation means (alternative) used (bus or own car). It is important to note that this is neither a necessary nor a systematic feature of labelled experiments.

Choosing between a labelled or generic design

In choosing between the type of choice experiment, the objectives of the research and the research validity were key considerations (Blamey et al., 2000, Huybers, 2004). Here, a labelled design was adopted for two reasons to ensure greater realism in the choice experiment and to mimic the real labour market opportunities presented to nurses as closely as possible.

First, labelled experiments allow more refined analysis, as they enable a differential valuation of attributes across alternatives. For example, the type of facility in which a nurse might work (hospital or clinic) may be valued differently depending on the sector it is in, as public hospitals might convey a different reality or meaning than private hospitals. In the analysis of a labelled experiment, parameters can be estimated distinctly for each attribute under each label (or alternative). To do so in an unlabelled experiment is feasible, but tedious and demanding. For instance, one may have to undertake different experiments for each of the alternatives of interest (which would obviously prevent estimating trade-offs between alternatives). Alternatively, one could include the alternatives as attributes in a generic experiment, and estimate interaction effects between attributes. Whilst possible, this would increase the complexity of the design (Street and Burgess, 2007).

Second, labelled choices appear more realistic in the present research context for two reasons. First, an experiment proposing a choice between positions in the private compared to the public sector or an overseas posting is more realistic than one offering a choice between "job A" or "job B" or "job C". Indeed, job adverts for nurses typically include company logos or distinct features that make it obvious whether they are offered overseas, or in private groups or in public facilities. Second, a labelled experiment better mimics the actual features of each sub-job market by allowing for flexibility in the levels of each attribute. In an unlabelled experiment, the levels of each attribute would be the same for all sectors and therefore unrealistic combinations of attribute levels would occur in some job descriptions, such as a position in the public sector proposing a salary equivalent to those usually earned overseas. Although it is theoretically possible to produce unlabelled designs avoiding such problems, for example through nesting of the attribute levels (Louviere et al., 2000), this is practically difficult to implement as it imposes many constraints on the design[54]. A labelled experiment, where attributes and attribute levels are

[54] Nested attributes are attributes that contain two dimensions. See discussion below on design, in particular the implications raised by the number of levels in an attribute.

defined separately for each alternative, avoids the problem of forcing participants to choose between unrealistic scenarios, and hence increases the validity of the method (Louviere et al., 2000).

Identifying the labels

Having decided to use a labelled experiment, the next step in the DCE design was to define the appropriate labels. To guide the definition of labels relevant nursing literature was reviewed (see sections 2.3 and 2.4) and two Focus Group Discussions (FGD) were conducted in July 2008 with 14 final year nursing students from Baragwanath nursing college, in Soweto[55] (see topic guide in Appendix 6.1).

First, the availability of alternative jobs (other than nursing jobs) is both unrealistic and uncommon at the beginning of a nursing career. It is too early into their career for opting out of the nursing profession in order to take up another post in the public sector, and opportunities in the private sector other than nursing (e.g. pharmaceutical or nursing placement companies) are not available at such an early stage either. FGD participants viewed these as possible opportunities at a much later stage of their career, when they would "*not want to be a nurse anymore*". Therefore, relevant labels were identified as the public sector, the private sector and overseas, for two main reasons. These categories cover three clearly distinct choices for nurses. In the literature, public sector positions are typically associated with difficult working conditions and poorer patients (Edginton and Holst, 1991, De Vries and Marincowitz, 2004, Hall, 2004, Thutse, 2006), but provide job security and the social benefits offered by the civil service (pensions and health insurance for example). This was confirmed by FGD participants. On the other hand, the working environment in private sector jobs is better, with fewer better-off patients (Pillay, 2009). FGD participants confirmed that workload is less heavy in the private sector, while patients are typically more "demanding" than in the public sector. Finally, positions overseas represent an obvious distinct career path, associated with much higher salaries and different working and life environments.

Furthermore, public jobs were split into two distinct alternatives, rural and urban jobs[56] for two reasons. First, the literature review as well as feedback from FGD participants suggested that opportunities in rural areas differ from those in urban areas in terms of incentives offered (a rural allowance is available), work environment (facilities in rural areas are more isolated, under-staffed

[55] Although it would have been better to organise FGDs in both rural and urban settings, this was not possible due to time constraints. The FGDs were held at the same time by two different facilitators and similar issues were raised.
[56] No similar break down was made for positions in the private sector because the latter is virtually absent from South African rural areas, with the rare exception of GP practices.

and usually associated with poorer equipment), and lifestyle. Second, understanding the motives for working in rural areas was one of the objectives of this thesis.

B. Identifying the attributes and the levels

Identifying the attributes

The third stage of the DCE design involved identifying the attributes (Hensher et al., 2005) and defining attributes and levels which would reflect participants' experiences realistically or represent credible new alternatives (Wittink and Cattin, 1989). Two principles guided this process.

First, it was essential to identify the attributes that play a determinant role in the decision-making process (Hensher et al., 2005). Indeed, when key characteristics are not included in choice sets, respondents may infer levels for these attributes, introducing unobservable biases in parameter estimates (Louviere et al., 2000). Furthermore, as the valuation of attributes is interdependent, introducing a meaningless or irrelevant attribute in the DCE would bias the results for other attributes.

Second, the number of attributes included was limited by design constraints as there is a direct relationship between the number of attributes and the number of choice sets needed to obtain an optimal design[57]. In order to limit respondent fatigue, the number of choice sets administered to each participant is limited to a manageable number, typically between 12 and 16 (Fiebig et al., 2005, Guttman et al., 2009). A higher number of attributes also increases the complexity of the task thereby leading to increased random variability in choices and reduced efficiency of estimation (Louviere et al., 2000).

A review of the literature presented in Chapter 2 and Chapter 4 helped identify meaningful attributes, while the FGDs ensured that the study population's perspective and experience was accounted for (Coast and Horrocks, 2007). The literature review led to a first list of potential attributes: salary, presence of equipment, education opportunities, promotion, type of facility, staffing levels, type of management. Focus groups confirmed the importance of the following job characteristics: salary, working conditions (in particular workload or staffing levels, presence of sufficient drugs and equipment, management support), type of facility (hospital or clinic), education opportunities (in particular the possibility to specialise), career prospects and geographical location. Furthermore, the FGDs helped clarify the meaning and importance of the following aspects:

[57] For example, the introduction of a two-level attribute in one alternative requires the estimation of one more parameter, thereby translating into at least one more choice set to be answered by respondents (see design section for more details).

- An overlap was identified between the type of facility (where a job is held) and typical working hours: nurses working in a clinic would always have regular hours, while working in a hospital would always require some flexibility, through night shifts and rotations.
- Meaningful promotion prospects and further education opportunities were closely related, with the latter seen a pre-condition for the former. Participants in FGDs said they wished to specialise to obtain a more interesting job (more valued, with more clinical responsibilities) and a better salary. It seemed that without further formal qualifications, this would not be feasible.
- There was a strong association between staffing levels and the labels. Under-staffing was not seen as an issue for overseas or private jobs, whilst working in the public sector was always associated by FGD participants with under-staffed facilities. These differences in staffing levels between public and private have been confirmed by several studies (Meel, 2003, Penn-Kekana et al., 2005, King and McInerney, 2006, Pillay, 2009).

Finally, although it did not appear in the literature review as a key dimension, a fifth attribute was considered for inclusion, for its relevance for this research objectives. The objective of such attribute was to investigate further the extent to which nurses take into account their patients' well-being into account, and more precisely the extent to which nurses could choose their jobs according to the benefits received by the populations they serve. In addition to being in line with this research objectives, this dimension is somehow supported by some studies in the literature (see sections 2.3 and 4.2.4). Besides, when explored in the FGDs, participants suggested that this was indeed an important aspect of their job, and they contrasted the impact they would have in the private sector (i.e. answering the requests of "*demanding and well-off*" patients) with that in the public sector where they would "*give back to the community*".

Identifying the levels

Due to the large number of attributes and alternatives already defined, it was decided to limit the number of levels to two per attribute. Although this decision was necessarily going to preclude the study of non-linear effects for attributes measured in continuous units (mainly salaries here), it was judged necessary to minimise the complexity of the task, and the number of choice sets answered by each participant. For each attribute, the base level was anchored to prevailing conditions or nurses' expectations in the labour market. These levels were therefore established using data collected from official sources and qualitative data collected during the focus groups. Additional levels were determined to be a reasonable improvement from the base level. This was discussed at great length during the FGDs, as the choice of realistic and meaningful levels has

been recognised to increase the precision of parameter estimates (Hall et al., 2006). All levels (with the exact wording used in the questionnaire) can be found in Table 6.1.
Salary levels for the public and private sectors were obtained from official sources and matched the salaries of nurses to be recruited in January 2009, correcting for annual inflation (about 10%). The second level was determined for each job as an increase of about 25%. Determining the salary levels in the overseas alternative was a more delicate task, as they vary a lot from one country to another. For example, job adverts were found offering R200,000 to South African nurses in Dubai, but €30,000 (about R340,000) for specialised nurses in Ireland. Due to a concern that very high salaries might be too attractive to respondents and skew the results, salary levels overseas were initially set to R220,000 and R264,000 (essentially based on job adverts from Middle-Eastern countries). But these levels were judged unrealistically low by participants in the pilot, and therefore were subsequently increased to R250,000 and R325,000, corresponding approximately to salary offers in Middle-Eastern countries (for the first) and Western countries (for the second).

Public jobs could either be undertaken in a clinic or a hospital. As mentioned above, these levels, clinic and hospital, also encompassed the types of working hours, as well as different types of activities (in clinics, nurses essentially do primary health care activities while in hospitals, as general nurses, they can work in different wards but would never really have much clinical responsibility). Overseas and private sector job alternatives had only one level for the facility attribute, as hospitals appeared to be the only obvious option.

For the attribute 'training opportunities', it was assumed that jobs overseas did not provide any formal training, which is why the attribute only had one level, "informal on-the-job training". In the private sector, formal training opportunities seem unusual and are not expected by nurses; this provided a base level consisting of "informal on-the-job training". However, job adverts for the private sector sometimes mention the possibility of support for further training. Therefore another level was defined as some time off and some financial support for training. In the public sector, the main training opportunity for a nurse is to obtain study leave to specialise. Usually, nurses expect to have to wait an average of five to six years before they would be able to take study leave. Therefore levels were set to waiting period of six and two years, reflecting the current situation and a hypothetical (significant) improvement.

For the working conditions attribute, in the public sector the issue of the presence of adequate equipment and supplies (or lack thereof) was clearly the most critical, and provided both levels. In the private sector, the attitude of the management (supportive or not) in the presence of "demanding" patients seemed to be key. Finally, in overseas positions, discrimination at work was perceived as an obvious potential issue ("*you can be demoted as a foreigner*", "*not recognized as professional nurses*"), and was confirmed by numerous studies on nurses from low- and middle-income countries working in the UK or other developed countries (Culley et al., 2001, Allan et al., 2004, Likupe, 2006, Obrey et al., 2006, Larsen, 2007, Troy et al., 2007)

The levels of the 'social impact' attribute were defined differently across alternatives. In the private sector and overseas alternatives, only one level was defined, reflecting the idea that nurses would attend wealthy populations (see Table 6.1). In contrast, the levels defined for public jobs followed FGD comments that in public facilities they felt that they were benefiting "the community". The two levels were defined to emphasise that in some positions, they would attend usually under-served populations.

Once the alternatives, attributes and levels were defined, the questionnaire had to be produced following experimental design theory principles, as detailed in the next section.

Table 6.1: Attribute levels – final design

Label	Attribute	Number	First level	Second level
Overseas	Salary	1	ZAR 250,000	ZAR 325,000
	Facility		Hospital	-
	Training opportunities		You will benefit from an interesting on-the-job in-service training	-
	Social impact		You will help us provide good quality clinical care to the population of our country	-
	Working conditions	2	You may not be fully considered as a professional nurse and be sometimes looked down on as a foreigner	Your status as a Professional Nurse will be fully recognised
Public, rural	Salary	3	ZAR 132,000	ZAR 158,000
	Facility	4	Clinic	Hospital
	Training opportunities	5	You will be able to get a study leave to specialize within 2 years	You will be able to get a study leave to specialize within 6 years
	Social impact	6	Your presence would help us improve access to basic services for everyone	Your presence will benefit populations who would otherwise have no access to essential services
	Working conditions	7	There is NO lack of basic equipment, medical supplies and drugs.	There is regularly a lack of basic equipment, medical supplies and drugs.
Urban, private	Salary	8	ZAR 120,000	ZAR 150,000
	Facility		Hospital	-
	Training opportunities	9	You will benefit from an exciting in-service training!	5 days off and a 10% contribution to your fees will be provided to you for training
	Social impact		Your presence will help us provide advanced care to our clients	-
	Working conditions	10	The hospital management is supportive of its staff	Patients are demanding and their satisfaction is a key objective for the management
Urban, public	Salary	11	ZAR 120,000	ZAR 144,000
	Facility	12	Clinic	Hospital
	Training opportunities	13	You will be able to get a study leave to specialize within 2 years	You will be able to get a study leave to specialize within 6 years
	Social impact	14	Your presence would help us improve access to basic services for everyone	Your presence will benefit populations who would otherwise have no access to essential services
	Working conditions	15	There is NO lack of basic equipment, medical supplies and drugs.	There is regularly a lack of basic equipment, medical supplies and drugs.

6.2.2. *Experimental design*

A. Experimental design theory

Factorial and fractional factorial designs

The number of attributes and their levels determines the total number of possible alternatives in the factorial design. In this choice experiment, there were 15 attributes each with two levels, therefore the total number of possible combinations was 2^{15} or 32,768 combinations. As respondents cannot answer so many questions, an optimal sub-set of choices sets, called a fractional factorial design, must be selected, following the latest developments in experimental theory and design methods (Street et al., 2008).

Experimental design properties

The identification of the optimal experimental design requires an understanding of the various properties the design should meet, as well as a clarification of the questions to be answered in the analysis.

Huber and Zwerina (1996) have described four features of optimal choice designs:

- Level balance: that the occurrence of all levels of every attribute will be the same. Checking level balance is easily done by counting the number of occurrences of each level for each attribute.
- Orthogonality: the independence of attributes in the design. A simple computation of the correlation matrix of the design allows verification of orthogonality.
- Minimal overlap: within choice sets the occurrence of similar combinations of levels should be minimised;
- Utility balance: that options within a choice set should be equally attractive to respondents, to ensure that respondents will trade between choices.

While the first three characteristics of optimal choice design are easily verified, the final objective is more open to interpretation, particularly in labelled designs. Indeed, without preliminary information about individual preferences, it is difficult to assess to what extent some job descriptions might be systematically perceived as more attractive than others. Besides, in a labelled experiment, heterogeneity of preferences can result in some individuals systematically preferring one label. This would not necessarily result in the utility between alternatives being systematically unbalanced for all respondents.

Efficiency of the design

Street and Burgess (2007) have underlined that the primary concern of Huber and Zwerina (1996) for orthogonality of the design has overlooked a more important issue, the statistical efficiency of the choice design. This ensures that the parameters can be robustly estimated in the analysis - the more efficient the design, the greater the ability to minimise the confidence interval around the parameters. Street and Burgess (2008) show how the efficiency of a generic experiment can be assessed by considering some mathematical properties of the information matrix of a model to be estimated using a multinomial logit model[58]. They show how a D-efficient design minimises the overall variance of the parameter estimates. These authors then demonstrate that for a given class of *unlabelled* designs a minimum value of efficiency can be computed (Street et al., 2008). The (statistical) efficiency of any design in a given class can then be calculated by comparing its D-efficiency to that of the optimal benchmark. By definition, efficiency lies between 0 and 1 (the closest to the optimal design), and can be expressed as a percentage.

However D-efficiency measures present several shortcomings. First, the statistical efficiency of the choice design (based on the minimisation of the standard errors around the parameter estimates) assumes that a multinomial logit model is used in the analysis (Street and Burgess, 2007), while developments in discrete choice modelling have encouraged researchers to use other models (such as mixed logit models), since they account for individual heterogeneity and do not assume independence of irrelevant alternatives (Train, 2003). Second, Kuhfeld (2009) has underlined that the computation of the D-efficiency relies on an optimal benchmark that can sometimes not be satisfyingly calculated, or is based on unrealistic assumptions (all parameter estimates are supposed to be zero). Finally, for labelled designs, it is unclear how to calculate the D-efficiency, since the methods developed by Street and Burgess specifically refer to generic designs (Street and Burgess, 2007).

Here, no priors were used to estimate the design. It means that one assumed that all coefficients would be equal to zero in a MNL model. SAS identified a linear design that 100% D-efficient.

58 D-optimality is measured by computing the determinant of the variance-covariance matrix. D-optimal designs will minimise this measure.

Utility specification

Finally, to construct a design, one has to consider the form of the utility function to be estimated. Specifically, the researcher has to decide whether to estimate main effects (the impact of each job attribute on job utility) or whether interaction effects will also be evaluated (the role of the interaction between a combination of two or more attributes on job utility). Most choice experiments in the health literature use a main effects design. Such designs require fewer choice sets and ensure that all the main effects are uncorrelated with each other. The main effects are correlated with all the interaction effects, which are assumed to be non-significant (Hensher et al., 2005).

B. Design of the discrete choice experiment

Strategy used for constructing the choice experiment

In a comparison of four methods to design optimal choice experiments, Street and Burgess found that the results obtained with the macros developed by Warren Kuhfeld in SAS (Kuhfeld, 2009) often provided the best results (Street et al., 2005). Therefore, this design was generated using SAS v9 and the SAS macros (Kuhfeld, 2009).

With a 2^{15} design, a balanced, efficient experimental design capable of estimating main effects can be produced in a minimum of 16 choice sets[59]. Indeed, an optimal 2^{15} design requires that the number of choice sets be divisible by 2 and 4 (to ensure an equal number of occurrences of the levels, or level balance) and be at least equal to the number of coefficients to estimate (one for each attribute – here 15) plus a constant.

However, such a factorial design cannot estimate any interaction effect between attributes. So in the present case, for example, a main effects design would not allow an assessment of whether nurses who are more sensitive to having a greater social impact are also less sensitive to remuneration. When the design was constructed, it was decided to allow for the estimation of some of the two-way interactions[60]. Consequently, it was decided to use an efficient design in more than the minimal number of 16 choice sets.

59 In SAS, the macro %MktRuns indicates whether an efficient orthogonal design can be achieved for a given design based on the numbers of choice sets (Kuhfeld, 2009).

60 Due to the limited sample size, it was never planned to test all the two-way interactions. This would have required a large number of choice sets, and, hence, would have been unfeasible in practice.

A 100% efficient linear design was generated in 24 choice sets[61] using the SAS macro *%MktEx*. The SAS macro *%Markteff* provides the properties of the design – see the design produced in Appendix 6.2. The design was orthogonal and provided level balance (Huber and Zwerina, 1996).

Following the method described by Henscher et al. (2005), the correlation matrix of all the main effects and interaction terms was computed (see Appendix 6.3), and three two-way interactions were found to be un-confounded with the main effects. Attribute labels were re-arranged to allow the estimation of some specific interactions. However, since this aspect was not further explored in the analysis, it is not presented here.

Blocking the design

There were a total of 24 choice sets, each composed of four jobs, to be evaluated by respondents. To limit the cognitive burden on survey participants, the choices were split into two sets (blocks) of 12 questions each. Indeed, all studies involving health workers have used a maximum of 16 choice sets (Lagarde and Blaauw, 2009), and several have blocked their design to decrease the number of choice sets down to five or six (Scott, 2001, Ubach et al., 2003, Wordsworth et al., 2004). Although some studies found that the number of choice sets only has a marginal impact on responses in choice experiments (Dellaert et al., 1999, Stopher and Hensher, 2000), other studies have found that the number of choice sets matters. For example, Ortuzar et al. (2000) decided to block a design as they found that presenting respondents with 16 choice sets led to confusion, boredom and inconsistencies in their responses. Even though there is no agreement in the choice experiment literature as to the maximum number of choice sets respondents can handle it was important within the current study to minimise the length of the task. As explained in Chapter 3, respondents completed the choice experiment after having undertaken three prior tasks (two behavioural experiments lasting about an hour, and another choice experiment presented in the next chapter).

Organising the questionnaire into choice sets

In contrast to a generic experiment, the linear design of a labelled experiment directly produces all the choice sets needed to evaluate respondents' preferences. Most of the recent developments in designing optimal choice experiments have focused on the design of generic experiments, but very little has been published on how to maximise the efficiency of a choice design in a labelled experiment. Consequently, it was assumed here that the most efficient linear design would also be the choice design that would lead to the greatest statistical efficiency.

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[61] This was based on an orthogonal array of 2^{20}.

C. Finalising the questionnaire

Four outstanding questions needed to be answered in order to finalise the questionnaire:

- Should the choice sets be framed?
- What question are participants asked?
- Should there be an opt-out option?
- Should tone introduce a test for internal consistency?

Framing the task

Following Louviere's principle of market realism (Louviere et al., 2000), it was decided to frame the choice sets as job adverts.
The formatting used to present the four alternatives in each choice set mimicked styles of typical newspaper adverts (see Figure 6.1). During the pilot, respondents reported that this made the task more interesting, realistic and easier.

However, framing the task as job adverts raised challenges in terms of the presentation of the working condition attribute. Indeed, a real job advert would never illustrate the difficult working conditions of the job. Therefore, during the preparatory FGDs, nurses' job search strategies were investigated. Most participants explained that when applying for a job, they would use their network or visit the health facility to find out more informally about the working conditions. This informal strategy was introduced in the questionnaire as a means of generating information about the job's working conditions, and was presented separately from the job advert. This was judged to be credible during the pilot, but was not seen as more credible or influential than the rest of the information. It was only seen as a complementary piece of information about the position.

Furthermore, consistent with usual practice, it was decided to produce four versions of the questionnaire with different orders of the questions, to control for a potential order effect. However, the order of the alternatives within the choice sets was the same in all choice sets (as it is in Figure 6.1). It is possible that this identical ordering of alternatives might have increased the use of heuristic rules by respondents. Yet this risk was weighed against the benefit in terms of cognitive simplicity provided by a unique ordering of alternatives. Due to the length of data collection and recognizing the cognitive difficulty of the task, it was decided to have a unique ordering of the four alternatives across choice sets.

Question format

In a DCE, respondents can be asked to rank options or to choose their preferred one. Hensher et al. (2005) provide a virulent argument against ranking. First they argue that asking people to rank alternatives is inherently different from making choices. When they rank options, individuals reveal their preferences in a utility space that might be very different for each individual, therefore precluding a meaningful aggregation of individual responses. Second, they argue that when people choose their favourite option, they take into account various constraints, which they do less or not at all when asked to rank alternatives. Finally, they underline that ranking is not realistic; in reality respondents choose the option they like most, but they hardly ever select a second best item, or express the full ranking of their preferences (Chapman and Staelin, 1982). In addition to these arguments, it could be argued that ranking alternatives instead of choosing the favourite one is moving away from a realist task as well as moving away from Lancaster's theory of consumer choice.

Despite these arguments it was decided to ask respondents to rank the four jobs, for two reasons.

First, it was felt that an appropriate framing of the task could limit some of the issues highlighted by Hensher et al. (2005). Indeed, the task was framed as a job search (see Figure 6.1), at the end of which respondents would have selected four relevant job adverts. They were then asked to say where they would apply first, which would be their second choice, etc. In this way, respondents were encouraged to take their personal constraints into account and the task was realistic.

Second, although ranking might not be a realist option in choosing between different products, in the context of a job search, this is probably close to an actual decision made by individuals. Since they have to apply to competitive jobs, they run the risk of being turned down for some jobs but not others, and need to be able to order their options.

Third, ranking alternatives provides more information than choosing a preferred option. Indeed, ranking alternatives provides information both on the favourite choice, but also on the trade-offs made when comparing the second-best with the remaining options. In the current study there was a high risk that respondents would never choose one of the four alternatives if they were only asked to choose their preferred option. If the choice between alternatives is both random and independent, the probability of not choosing a given alternative is 0.75 for every choice set. Therefore, the probability of never choosing a given alternative is $(0.75)^{12}=0.0316$. Whilst this is a small risk, it assumes random independent choices which are unlikely to hold. If it is assumed instead that one option has a two times lower probability of being chosen than the other three options[62], then the probability of not choosing that option increases to $(0.857)^{12}=0.157$. This higher probability of 16% is probably quite reasonable (even under-estimated) given that people certainly do not have random preferences over labels. Therefore asking individuals to rank the alternatives would reduce the risk of never obtaining information on the trade-offs made over the attributes of the least preferred alternative.

Rank-ordered choices have recently been used in a few generic DCEs to provide analysts with richer preference datasets (Lancsar and Louviere, 2008, Scarpa et al., 2009). However, there are two differences between these studies and the current one.

First, some of these studies were based on new design approaches used with unlabelled DCEs (Louviere and Lancsar, 2008). Instead of asking respondents to rank all the alternatives proposed, respondents were asked to choose their preferred option, then their least favourite out of the remaining options, then their second best option, then the second worst, etc. The current study did not follow this approach, as the task was written, and administered to a large group (not computerised or administered individually and face-to-face) making it difficult to ensure that respondents would understand what was expected of them. Indeed, such studies in the literature have been administered face-to-face (Scarpa et al. 2009) or computerised (Lancsar and Louviere, 2008).

Second, these studies were designed to make possible the estimation of respondent-specific preferences. While it is still unclear whether this analysis would have been possible here (as the implications for the design have only been studied in the case of unlabelled choice experiments), it could not be performed as the questionnaire was administered in two blocks.

To opt-out or not to opt-out

In a DCE, an opt-out option gives respondents the option of not selecting any of the alternatives ("choose neither"). In most real life contexts individuals would not have to choose an alternatives and forcing a decision is likely to make the task less realistic, and inflate the parameters obtained (Hensher et al., 2005).

However, including an opt-out option provides several disadvantages. First, when respondents choose the opt-out option, they do not provide any trade-off information to the analyst. Second, the more complex the task, the more respondents might be tempted to opt-out because it would be less demanding. Prior research (Dhar and Simonson, 2003) – indicates that forced choice

[62] If one of the 4 alternatives is half as likely to be chosen as the others, then the probability of it being chosen is 0.143 (the chance of choosing any of the others being 0.286). Therefore the probability that this option would not be chosen is 1-0.143= 0.857.

under preference uncertainty can produce conflict and psychological discomfort and lead to selection of options that reduce the need to make "hard choices". In an experimental setting, where a choice task might be less involving than an actual decision, preference uncertainty and possible concerns about being evaluated have been identified as factors that can enhance the tendency to select default options that are less likely to be seen as errors. Therefore when the opt-out option is chosen, it might be difficult to distinguish between a true or false 'non-responder'.

Here, considering the potential complexity of the task and the length taken by all the data collection activities it was decided not to have an opt-out option, to avoid the risk of fatigue pushing respondents down the easier "neither" route.

Figure 6.1: Example of choice set

Seeking
Professional Nurse

Location: OVERSEAS
Facility: HOSPITAL
Salary: R 325,000 per year

Training opportunities offered:
You will benefit from an interesting on-the-job in-service training

Social impact:
You will help us provide good quality clinical care to the population of our country

For the position described above, you have learnt through your own investigation that:

You may not be fully recognised as a professional nurse, and may sometimes be looked down on as a foreigner

Exciting position available in the **public sector** for a Professional Nurse

Location: RURAL AREA
Facility: HOSPITAL
Salary: R 132,000 per year (incl. R12,000 for rural allowance)

Training opportunities offered:
You will be able to get study leave to specialise within 6 years

Social impact:
Your presence will benefit populations who would otherwise have no access to essential services.

For the position described above, you have learnt through your own investigation that:

There is NO lack of basic equipment, medical supplies or drugs.

PRIVATE HOSPITAL SEEKS
PROFESSIONAL NURSE

LOCATION: URBAN AREA
FACILITY: HOSPITAL
SALARY: R 150,000 PER YEAR

TRAINING OPPORTUNITIES OFFERED:
5 DAYS OFF/ YEAR AND A 10% CONTRIBUTION TO YOUR FEES WILL BE PROVIDED TO YOU FOR TRAINING

SOCIAL IMPACT:
YOUR PRESENCE WILL HELP US PROVIDE ADVANCED CARE TO OUR CLIENTS

For the position described above, you have learnt through your own investigation that:

The hospital management is supportive of its staff.

PROFESSIONAL NURSE
POSITION
IN THE PUBLIC SECTOR

LOCATION: URBAN AREA
FACILITY: CLINIC
SALARY: R 144,000 PER YEAR

TRAINING OPPORTUNITIES OFFERED:
YOU WILL BE ABLE TO GET STUDY LEAVE TO SPECIALISE WITHIN 6 YEARS

SOCIAL IMPACT:
YOUR PRESENCE WILL BENEFIT POPULATIONS WHO WOULD OTHERWISE HAVE NO ACCESS TO ESSENTIAL SERVICES.

For the position described above, you have learnt through your own investigation that:

There is NO lack of basic equipment, medical supplies or drugs.

Testing for internal consistency

It is usual practice in DCEs to introduce an additional choice set where one "dominant" alternative is superior to the other(s) on all characteristics. Some authors have claimed that this was a way to test the "internal consistency" of the responses provided by respondents (Mangham et al., 2009), in particular to check whether they had understood the task correctly and not answered randomly. Others have seen in such tests a way to validate some of the axioms of consumer theory (monotonicity or non-satiation) upon which rely DCEs (Lancsar and Louviere, 2006). In either case, individuals are expected to choose the best alternative over the dominated one(s). Some authors have chosen to exclude from the analysis respondents who fail that test, although this is a disputed issue (Lancsar and Louviere, 2006).

The possibility of introducing a "dominant" option relies on the capacity to construct "*an option in which all levels of all attributes are deemed by the researcher to be worse (or no better) than other alternatives in the choice set*" (Lancsar and Louviere, 2006). In a labelled experiment, constructing such dominant option may not be possible for two reasons.

First, in a labelled DCE each alternative is explicitly labelled. Since it is reasonable to assume that individuals make inferences based on the attributes but also on the labels, constructing a dominant option means establishing a clear ordering between the labels (e.g. overseas is better than private which is better than urban which is better than rural). It is not always feasible to establish that ranking, as exemplified in the present case.

Second, the existence of alternative-specific levels for the same attribute means that all levels might not be easily compared. In a generic DCE, even if the ranking of levels for a specific attribute is unclear, it is always possible to construct alternatives that will present similar levels for that particular attribute, but will differ for all other attributes whose levels can be clearly ordered. In a labelled DCE, this choice may not be possible as the levels of the same attribute may be different under each alternative (for example, here the management levels of the overseas alternative and the urban/public ones do not overlap).

Due to both problems, no additional choice set was introduced to test for internal consistency.

6.2.3. Data collection

A. Questionnaire administration

The questionnaire was the third task to be administered during the survey (after the economic game presented in Chapter 5 and the other DCE presented in Chapter 7). The task was briefly explained to study respondents and an example of a choice profile was projected onto a large screen. Participants were invited to imagine that the proposed choices were taken from newspapers adverts, and that they had to report the *order* in which they would choose to apply for the jobs.

Following a minor error in the preparation of fieldwork, only one block of 12 questions (block 1) was printed, instead of two. Before that problem was spotted, 315 study participants answered the same block of 12 questions (instead of half of them answering 12 questions – those forming block 1 – and the other half of respondents answering the other 12 questions of the design, or block 2). This problem jeopardised the need to obtain an equal number of block 1s and 2s in order to carry out the analysis (with all the questions of the design). Three steps, described in detail in Appendix 6.4, were taken to address this issue:

- After the mistake was spotted, the 12 'block 2' questions were administered to all remaining 51 respondents;
- 10 study participants who had received the block 1 and provided an email address were invited by email to complete and send back the block 2 questions. Two replied and completed a new questionnaire.
- A second administration of the DCE was organised in two nursing colleges where only the block 1 questions had been administered. All 198 students who had taken part in the study in the first round were invited to fill in the block 2 questions at the end of a lecture; by the end, 166 of them completed the block 2 questions.

In the end, a total of 377 questionnaires were collected in the first (normal) data collection round, 51 of which were block 2 questionnaires. An additional 111 questionnaires were gathered in the second round of data collection (comprising internet and new administration of the DCE), all of which were block 2 questionnaires. A total of 326 students completed the block 1 questions and 221 students completed block 2 questions (see Appendix 6.4).

B. Data cleaning

Cleaning the data involved two stages: the exclusion of incomplete questionnaires and the reconstitution of a sample containing only one questionnaire per individual.

A questionnaire was deemed incomplete when one or more of the 12 questions had not been correctly completed, with a full ranking. The proportion of incomplete questionnaires was slightly higher during the second round of questionnaires (6.5% vs. 2.1%). A total of 19 incomplete questionnaires from the two rounds of data collection were excluded (see Appendix 6. 4).

The second step was to reconstruct a sample of questionnaires whereby each individual would appear only once. This meant selecting randomly one of the two questionnaires for those individuals who had filled the two blocks of questions, whilst ensuring a balance between the final number of block 1 and block 2 responses. A summary of the characteristics of the original and final sample used is presented in Table 6.2 below, more details can be found in Appendix 6.4.

Table 6.2: Description of final sample

Nursing college	Overall distribution of original sample	Overall distribution of reconstructed sample	Block 1	Block 2
Ann Latsky College of Nursing (Johannesburg)	125	125	41	84
S.G. Lourens Nursing College (Pretoria)	71	70	68	2
University of Johannesburg	20	20	17	3
North West University (Mafikeng campus)	42	41	0	41
Mmabatho Nursing College	37	37	37	0
Excelsius Nursing College (Klerksdorp)	73	73	25	48
North West University (Potchefstroom campus)	9	9	0	9
TOTAL	377	375	188	187

6.3. Methods for analysing discrete choice data

6.3.1. Theoretical framework

The analysis of choice experiments builds upon three main bodies of work.

First, it builds upon the neo-classical theory of consumer behaviour that relies on several axioms about individuals' preferences. These axioms posit that preferences can be represented by a numerical scale (utility), alternative goods can be ordered by an individual's preference function, and that individuals behave in a rational manner (choosing to consume the goods that maximise their utility). It is also assumed that individuals have complete[63] and consistent preferences. Violation of this latter axiom means that preferences may be constructed at the time they are being elicited, and be driven by contextual or heuristic factors (Swait et al., 2002). Finally, individuals are assumed to employ compensatory decision-making. This means that individuals take all available information into consideration in order to make a rational decision, and are ready to trade over attributes (accepting less of one attribute for more of another). This assumption also implies that individuals will not use simple "shortcuts" or heuristic rules to avoid a complex choice task, nor have lexicographic preferences (that is not being willing to trade over one particular attribute).

Second, choice experiments follow the assumptions developed by Kelvin Lancaster (Lancaster, 1966), who hypothesized that the demand for a product is effectively a demand for the combination of product characteristics.

Finally, choice models are analysed within the random utility framework developed in economics by McFadden (1974). According to this framework, the utility derived by individual *i* from the consumption of an alternative *k* in a choice set *C* can be decomposed into two parts: a deterministic component (*V*) which is a function of the attributes of the alternative (X_{ik}) and a random component (ε_{ik}). The random component represents unmeasured variation in preferences that stems from unobserved attributes, individual heterogeneity in tastes or measurement errors affecting choices.

$$U_{ik} = V_{ik} + \varepsilon_{ik} = \beta_i X_{ik} + \varepsilon_{ik} \qquad (1)$$

As a result, utility-maximising rational individuals choose alternative *k* if and only if it maximises their utility amongst the set of *J* alternatives proposed. From equation (1), one derives that alternative k is chosen over alternative *m* if and only if:

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63 Individuals have well-defined preferences between alternatives; in other words they cannot be indifferent.

$$U_{ik} > U_{im} \Leftrightarrow V_{ik} + \varepsilon_{ik} > V_{im} + \varepsilon_{im} \Leftrightarrow V_{ik} - V_{im} > \varepsilon_{im} - \varepsilon_{ik} \quad (2)$$

Inequality (2) shows that the distribution of individual error terms determines the distribution of the difference between utilities. The various econometric models developed to analyse individual choices mainly differ in the assumptions they make about the distribution of the error terms.

Discrete choice modelling has been one of the most dynamic areas of econometrics research in the past decade. Increased computing power has allowed the development of new models improving the behavioural realism of choice modelling, liberating researchers from the simpler assumptions of the early models. This section presents the models that can be used to analyse ranked data, and briefly summarises their properties.

A. Rank-ordered logit model

The rank-ordered logit model is a generalization of the multinomial logit (MNL) model[64] for choice data introduced by McFadden (see Appendix 6.5 for more details) that has been used in the economics literature (Beggs et al., 1981, Hausman and Ruud, 1987) In the marketing literature it is referred to as the exploded logit model (Chapman and Staelin, 1982).

The rank-ordered logit model considers the ranking of *J* alternatives as a sequence of *J-1* choices made by the respondent. Because of the assumed independence between choices deriving from the *iid* assumption of the logit model (see Appendix 6.5), the likelihood of a certain ranking of the alternatives in the entire choice set *k* is the product of *J* logit probabilities, that is:

$$Pr\,(\mathrm{y}_1 = \mathrm{r}_1, \mathrm{y}_2 = \mathrm{r}_2, \ldots \mathrm{y}_{\mathrm{j}-1} = \mathrm{r}_{\mathrm{j}-1} \mid \mathrm{X}) = \prod_{j=1}^{J} \left(\frac{e^{x'_{kj}\beta}}{\sum_{j'=1}^{J} \lambda_{kjj'} e^{x'_{kj'}\beta}} \right)$$

where the dummy variable $\lambda_{kjj'}$ equals zero when alternative *j'* in choice set *k* has a better ranking than alternative *j*, and one otherwise.

In relation to the present study, the ranking of the four alternatives is made through three independent decisions (e.g. choosing the overseas post (O) as the 1st, the private facility position (P) as the 2nd, the public rural position (R) as the 3rd and the public urban position (U) as the final choice). Because in a logit model the utility of each alternative is distributed *iid* extreme value (see Appendix 6.5), then the probability of this particular ranking (O,P,R,U) can be expressed as the logit probability of choosing O from the whole set of options, multiplied by the logit probability of choosing P from the sub-set of three (P, R, U), multiplied by the logit probability of choosing R

[64] Because the rank-ordered logit relies entirely on the MNL, one refers to the MNL and its limitations a lot in that section.

over U from the last two remaining options. Therefore, the probability of a particular ranking is the joint probability of three independent decisions, or the product of three probabilities:

$$\Pr(y_1 = O, y_2 = P, y_3 = R \mid X) =$$

$$Pr(y_1 = O \mid X) \times Pr(y_2 = P \mid X, y_1 = O) \times Pr(y_3 = R \mid X, y_1 = O, y_2 = P)$$

With the utility of a given alternative *J* expressed as $U_{kj} = X_{kj}\beta + \varepsilon_{kj}$ with ε_{kj} *iid* extreme value, it follows in this example:

$$Pr(y_1 = O \mid X) = \frac{e^{x'_{kO}\beta}}{\sum_{j'=O,P,U,R} e^{x'_{kj'}\beta}}$$

$$Pr(y_2 = P \mid X, y_1 = O) = \frac{e^{x'_{kP}\beta}}{\sum_{j'=P,U,R} e^{x'_{kj'}\beta}}$$

And finally:

$$Pr(y_3 = R \mid X, y_1 = O, y_2 = P) = \frac{e^{x'_{kR}\beta}}{\sum_{j'=U,R} e^{x'_{kj'}\beta}}$$

This expression for the ranking probability is a direct consequence of the nature of the extreme value distribution (Luce and Suppes, 1965).

Also deriving from this property, the model presents two main limitations:

- The restrictive assumption of the independence of irrelevant alternatives (IIA), which precludes the existence of cross-substitution patterns between alternatives;
- The incapacity of the model to account for correlation between decisions made by the same individual (i.e. intra-correlation that can be found in panel datasets).

The IIA assumption means that if one introduces or suppresses an alternative, the choice probabilities of the remaining alternatives should all change in the same proportion, thereby assuming that one alternative is never more of a substitute to an existing one than any other alternative[65]. In the present labour market example, it means for example, that if regulation made it impossible for South African nurses to work overseas, the model would predict that the take-up rate of the three main job categories would automatically increase by the same proportion, and not that nurses would choose one particular alternative as a preferred substitute (e.g. work in the private sector). This assumption of equal competition and proportional substitution patterns between alternatives can be unrealistic when looking at job alternatives, as it is likely that some

65 One can easily show formally that the ratio of choice probabilities of any two alternatives is unaffected by other alternatives.

jobs might be better substitutes than others[66]. If this is the case, it has been shown that the MNL performs poorly (Brownstone and Train, 1999). This problem can be avoided by using more complex modelling, presented below.

The other restriction of the model is the absence of adjustment for serial correlation across individual observations. Because each respondent is asked to answer a sequence of choices, DCE data should be analysed with panel data estimators accounting for the fact that the within-individual variation across choices may not be random. To adjust for that, a random parameter that is correlated *within* an individual's choices but not *across* individuals has to be added. For individual i this means that the utility from a particular choice is given by:

$$U_{ni} = V_{ni} + \varepsilon_{ni} + \mu_i$$

where ε_{ni} is the random error term that includes random variation across individual choices, while μ_i is the random error term across respondents and is constant for each individual.

Although more sophisticated models are increasingly being used (see below), the MNL remains a popular choice in the DCE literature (Fiebig et al., 2005, Guttman et al., 2009). In the current study, a first estimation was made with the rank-ordered logit model in Stata v10.

B. Rank-ordered mixed logit model

With the development of computing power, new estimation techniques (simulated maximum likelihood estimation) have been developed, and with them the introduction of a model evaluated through numerical simulations, the Random Parameter Logit (RPL) or mixed logit model (Hensher and Greene, 2003). The mixed logit model proposes a general modelling framework that addresses the main limitations encountered in the MNL. First, it solves the IIA assumption issues and allows alternatives to be uncorrelated, without constraining groups of alternatives to be similar. Second, it proposes a way to model the serial correlation across choices. Finally, it seeks to introduce more heterogeneity of preferences at the individual level through the use of random parameters that infer a distribution rather than a point estimate. The random parameter specification requires each coefficient β associated with an attribute of an alternative to have both a mean and a standard deviation – coefficients are treated as random instead of fixed parameters. The standard deviation of a parameter β introduces preference heterogeneity into the sampled population. However this specification presents a challenge in that the distribution of

[66] For example, all domestic jobs might be better substitutes of each other, in comparison with the overseas alternative.

the parameter is unknown. It is up to the researcher to determine the form of the distribution that should be fitted. Deciding which distributional form to choose is complicated, as coefficients can be drawn from any distribution such as normal, lognormal, uniform or triangular distributions (Hensher and Greene, 2003). So far, researchers have mostly favoured the choice of normal distributions, which present several mathematical advantages when trying to estimate some results, such as willingness-to-pay estimates (Greene et al., 2006, Balcombe et al., 2009).
To address the limitations of the rank-ordered logit model exposed above, one can use a rank-ordered *mixed* logit model (Train, 2003). This model uses the same approach as the rank-ordered logit model (i.e. one person's ranking is a product of logits), except that it uses random parameters in the same manner as the mixed logit model. This solves the IIA problem and accounts for serial correlation between observations and decisions within the choice set (Train, 2003). As the examination of heterogeneity of individual preferences is not the priority here, and because the computational requirements for the rank-ordered mixed logit model are quite significant[67], the use of random parameters is limited to salary variables, and normal distributions are used.

The mixed logit model was estimated with NLOGIT 4.0, an extension of the statistical software LIMDEP designed for choice modelling.

6.3.2. Model specification

The model evaluates the utility provided by each job k for a given individual i. Utility is influenced by job characteristics (X_{ik}), socio-economic and educational characteristics influencing tastes (Z_{ik}), concern for others (V_{ik}), and a random component of utility (ε_{ik}) accounting for the analyst's inability to accurately observe individual behaviour (McFadden, 1986):

$$U_{ik} = \alpha_{ik} + \beta_i X_{ik} + \xi_i Z_{ik} + \theta_i V_{ik} + \varepsilon_{ik}$$

Three separate regression models were estimated using a rank-ordered logit model. The first model included the main job characteristics. The second model examined how preferences are associated with respondents' demographic/socio-economic and educational characteristics. The third model augmented the second one with individuals' altruistic values and concerns for others. For job attributes, quantitative attributes were coded as they appear, while qualitative attributes were converted into dummy variables (see Table 6.3).

67 It took about 10 hours for the computer to run the estimated model.

With dummy variables, it is essential to remember that each intercept (here the alternative specific constants) will incorporate the base level category of each attribute (Mark and Swait, 2004). For alternative-specific constants, one alternative has to be left out and the urban alternative was chosen as the reference category.

Table 6.3: Independent variables – job characteristics

Variable	Description and coding	Expected sign
Interaction terms for the "overseas" alternative		
Alt.-specific constant	1 if overseas alternative, 0 otherwise	?
Salary	250, 325 (x R1,000)	+
Working conditions	1 for "fully recognised as a PN", 0 for "not fully recognised and looked down on"	+
Interaction terms for the "public rural" alternative		
Alt.-specific constant	1 if public rural alternative, 0 otherwise	?
Salary	132, 158 (x R1,000)	+
Training opportunities	Numbers of years nurses have to wait until they get study leave (2 or 6 years)	-
Social benefit	1 for "benefit populations who would have no access otherwise", 0 for "basic services for everyone",	?
Type of facility	1 for "clinic", 0 for "hospital"	?
Working conditions	1 for "no lack of supplies", 0 for "regular lack of supplies"	+
Interaction terms for the "private" alternative		
Alt.-specific constant	1 if private alternative, 0 otherwise	?
Salary	120, 150 (x R1,000)	+
Training opportunities	1 for "time off and contribution to fees", 0 for "exciting in service"	+
Working conditions	1 for "supportive management", 0 for "demanding patients,	+
Interaction terms for the "public urban" alternative		
Salary	120, 144 (x R1,000)	+
Training opportunities	Numbers of years nurses have to wait until they get study leave (2 or 6 years)	-
Social benefit	1 for "benefit populations who would have no access otherwise", 0 for "basic services for everyone",	?
Type of facility	1 for "clinic", 0 for "hospital"	?
Working conditions	1 for "no lack of supplies", 0 for "regular lack of supplies"	+

The second and third models included all the main attributes and several interaction terms that multiplied each alternative-specific job characteristic with selected socio-demographic variables (see Table 6.4). For example, the interaction between the rural label and gender measures the extent to which the preference for rural jobs depends on gender. The inclusion of individual characteristics (see Table 6.4) intended to test three series of assumptions:

- The role of "nature", i.e. the impact on job choices of socio-demographic characteristics such as gender, age or place of birth, has been underlined in the nursing and labour economics literature (Antonazzo et al., 2003, Chopra et al., 2008). In addition, some studies in South

Africa have emphasized the racial dimension of emigration decisions (Xaba and Phillips, 2001, Oosthuizen, 2005).

- The role of "nurture", or the impact of training characteristics (place and type of training institutions) on job preferences (Brewer et al., 2000, Coomber and Louise Barriball, 2007), in particular when it comes to choosing between rural and urban postings (Brooks et al., 2002, Dussault and Franceschini, 2006, Lehmann et al., 2008).
- The role of other-regarding preferences or altruism on labour market preferences (see Chapters 2 and 3). To avoid problems of collinearity between survey and experimental variables capturing similar constructs, two models were estimated separately.

Table 6.4: Independent variables – individual demographic and attitudinal variables

Variable	Expected sign		
	Rural	Private	Overseas
Socio-Demographic characteristics			
Male	+	?	?
White	?	?	+
Young (<25 y.)	?	?	+
Born in rural areas	+	?	-
Training characteristics			
Trained in university	?	+	?
Trained in NW province	+	?	?
Attitudinal variables and individual values			
DG student	-	?	?
DG patient	?	?	?
DG poor	+	-	-
Positive attitude towards rural lifestyle	+	?	-
Conservative attitude	-	+	+
Pro 'Welfare state' attitude	+	-	-
Pro-poor attitude	+	-	-

6.4. Results

6.4.1. Descriptive results

One of the disadvantages of ranked experiments is the difficulty respondents have completing a task which presents a high number of choice sets, each of them being a complex combination of several alternatives (in this case four) made up of numerous similar attributes (here five in each alternative) (Hausman and Ruud, 1987, Ophem et al., 1999). The complexity of the task can lead to poor data quality due to low response rates, incomplete ranking, less reliable responses for the lower ranks, or non-compensatory decision-making (simple heuristics). Task complexity might also lead individuals to develop lexicographic preferences (or non-compensatory decision-making), whereby they are not ready to substitute one characteristic for another, violating some of the assumptions underpinning DCE analysis. This section presents some descriptive information on the data collected, in order to investigate briefly issues around the complexity of the task and detect the potential presence of lexicographic preference orderings. Issues around the reliability of lower ranks are discussed in section 6.5.2.

A. Data quality

Table 6.5 reports results about response rates and completeness of questionnaires. The proportion of fully ranked choice sets was particularly high (96.5% for all questionnaires collected).

Table 6.5: Proportion and type of incomplete rankings

Number of missing answers [a]	First round – Percentage of respondents (N=377)	Second round – Percentage of respondents (N=170)	Total (N=547)
0	97.9%	93.5%	96.5%
3	0.5%	0.0%	0.4%
4[b]	0.3%	1.8%	0.7%
8[b]	0.3%	0.6%	0.4%
12[b]	0.0%	0.6%	0.2%
22[c]	0.3%	0.0%	0.2%
36[c]	0.8%	1.2%	0.9%
47	0.0%	0.6%	0.2%
48	0.0%	1.8%	0.5%
TOTAL	100%	100%	100%

[a] An "answer" is defined as a rank associated with a job. Each questionnaire is made up of 12 questions where respondents are asked to provide a full ranking of their job preferences (hence 4 answers per questions). There is a total of 48 answers in a questionnaire.
[b] this corresponds to cases where one question (asking to rank the 4 alternative jobs) was skipped or left blank.
[c] this corresponds to cases where only one or two ranks were filled in a question (usually the first rank), for example [1 – 2 –] .

Although a slightly lower proportion of fully ranked choice sets were compiled during the second round, as respondents completed the questionnaire on their own without the presence of the researcher to provide clarification, the proportion of fully completed questionnaires was still very high (93.5%). There was little indication of boredom or respondent inability of ranking the four alternatives fully; only 1.1% of all questionnaires were returned with only the first rank or the first two ranks completed.

B. Choice patterns

The analysis of the choice patterns of respondents provides a second indication of the ability of respondents to perform the task and presents some evidence of the presence of lexicographic preferences. High occurrences of rankings with ties (i.e. two or more jobs were given the same rank), or a high frequency of identical choice patterns could be considered as signs of a difficult task.

Table 6.6: Preference ranking for job choices by surveyed respondents

Preference order	Number of choice sets	Percentage
1232	1	0.0002
1321	1	0.0002
1322	1	0.0002
2131	1	0.0002
3122	1	0.0002
3141	1	0.0002
4112	1	0.0002
4131	1	0.0002
4142	1	0.0002
4211	1	0.0002
4311	1	0.0002
4314	1	0.0002
4331	1	0.0002
1132	2	0.0004
2413	23	0.0051
3412	39	0.0087
2431	40	0.0089
3421	43	0.0096
3214	47	0.0104
2314	49	0.0109
2341	55	0.0122
1432	68	0.0151
1423	78	0.0173
1324	99	0.0220
3124	100	0.0222
2134	103	0.0229
3241	109	0.0242
1342	121	0.0269
2143	125	0.0278
1243	168	0.0373
1234	177	0.0393
4213	180	0.0400
3142	200	0.0444
4312	223	0.0496
4321	384	0.0853
4123	421	0.0936
4231	632	0.1404
4132	1001	0.2224
TOTAL	**4500**	**1.0000**

Note: the ordering of options was systematically: O (overseas) / R (rural) / P (private) / U (urban)

The use of the same response pattern across all twelve choice sets could be a sign of lexicographic preferences (individuals have a clear hierarchy of preferences across the four job sectors and are not willing to substitute one job type for another). Table 6.6 summarises all the possible choice patterns that were found, and how often they occurred. The first column indicates the ranking given by respondents to the four options presented in each choice set. For example "2413" means that the first option presented in the choice set (overseas) is given the rank "2", the second option from the left (the rural job) is given the rank "4", the third alternative from the left (the urban job) is given the rank "1" and the final option in the choice set (the one on the right, i.e. the private job) is given the rank "3". The second column indicates how often that particular ranking pattern was observed. For example the first row of the table "1232" indicates that there was one of the 4,500 choice sets answered[68], a respondent ranked the overseas option first, ranked the rural public job second, the private job third and the urban public job second again (hence the ranking pattern "1232").

A few results emerge from Table 6.6:

- Only 15 choice sets were not ranked according to the guidelines that had been given to the respondents. In these 15 instances, respondents either failed to correctly apply the guidelines, or had incomplete preferences (or an equal preference for two of the options). This represents a very small and virtually insignificant proportion of answers, suggesting that respondents had complete preferences.
- Although there are theoretically 24 ways of ordering four alternative choices, the majority of the choice sets (75.2%) were answered with only 9 response patterns. If all the orderings had been made at random, on average the 9 patterns should have accounted for 37.5% of the answers.
- The most popular ordering (overseas ranked 4th, rural ranked 1st, private ranked 3rd and urban ranked 2nd) represented 22.2% of the answers, or more than five times what one would expect from a random occurrence.

This last point could suggest that some respondents systematically used the same ranking to answer the 12 choice sets, hence displaying lexicographic preference ordering. A more refined analysis allows the identification of response patterns at the individual level. Table 6.7 shows that only 2.4% of respondents (nine individuals) systematically used the same ranking to answer all 12 choice sets, and can be said to have 'complete' lexicographic preferences (individuals who base their decisions on the label only and who have a complete preference ordering of the four labels).

[68] Since each of the 375 respondents stated their preferences for 12 sets of job descriptions, a total of 4500 rankings were observed.

Further descriptive analysis showed that 0.3% of respondents (1 individual) systematically ranked the private job first across the 12 choice sets, 1.1% the urban job, 3.2% the overseas job and 5.1% the rural position. Therefore a total of 9.6% of individuals could be said to have 'incomplete' lexicographic preferences[69], with one favourite label (never traded against any other job characteristic), but possibly more indifference between the other three labels.

Table 6.7: Individual choice patterns

Maximum number of identical rankings repeated throughout the 12 choice sets	Actual Percentage (N=375)
1	0.53
2	12.80
3	24.27
4	17.07
5	16.27
6	8.00
7	5.87
8	4.53
9	3.47
10	2.93
11	1.87
12	2.40

Overall, the presence of alternative-specific levels for all attributes makes the identification of lexicographic preferences (based on labels or attributes) difficult. Indeed, because levels of a same attribute may vary differently across alternatives, it is not necessarily possible to distinguish hierarchical preferences over labels from those over attributes. For example, in the DCE constructed here salaries in overseas positions are systematically the highest. Therefore ranking the overseas job systematically in the first position could have been the result of a "dominant" preference for salary or of hierarchical preferences between labels (with a systematic preference for the "overseas" position).

In any case, Lancsar and Louviere (2006) argue that lexicographic preferences provide useful information as they clearly denote strong preferences that should be accounted for in the analysis, and that all observations should be kept for the analysis.

69 Obviously the 2.4% of individuals with complete lexicographic preference are included in these 9.6%.

6.4.2. Regression results with the rank-ordered logit model

Effects of job characteristics on labour market preferences

The results presented in Table 6.8 show the effect of job characteristics on the labour market preferences of nurses.

Table 6.8: Results from the rank-ordered logit regression (job characteristics only)

Alternative	Variable	Coeff.	St. Error	p-value
Private job	Alternative-specific constant	-0.593	0.327	0.070
	Salary (in R 1,000)	**0.021**	**0.001**	**0.000**
	Supportive staff [demanding patients]	**0.261**	**0.045**	**0.000**
	Support for external training [on-the-job training]	0.060	0.045	0.178
Overseas job	Alternative-specific constant	-0.038	0.339	0.911
	Salary (in R 1,000)	**0.004**	**0.001**	**0.000**
	Status recognised overseas [not fully recognised]	**0.827**	**0.057**	**0.000**
Rural job	Alternative-specific constant	**0.820**	**0.369**	**0.026**
	Salary (in R 1,000)	**0.018**	**0.002**	**0.000**
	Clinic [hospital]	**0.219**	**0.047**	**0.000**
	No shortage of supply/drugs [regular shortages]	**0.459**	**0.047**	**0.000**
	Waiting time (per year) to get study leave	**-0.119**	**0.012**	**0.000**
	Service for underserved [services for all]	-0.029	0.047	0.542
Urban job	Salary (in R 1,000)	**0.023**	**0.002**	**0.000**
	Clinic [hospital]	**0.219**	**0.045**	**0.000**
	No shortage of supply/drugs [regular shortages]	**0.360**	**0.045**	**0.000**
	Waiting time (per year) to get study leave	**-0.104**	**0.011**	**0.000**
	Service for underserved [services for all]	-0.009	0.045	0.844

Note: N=18,000; Log-L: -11945; $\chi^2(18)$= 4692 (p<0.000)
Proportion of 1st choices correctly predicted: = 48.33%; proportion of first 2 choices correctly predicted=33.93%; proportion of full ranking correctly predicted: 22.24%. In addition to the predictive power of the model based on the first choice only, a statistical measure (see Appendix 6.6) evaluating the degree of correspondence between rankings was computed. The result of this test shows a significant degree of correlation between the observations and the model predictions: Kendall's τ= 0.4262.

First, the negative but insignificant alternative-specific constant terms for overseas and private jobs indicate no general preference for urban public jobs compared to these two alternatives. Interestingly, the significant alternative-specific constant for rural jobs suggests that there is a positive vision of rural jobs compared to the urban ones. However the interpretation of the constant terms is not straightforward as these terms also capture the base categories of the dummy variables for each relevant alternative-specific attribute. For example the overseas job constant encompasses the baseline level of "working conditions" in this position, that nurses are not fully recognised as professionals. This is a particularly strong level, which might explain why the coefficient on this alternative specific constant is so large (and negative).

The utility of jobs increases with higher salaries (for all jobs) and better working conditions (no lack of drugs and supplies for jobs in the public sector, and a supportive managerial environment in overseas and private jobs). These results conform to theoretical expectations.

Interestingly, salaries are not valued in the same way across the four job options. Indeed, a model using a unique salary variable (as opposed to alternative-specific salaries) was formally rejected (see Appendix 6.7). Taking the valuation of salary in a rural post as a reference (see Table 6.9, second column), R 1,000 in the private sector are "worth" 15% more to nurses, while R1,000 in an urban (public) post is worth 23.5% more. However, nurses value R1,000 overseas about 75% less than the same amount for rural positions.

Table 6.9: Marginal rates of substitutions between salaries across jobs

	Rural	Urban	Private	Overseas
Rural	1	0.81	0.87	4.21
Urban	1.24	1	1.07	5.20
Private	1.15	0.93	1	4.84
Overseas	0.24	0.19	0.21	1

Note: each marginal rate of substitution is obtained by dividing the alternative-specific salary coefficient with each other. For example, in the urban job R1,000 of salary increases a worker's utility by about 0.018 which is 0.81 less than the impact on utility of the same amount in the urban job (0.023). Note that this table was calculated with the actual coefficients of the regression, not rounded to the third decimal.

Willingness to be compensated for different job characteristics

In DCEs, the monetary valuation of job attributes can be computed by dividing the coefficient of each variable by the income coefficient (Scott, 2001). Due to the presence of the labels and their significant effect on the interpretation of the alternative-specific attributes, it is the utility of each job separately that is evaluated by individuals, and reconstructed in the regression model. Therefore, to compute the monetary value of each job characteristic, one has to consider each job separately, and use the coefficient of the relevant alternative-specific salary.

In public and private positions, the characteristic with the highest monetary value per unit of change was the one relating to working conditions (see Table 6.10). Nurses would be willing to relinquish 19% of their annual salary to work in a job where there would no shortages of drugs and medical supplies in rural areas. Conversely this means that they would require a compensation of 19% in rural posts and 13% in urban posts to work in posts where there would be regular shortages. The model also predicts that nurses would need to be compensated a substantial amount of money (R220,000, or nearly 90% of the typical overseas salary) to accept a position overseas where they would not be fully recognised as a professional nurse.

The next most important job characteristic for public positions was the type of facility where the job was based. Nurses value working in a clinic more, therefore they would require an increase of about 9% of the current salary base to accept a job in a rural hospital, while they would expect an increase of about 8% of the base salary in urban areas to work in a hospital there.

Table 6.10: Absolute and relative monetary values of job characteristics (based on coefficient estimates presented in Table 6.8)

	Monetary value of job characteristic (Rands)* [95% confidence intervals]	Value of job characteristic as % of current base income offered**
Rural job		
Working in a clinic	12,222 [8,849 ; 14,483]	9.3%
No shortage of drugs and medical supplies	25,652 [25,576 ; 25,703]	19.4%
Waiting one more year to get study leave	- 6,664 [- 9,900 ; - 4,495]	5.0%
Serving underserved populations	- 1,592 [- 8,358 ; 2,942]	1.2%
Urban job		
Working in a clinic	9,454 [6,683 ; 11,461]	7.9%
No shortage of drugs and medical supplies	15,577 [13,972 ; 16,739]	13.0%
Waiting one more year to get study leave	- 4,480 [- 6,477 ; - 3,034]	3.7%
Serving underserved populations	- 386[- 5,029 ; 2,975]	0.3%
Private job		
Supportive management	12,353 [9,528 ; 14,492]	10.3%
Limited support for external training	2,846 [-1,508 ; 6,142]	2.4%
Overseas job		
Professional status not fully recognized	-219,614 [-310,434 ; -179,544]	87.8%

* This should be interpreted as the amount of money nurses would require to compensate them for the job characteristic
** The reference salary chosen for each category corresponds to the lower level in the DCE, which is also the current (typical) salary for a nurse graduate: R120,000 in the private sector and in the urban public sector, R132,000 in the rural public sector and R250,000 in positions overseas.

Finally, nurses would require approximately an extra R6,600 per year (5% of the current base salary) to compensate them for each additional year they have to wait to obtain study leave. In urban areas, nurses would only ask for a compensation of about R4,500 per year. The relative findings also show that nurses would be willing to accept a job in rural areas with a regular lack of drugs, if they had a shorter waiting period (four years less than the base period) for study leave.

Finally, for both categories of public job, the "social impact" of the job was not found to have a significant impact on nurses' job preferences. The absence of significance of the "social impact" attributes in the public jobs may result from a lack of perceived difference between the two levels.

Indeed, the difference between "*Your presence would help us improve access to basic services for everyone*" and "*Your presence will benefit populations who would otherwise not have access to services*" is possibly too subtle to have retained nurses' attention.

Impact of "nature" and "nurture" on job preferences

Table 6.11 shows the regression results for the interactions of the labels with the nurses' personal characteristics. Using the odds-ratios make the interpretation of the table easier, and the following results are based on them.

Preferences between the two main types of public jobs differed according to socio-economic characteristics. The younger nurses, who were born in rural areas, were more likely to choose public sector positions in rural than urban areas. For example, nurses who were less than 25 years old had 1.27 more chances than older nurses to opt for a rural job rather than an urban one. A male nursing graduate was also 1.2 times more likely than a female to choose a public sector job in a rural rather than an urban area. Jobs in the private sector were preferred to public positions in urban areas by the young (less than 25 years old). Preferences for the private sector did not vary according to race, gender or place of birth. Confirming the results found in the South African emigration literature, it was found that white nurse graduates were more likely than other population groups to favour a job overseas compared to a job in the public sector in an urban area. Furthermore, young males were more likely to consider emigration than a job in the public sector in urban areas. Finally, as expected, there was a positive correlation between a positive attitude towards rural areas and preferences for jobs in the public sector in rural compared to urban areas. The model also shows that those who were more positive towards rural areas were less likely to be attracted by positions overseas (compared to public posts in urban areas).

The impact of "nurture" was also key in shaping job attractiveness. Students who had trained in universities were more likely than nursing college students to be attracted by overseas jobs or private jobs compared to urban public positions. However, they were less likely to favour public positions in rural areas. Finally, students who were trained in North-West province (a more rural province than Gauteng) were more likely to choose any job rather than a public urban job.

Table 6.11: Results from the rank-ordered logit regression

Alternative	Variables in utility functions	Model I				Model II			
		Coeff.	St. Error	p-val.	Odds-Ratios	Coeff.	St. Error	p-val.	Odds-Ratios
Private job	Alternative-specific constant	**-1.054**	**0.350**	**0.003**	**0.349**	**-0.905**	**0.351**	**0.010**	**0.405**
	Salary (in R 1,000)	**0.022**	**0.002**	**0.000**	**1.023**	**0.023**	**0.002**	**0.000**	**1.023**
	Supportive staff [demanding patients]	**0.280**	**0.046**	**0.000**	**1.323**	**0.292**	**0.048**	**0.000**	**1.339**
	Support for external training [on-the-job training]	0.045	0.046	0.331	1.046	0.027	0.048	0.576	1.027
	Male	0.147	0.081	0.072	1.158	0.073	0.085	0.392	1.076
	White	0.218	0.129	0.090	1.244	0.210	0.131	0.109	1.233
	Young (<25 y.)	**0.209**	**0.073**	**0.004**	**1.232**	**0.202**	**0.074**	**0.006**	**1.224**
	Born in rural area	0.019	0.065	0.770	1.019	-0.046	0.067	0.497	0.955
	Trained in university	**0.224**	**0.084**	**0.008**	**1.251**	**0.218**	**0.086**	**0.012**	**1.243**
	Trained in NW province	**0.165**	**0.065**	**0.011**	**1.179**	**0.134**	**0.066**	**0.041**	**1.144**
	Positive attitude towards rural lifestyle	0.009	0.020	0.660	1.009	0.020	0.020	0.313	1.020
	Conservative attitude					**0.052**	**0.022**	**0.021**	**1.053**
	Pro 'Welfare state' attitude					-0.021	0.020	0.281	0.979
	Pro-poor attitude					0.026	0.027	0.332	1.027
	DG student	**0.413**	**0.155**	**0.008**	**1.512**				
	DG patient	-0.078	0.185	0.675	0.925				
	DG poor	0.090	0.153	0.559	1.094				
Overseas job	Alternative-specific constant	**-1.383**	**0.371**	**0.000**	**0.251**	**-1.214**	**0.368**	**0.001**	**0.297**
	Salary (in R 1,000)	**0.005**	**0.001**	**0.000**	**1.005**	**0.005**	**0.001**	**0.000**	**1.005**
	Status recognised overseas [not fully recognised]	**0.986**	**0.060**	**0.000**	**2.681**	**0.988**	**0.061**	**0.000**	**2.685**
	Male	**0.846**	**0.092**	**0.000**	**2.331**	**0.786**	**0.097**	**0.000**	**2.194**
	White	**0.806**	**0.145**	**0.000**	**2.239**	**0.801**	**0.147**	**0.000**	**2.229**
	Young (<25 y.)	**0.753**	**0.084**	**0.000**	**2.124**	**0.755**	**0.086**	**0.000**	**2.128**
	Born in rural area	0.069	0.080	0.389	1.071	0.000	0.083	1.000	1.000
	Trained in university	**0.431**	**0.096**	**0.000**	**1.539**	**0.439**	**0.099**	**0.000**	**1.550**
	Trained in NW province	**0.968**	**0.079**	**0.000**	**2.633**	**0.868**	**0.080**	**0.000**	**2.382**
	Positive attitude towards rural lifestyle	**-0.121**	**0.024**	**0.000**	**0.886**	**-0.113**	**0.025**	**0.000**	**0.893**
	Conservative attitude					**0.064**	**0.027**	**0.018**	**1.066**

	Pro 'Welfare state' attitude					-0.044	0.024	0.068	0.957
	Pro-poor attitude					0.020	0.033	0.559	1.020
	DG student	0.163	0.192	0.396	1.177				
	DG patient	0.090	0.225	0.690	1.094				
	DG poor	0.020	0.184	0.914	1.020				
Rural job	Alternative-specific constant	0.102	0.392	0.795	1.107	0.261	0.395	0.508	1.299
	Salary (in R 1,000)	**0.020**	**0.002**	**0.000**	**1.020**	**0.019**	**0.002**	**0.000**	**1.020**
	Clinic [hospital]	**0.242**	**0.048**	**0.000**	**1.274**	**0.239**	**0.050**	**0.000**	**1.269**
	No shortage of supply/drugs [regular shortages]	**0.491**	**0.048**	**0.000**	**1.633**	**0.491**	**0.050**	**0.000**	**1.634**
	Waiting time (per year) to get study leave	**-0.122**	**0.012**	**0.000**	**0.885**	**-0.123**	**0.012**	**0.000**	**0.884**
	Service for underserved [services for all]	-0.028	0.048	0.566	0.973	-0.018	0.050	0.710	0.982
	Male	**0.231**	**0.082**	**0.005**	**1.260**	**0.175**	**0.085**	**0.040**	**1.191**
	White	0.171	0.129	0.185	1.187	0.218	0.132	0.098	1.244
	Young (<25 y.)	**0.238**	**0.074**	**0.001**	**1.269**	**0.261**	**0.076**	**0.001**	**1.298**
	Born in rural area	**0.413**	**0.065**	**0.000**	**1.511**	**0.440**	**0.068**	**0.000**	**1.552**
	Trained in university	**-0.421**	**0.086**	**0.000**	**0.656**	**-0.453**	**0.088**	**0.000**	**0.636**
	Trained in NW province	**0.606**	**0.066**	**0.000**	**1.833**	**0.578**	**0.067**	**0.000**	**1.782**
	Positive attitude towards rural lifestyle	**0.117**	**0.020**	**0.000**	**1.124**	**0.114**	**0.020**	**0.000**	**1.121**
	Conservative attitude					-0.022	0.022	0.332	0.979
	Pro 'Welfare state' attitude					-0.014	0.020	0.485	0.986
	Pro-poor attitude					**0.057**	**0.027**	**0.037**	**1.059**
	DG student	0.051	0.155	0.745	1.052				
	DG patient	-0.123	0.185	0.506	0.885				
	DG poor	0.272	0.153	0.076	1.312				
Urban job	Salary (in R 1,000)	**0.024**	**0.002**	**0.000**	**1.025**	**0.024**	**0.002**	**0.000**	**1.025**
	Clinic [hospital]	**0.235**	**0.047**	**0.000**	**1.265**	**0.230**	**0.048**	**0.000**	**1.258**
	No shortage of supply/drugs [regular shortages]	**0.378**	**0.047**	**0.000**	**1.460**	**0.373**	**0.048**	**0.000**	**1.452**
	Waiting time (per year) to get study leave	**-0.111**	**0.012**	**0.000**	**0.895**	**-0.112**	**0.012**	**0.000**	**0.894**
	Service for underserved [services for all]	-0.028	0.047	0.554	0.973	-0.030	0.048	0.528	0.970

Model I: N=17,520; Log-L: -11,118; $\chi^2(48)$=5,583 (p<0.000); Proportion of 1st choices correctly predicted: 51.3%; proportion of first 2 choices correctly predicted: 32.4% ; proportion of full rankings correctly predicted: 22.4% ; Kendall's τ= 0.4627

Model II: N=16,656 ; Log-L: -10,559; $\chi^2(48)$=5,329 (p<0.000) ; Proportion of 1st choices correctly predicted: 51.5%; proportion of first 2 choices correctly predicted: 30.9% ; proportion of full rankings correctly predicted: 21.3% ; Kendall's τ= 0.4644

Effects of other-regarding preferences on labour market preferences

Due to problems of collinearity between the two measures of social preferences (survey and experimental), two separate models were estimated. The results of the two regressions indicate that job preferences vary as a function of the level of individual concern for others. Model II (with survey measures) performs better than the model with experimental measures (it presents a smaller log-likelihood for an identical number of parameters estimated).

Model I in Table 6.11 shows the impact on preferences of the measures of altruism obtained with the economic behavioural games reported in Chapter 5. Most of these measures were not associated with significant differences in job preferences. However there are two interesting findings. First, nursing students who were more generous towards their peers preferred private jobs to public urban ones ($p<0.006$). Second, although the coefficient estimates are not significant at the 5% level, the sign of the interaction terms between labels and results in the poor framing confirms an intuitive result – individuals who were more generous towards the poor were more likely to prefer rural jobs (over urban ones, $p<0.08$), and they were also more likely to prefer public positions over private ones (negative signs on the interactions with the private and overseas labels).

The results obtained with survey measures of pro-social concerns (see section 5.4.2 in Chapter 5 for a complete explanation of how these measures were constructed) are presented in model II of Table 6.11. Unlike what was found with the experimental measures, many of the survey measures capturing social norms and attitudes towards the poor were associated with differences in job preferences. Nursing students with more pro-poor attitudes favoured public sector jobs in rural compared to urban areas, consistent with their concerns for the well-being of more needy individuals. In contrast, those who indicated a more conservative role for government favoured jobs in the private sector and overseas, over jobs in the public sector in urban areas.

6.4.3. Rank-ordered mixed logit model

Table 6.12 below presents the results obtained with the rank-ordered mixed logit for the same two sets of variables presented in Table 6.11. Results concur with those of the rank-ordered logit model, which means that the results explained in the section above (Table 6.11) are robust to serial correlation between observations. The only notable exception pertains to the role of gender in the preference for rural jobs. The rank-ordered mixed logit model does not find that males are more attracted by public sector posts in rural compared to urban areas.

Table 6.12: Results from the rank-ordered mixed logit regression

Alternative	Variables in utility function	Model I			Model II		
		Coeff.	St. Error	p-value	Coeff.	St. Error	p-value
Private job	Alternative-specific constant	**-1.060**	**0.455**	**0.020**	**-0.907**	**0.449**	**0.043**
	Salary (in R 1,000)*	**0.023**	**0.002**	**0.000**	**0.024**	**0.002**	**0.000**
	Standard deviation of random parameter distribution	***0.013***	***0.001***	***0.000***	**0.012**	**0.001**	**0.000**
	Supportive staff [demanding patients]	**0.278**	**0.059**	**0.000**	**0.290**	**0.059**	**0.000**
	Support for external training [on-the-job training]	0.042	0.057	0.463	0.023	0.058	0.692
	Male	0.148	0.085	0.082	0.074	0.080	0.358
	White	0.223	0.181	0.219	0.214	0.175	0.223
	Young (<25 y.)	**0.207**	**0.064**	**0.001**	**0.200**	**0.064**	**0.002**
	Born in rural area	0.022	0.067	0.740	-0.043	0.067	0.518
	Trained in university	0.221	0.156	0.157	0.217	0.130	0.097
	Trained in NW province	0.168	0.099	0.090	0.137	0.096	0.156
	Positive attitude towards rural lifestyle	0.008	0.018	0.671	0.020	0.019	0.304
	Conservative attitude				**0.052**	**0.019**	**0.006**
	Pro 'Welfare state' attitude				-0.021	0.019	0.263
	Pro-poor attitude				0.027	0.026	0.293
	DG student	**0.414**	**0.132**	**0.002**			
	DG patient	-0.072	0.172	0.673			
	DG poor	0.088	0.154	0.566			
Overseas job	Alternative-specific constant	**-1.371**	**0.438**	**0.002**	**-1.197**	**0.430**	**0.005**
	Salary (in R 1,000)*	**0.004**	**0.001**	**0.000**	**0.004**	**0.001**	**0.000**
	Standard deviation of random parameter distribution	***0.010***	***0.000***	***0.000***	***0.004***	***0.000***	***0.000***
	Status recognised overseas [not fully recognised]	**0.986**	**0.060**	**0.000**	**0.987**	**0.059**	**0.000**
	Male	**0.831**	**0.075**	**0.000**	**0.773**	**0.070**	**0.000**
	White	**0.800**	**0.139**	**0.000**	**0.796**	**0.136**	**0.000**
	Young (<25 y.)	**0.756**	**0.056**	**0.000**	**0.757**	**0.055**	**0.000**
	Born in rural area	0.066	0.056	0.242	-0.003	0.056	0.959
	Trained in university	**0.435**	**0.162**	**0.007**	**0.442**	**0.130**	**0.001**
	Trained in NW province	**0.967**	**0.109**	**0.000**	**0.866**	**0.089**	**0.000**
	Positive attitude towards rural lifestyle	**-0.119**	**0.018**	**0.000**	**-0.111**	**0.018**	**0.000**
	Conservative attitude				**0.063**	**0.017**	**0.000**

	Pro 'Welfare state' attitude				**-0.043**	**0.017**	**0.011**
	Pro-poor attitude				0.017	0.022	0.443
	DG student	0.166	0.124	0.180			
	DG patient	0.091	0.157	0.565			
	DG poor	0.019	0.141	0.894			
Rural job	Alternative-specific constant	0.081	0.485	0.867	0.242	0.485	0.618
	Salary (in R 1,000)	**0.021**	**0.002**	**0.000**	**0.020**	**0.002**	**0.000**
	Standard deviation of random parameter distribution	***0.011***	***0.001***	***0.000***	**0.010**	**0.001**	**0.000**
	Clinic [hospital]	**0.240**	**0.064**	**0.000**	**0.237**	**0.064**	**0.000**
	No shortage of supply/drugs [regular shortages]	**0.493**	**0.063**	**0.000**	**0.494**	**0.064**	**0.000**
	Waiting time (per year) to get study leave	**-0.123**	**0.014**	**0.000**	**-0.124**	**0.014**	**0.000**
	Service for underserved [services for all]	-0.025	0.058	0.668	-0.015	0.058	0.796
	Male	0.212	0.087	0.015	0.156	0.084	0.063
	White	0.166	0.190	0.382	0.212	0.186	0.254
	Young (<25 y.)	**0.239**	**0.068**	**0.000**	**0.262**	**0.068**	**0.000**
	Born in rural area	**0.409**	**0.056**	**0.000**	**0.436**	**0.058**	**0.000**
	Trained in university	**-0.418**	**0.129**	**0.001**	**-0.449**	**0.119**	**0.000**
	Trained in NW province	**0.606**	**0.110**	**0.000**	**0.578**	**0.104**	**0.000**
	Positive attitude towards rural lifestyle	**0.119**	**0.017**	**0.000**	**0.116**	**0.017**	**0.000**
	Conservative attitude				-0.022	0.018	0.220
	Pro 'Welfare state' attitude				-0.014	0.017	0.431
	Pro-poor attitude				**0.055**	**0.021**	**0.010**
	DG student	0.052	0.138	0.708			
	DG patient	-0.120	0.167	0.475			
	DG poor	0.268	0.156	0.085			
Urban job	Salary (in R 1,000)*	**0.025**	**0.002**	**0.000**	**0.026**	**0.002**	**0.000**
	Standard deviation of random parameter distribution	***0.005***	***0.001***	***0.002***	***0.004***	***0.001***	***0.011***
	Clinic [hospital]	**0.236**	**0.057**	**0.000**	**0.230**	**0.059**	**0.000**
	No shortage of supply/drugs [regular shortages]	**0.379**	**0.053**	**0.000**	**0.374**	**0.056**	**0.000**
	Waiting time (per year) to get study leave	**-0.112**	**0.014**	**0.000**	**-0.113**	**0.014**	**0.000**
	Service for underserved [services for all]	-0.029	0.057	0.606	-0.033	0.060	0.586

Model I: N=13,140; Log-L: -10,244.; $\chi^2(52)$= 15,941 (p<0.000); McFadden Pseudo R^2=0.437

Model II: N=12,492; Log-L: -9,803.; $\chi^2(52)$= 15,029 (p<0.000) ; McFadden Pseudo R^2=0.434

6.4.4. Modelling the deployment of nursing graduates in the labour market

Based on the parameter estimates obtained from model II presented in Table 6.12[70], one can predict the relative market shares of each of the four job alternatives. Using the original equation estimated, the parameter estimates obtained from the model are used to compute the utility associated with each job described by a number of characteristics. The estimations are made for a representative individual who would have the average socio-economic characteristics of the populations. These simulations are produced automatically by LIMDEP.

Two types of simulations are presented in Table 6.13 below:

- The expected deployment of nurses given the typical job offers found by South African nurse graduates (see Appendix 6.8 for a detailed presentation of these base scenarios);
- The predicted deployment of nurses in the labour market under a number of simulated scenarios (e.g. salary increases, etc.).

Table 6.13: Predicted market shares of the four main labour market destinations

Scenario description	**% uptake of each type of post**			
	Overseas	**Rural**	**Private**	**Urban**
Base scenario (current conditions)	11.95	30.74	28.46	28.83
Changes in the public sector				
Increase in salary in rural post (R150,000)	11.19	35.21	26.80	26.80
Increase in salary in urban post (R150,000)	10.12	26.12	24.26	39.49
Better salaries in both public posts	9.51	30.47	22.99	37.03
Better training opportunities in rural post (wait 2 years)	10.89	36.94	26.15	26.02
Better training opportunities in urban post (wait 2 years)	10.84	28.04	25.91	35.22
Better training opportunities in both public posts (wait 2 years)	9.89	34.16	23.93	32.00
Better working conditions in rural posts	10.89	36.93	26.16	26.03
Changes in the private sector				
More supportive management	10.94	29.29	32.64	27.12
Increase in salary (R150,000)	9.66	26.94	38.90	24.51
Changes to overseas positions				
Marketing campaign (status recognised)	22.18	27.86	24.28	25.67
Increase in salary (R300,000)	14.68	29.96	27.37	27.99

The simulation shows that, under current market conditions, approximately 31% of the nursing graduates would choose rural posts in the public sector, 29% would choose urban public

70 It was necessary to use results from the rank-ordered mixed logit model, as the IIA assumption no longer holds, thereby allowing for more flexible cross-elasticity patterns between alternatives.

positions, 28.5% would opt for the private sector and 12% would choose to work overseas. Some simple simulations show that these choices could be altered in favour of the public sector by increasing salaries in rural and urban areas. Indeed, almost 70% of newly graduated nurses would take up posts in the public sector if salaries were to increase. Solving the problem of drug and medical supply shortages would attract about 20% more nurses to rural areas (36.9% compared to 30.7%). A similar effect would be achieved by offering study leave earlier. These simulations also confirm the importance of the status of nurses overseas. The willingness of nurses to take a position overseas virtually doubles when they are guaranteed that they will not be discriminated against, a much greater effect than a higher salary.

6.5. Discussion

6.5.1. Summary of key findings

This chapter presented the analysis of a labelled discrete choice experiment, looking at the stated preferences among newly qualified nurses in South Africa for various job opportunities.

A descriptive analysis of the results showed little indication that respondents may have found the task particularly difficult to complete. There was evidence that a minority of individuals systematically chose the same ranking of the four alternatives or had the same first choice across the twelve choice sets they answered. Although this could be the sign of lexicographic preferences contradicting the assumption of compensatory decision-making, the complexity of the labelled design made it difficult to confirm that fact.

Overall the results conformed to the theoretical expectations of the DCE (e.g. salaries increasing the utility of jobs, poor working conditions decreasing utility). Interestingly, the analysis showed a differential valuation of salaries across the different job opportunities.

Various socio-demographic characteristics were found to be particularly significant for job preferences. Nurses coming from rural areas or having a positive attitude towards rural areas were more likely to choose positions in rural areas than in urban areas. Younger graduates were more likely to choose a private job than a public urban one. Being white, young and male constituted favourable factors for choosing a job overseas rather than one in the public sector in urban areas. Findings also showed a the correlation between selfless and pro-poor values (measured through surveys) and a preference for public sector jobs, while more conservative and individualistic societal views are associated with a greater preference for private jobs.

The analysis also confirmed the importance of "nurture" as university students were found to favour private jobs more than nursing college students. Those trained in a more rural area (North West province rather than Gauteng) were significantly more likely to reject a job in urban areas. Finally, the predicted choices of nurses in the labour market show that, under what can be considered the current market conditions, 12% of nursing graduates would choose to work overseas, while those remaining in South Africa would split approximately equally between the three main employment opportunities. Simple simulations show that about 35% of nurses would choose the public sector if salaries were higher (instead of 30.7% under current circumstances), and 37% more nurses would choose a public sector position in rural areas if working conditions were better. These simulations also confirmed the importance of the status of nurses overseas.

6.5.2. Discussion of results

The results obtained provided mixed evidence to contradict or support some of the hypotheses of this research.

The positive effect of rural backgrounds on rural job choices provided some evidence supporting hypothesis H6[71]. The results partly supported hypothesis H2[72] as they showed a correlation between selfless and pro-poor values (measured through surveys) and a preference for public sector jobs, while more conservative and individualistic societal views are associated with a greater preference for private jobs. However, the findings also showed that altruism measured with economic experiments (presented in Chapter 5) was generally not significantly correlated with any preference for a particular job. One exception was the positive association between generous offers to poor recipients in the DG and a preference for public jobs, especially in rural areas, which also supports H3[73]. One reason behind this finding could be that respondents considered working conditions in public (rural) jobs not good enough to provide good quality care to the patients (which is an underlying assumption of H4[74] and H5[75]). This might have discouraged their pro-public (rural) choices, thereby blurring the difference in preferences between them and more selfish individuals. In fact, a preference for private jobs over public ones was found amongst individuals who had been more generous in the DG towards their peers, which offered partial support to hypothesis H4. Unfortunately, the design was not set out to test

[71] Nurses from rural areas are more likely to choose rural posts than other nurses

[72] *Ceteris paribus*, altruistic nurses are attracted by jobs in the public sector.

[73] *Ceteris paribus*, altruistic nurses are attracted by rural jobs.

[74] Ceteris paribus, more altruistic nurses will choose private jobs if working conditions in the public sector are sufficiently poor

[75] If altruistic individuals perceive public (rural) jobs as offering poor conditions, they will opt for private (urban) ones.

these two hypotheses further (for example through the investigation of interaction effects with the working condition attribute, or through an exploration of what was understood in the labels).

The work undertaken also contributes to several bodies of literature.

First, this study builds on a growing body of work using DCEs to study health workers' job preferences. A recent review of the literature showed that only nine studies using DCE techniques have addressed HR issues (Lagarde and Blaauw, 2009). Four of them (Gosden et al., 2000, Scott, 2001, Ubach et al., 2003, Wordsworth et al., 2004) were from the developed world (all in the United Kingdom) and the other five were carried out in developing countries: Indonesia (Chomitz et al., 1998), South Africa (Penn-Kekana et al., 2005), Malawi (Mangham and Hanson, 2008), Ethiopia (Hanson and Jack, 2008) and Tanzania (Kolstad, 2010). The majority of study participants were doctors, although three studies focused on nurses (Penn-Kekana et al., 2005, Hanson and Jack, 2008, Mangham and Hanson, 2008). Because the relative importance and quantitative estimates of job attributes in a DCE depends on the presence of other types of attributes, it is difficult to compare results across choice experiments, in particular the size of effects. Yet, some more generic comments can be made. For example, the influence of study leave on nurses' preferences in the DCE presented here echo the three other nursing DCEs in developing countries where education opportunities were identified as a key motivating factor (Chomitz et al., 1998, Mangham and Hanson, 2008, Kolstad, 2010). Furthermore, although this is different to other findings in the DCE literature where health workers in developing countries tend to favour jobs in hospitals over those in smaller facilities (Lagarde and Blaauw, 2009), the preference for clinics over hospitals in this study probably reflects a preference in South Africa for better working hours (with no nightshift or weekend work) and sometimes more independent work. The DCE presented makes a novel contribution to this growing field, as it differs from previous studies in two respects. First, none of the other studies used a labelled design. Second, all previous DCEs exploring HR issues were restricted to a particular sector (i.e. public or private), and did not attempt to assess the impact of sector preferences. By enabling the calculation of market shares between the different sectors, the DCE presented here demonstrates some new possible applications of choice experiments to labour issues (Lagarde and Blaauw, 2009).

Second, the results relating to the impact of job characteristics on health workers' job preferences complement the empirical literature presented in Chapter 2. The detrimental impact of poor working conditions in the public sector in South Africa has been highlighted by a large body of work (Thutse, 2006, Kekana et al., 2007, Nyathi and Jooste, 2008, Pillay, 2009), including a discrete choice experiment (Penn-Kekana et al., 2005). However, the present study is the first to explore in a quantitative manner the relative importance of job characteristics across sectors. In particular, the marginal rates of substitution between salary valuations presented in Table 6.9 provide some interesting insights. The differential valuation between jobs in rural areas and elsewhere in South Africa[76] provides some empirical justification to the theory of compensating wage differentials described in section 2.1.2 (Garen, 1988, McNabb, 1989, Borjas, 2005), which posits that job offers differ in salary to compensate workers for unpleasant working conditions. Accordingly, the findings presented here suggest that graduate nurses expect to be compensated for harder working conditions (in rural areas) or when there are hidden costs (leaving one's family and country to accept a job overseas).

Third, some results confirm the respective roles of nature and nurture as pull factors attracting people away from rural areas. The greater preference for rural posts of male compared to female South African nurses reported in the current study is consistent with literature from developed countries on other cadres (Brooks et al., 2002, Chopra et al., 2008, Wilson et al., 2009a) . The impact of having a rural background on preference for working in rural areas is also supported by a number of studies (Brooks et al., 2002, Laven and Wilkinson, 2003, Lea and Cruickshank, 2005, Matsumoto et al., 2005), including one about South African medical students (De Vries and Reid, 2003). Location and type of training received are also shown in the literature to influence preferences for rural sector jobs. (Laven and Wilkinson, 2003, Wibulpolprasert and Pengpaiboon, 2003, Matsumoto et al., 2005, Chopra et al., 2008). The role of curriculum content, which has also been shown to influence preferences for job location (Brooks et al., 2002), is confirmed to some extent here by the negative impact of universities as training centres. However, this could also hide a "nature" effect, as university students are usually better-off than nursing college students. A wealthier background has been shown to be negatively correlated with willingness to work in rural areas in a developing setting (Zaidi, 1986). Some of the results obtained are surprising and should be investigated more. In particular the interest of younger nurses in rural posts is relatively unexpected.

Fourth, since this study is the first to try to quantify the relative attractiveness of overseas compared to domestic jobs for health workers, it is difficult to compare it to other studies. Nonetheless, the weight respondents attached to the lack of recognition they might experience overseas is consistent with high levels of distress reported by some nurses working overseas (Taylor, 2005, Likupe, 2006, Obrey et al., 2006, Leroi, 2007). Furthermore, some of these results relating to preferences for positions overseas echo the literature on emigration decisions. The

[76] Results presented earlier in this chapter suggested that R 1,000 in a rural public sector job was equivalent to R810 in an urban public sector post and to R870 in the private sector (see Table 6.9).

lower valuation of salaries in overseas positions is consistent with the theoretical models of emigration decisions (Borjas, 2005): to make the decision to leave one's country, the expected marginal gain from emigration should be greater than the sum of the costs incurred in emigrating, such as the cost of re-locating, higher living costs and/or the pain of separation from family. The discrete choice results showed that individuals expected higher salaries in overseas positions, which can be interpreted as a willingness to be compensated for all the costs incurred through emigration. The results also indicated that young, white workers are more likely to emigrate from South Africa (Xaba and Phillips, 2001, Oosthuizen, 2005). This can be explained by the fact that the costs they face are less significant – they often already have relatives overseas, and/or they don't have partners and children to relocate with them. Unfortunately it was not possible to test that assumption in the analysis as no information on the presence of friends or family overseas was available about respondents.

Whilst the results obtained on individual preferences for emigration are consistent with the literature, the predicted uptake of nursing positions overseas (about 10%) is at odds with the estimated emigration flows of nurses of between 1-2% per year, despite the fact that this baseline simulation was done under the assumption that nurses are expecting difficult situation where their professional status might not be recognised. This contradiction begs the question of the capacity of DCEs to provide an adequate framework to assess preferences, when all the consequences of a choice are not clearly specified. Whilst it might be tempting to choose 'on paper' a lucrative offer overseas, in reality the administrative and emotional difficulties associated with leaving one's country (which were implied in the DCE, but not clearly stated) would prevent an individual's actual departure. Another possible explanation for the discrepancy between our findings and the emigration statistics is that the DCE measures the potential supply of nurses for overseas jobs under perfect market conditions, but international labour market imperfections result in a number of barriers that reduce the actual supply. In particular, in contrast to the DCE where information regarding the overseas position is readily available, in reality nurses lack information about overseas positions and/or face costs associated with the job search. Nurses also have limited international mobility due to administrative barriers to entry into certain national labour markets, whereas the DCE did not refer to such barriers, implying their absence.

Finally, this research also contributes to the economic literature on altruism, through the empirical investigation of its role in (stated) job preferences. Despite the lack of significance of experimental measures of altruism, the results indicated that pro-social attitudes, measured with survey questions, are correlated with distinct job preferences. In particular, more selfless and pro-poor values are correlated with a preference for public sector jobs, while more conservative and individualistic societal views are associated with a preference for private jobs. This is in line with the literature on 'public service motivation' which has shown a correlation between such other-regarding disposition and public service ethos (Rainey, 1982, Perry and Wise, 1990, Perry, 1996, Wright, 2001, Buurman et al., 2009, Perry et al., 2009). This research takes the existing literature one step further by highlighting that, everything else being equal, a concern for the poorest members of society will result in a greater willingness to work in the public sector positions, preferentially benefitting the poorest (in the present case posts in rural areas, where nurses generally provide services to more disadvantaged populations than they do in urban settings).

6.5.3. Limitations

The validity of the results may be limited by several biases arising from issues in the design of the choice experiment and its administration, as well as unanswered questions about the validity of DCEs in general.

First, the absence of an opt-out option in the choice experiment precluded participants from expressing a preference for other professional career paths. Indeed, although it seems that the majority of graduating nurses start their career as a nurse, some might actually turn to research or education (in particular when coming from universities). As a result, the simulated market shares of the different jobs might have been mis-estimated, although it is difficult to assess either the direction or the size of the potential biases. However, the opt-out option was ruled out on the grounds that a non-nursing career would actually only concern a tiny minority at this stage of their career, which gives us good reason to believe the bias, if any, would be minimal. Besides, including an opt-out option would have increased the cognitive difficulty of the task and might have driven some respondents to choose the "easy" way out (i.e. opting-out) to avoid making a difficult (or tiresome) choice (Ryan and Skåtun, 2004).

Second, two particularities in the data collection process might have led to possible biases.

First, too many 'block 1' questionnaires were initially administered, and additional 'block 2' questionnaires had to be administered by email or at the end of a lecture. Fundamental differences between the two rounds in the context in which the task was administered (with/without privacy and explanations; time available to complete the questionnaire, etc.) might well have influenced the way people responded to the task. Studies in behavioural economics and psychology have shown how differences in contexts can have an influence on individual decisions (Kahneman, 2003).

Second, the choice experiment described in this chapter was administered immediately after another choice experiment (presented in the next chapter). The first DCE presented to respondents was purposefully designed to make rural positions more attractive than they currently are. Therefore, there is a risk that this first DCE might have created some positive pre-conceptions about rural posts, leading respondents to rank them higher than they would otherwise have in the current DCE. Unfortunately it was not possible to measure the effects of either one of these issues. In the first case the 'administration' effect was confounded with the 'block' effect. Furthermore, because the design was blocked, it was not possible to infer preferences from the choice sets of one block in isolation from the choice sets in the second block, neither was it possible to compare answers provided by the same individual to the choice sets in each of the blocks. Concerning the second issue, it was not possible to determine the extent of any potential ordering effect, as the order of the two choice experiments was not varied during data collection. However, the differences in the formatting and framing of the two tasks reduce the likelihood of such an ordering effect to have occurred.

Third, the additional complexity of ranking compared to choosing the preferred option may have affected respondent ability to accurately complete the task, thereby violating the statistical assumptions inherent in the models used. Respondents may have successfully chosen their preferred option, but may have failed to dedicate enough attention to lower ranks. Indeed, some studies in the literature have shown that lower rankings may provide less reliable preferences (Chapman and Staelin, 1982, Hausman and Ruud, 1987, Bradley and Daly, 1994). To test whether the use of the full ranking was appropriate here, four model specifications were estimated with variations in the number of ranks included[77]. This was in line with some studies which suggested that computing results obtained from fewer ranks would generate possibly less efficient but equally consistent estimators (Ben-Akiva et al., 1992, Bradley and Daly, 1994). Equally, because the violations commonly occur in the responses given for middle ranks, it is possible to use only the information provided by the extreme ranks (in the present case, the 1st and 4th ones). This additional analysis showed that the higher the number of alternatives/ranks included in the model the lower the standard errors around the parameter estimates (Appendix 6.9). This reflects the increased statistical efficiency obtained by the use of more information to estimate the parameters. At the same time, the more ranks included in the analysis, the greater the log-likelihood of the model, suggesting that more ranks are associated with an increased amount of unexplained variance (i.e. people not knowing how to rank all alternatives). However, the good performance of the model using only extreme choices (see Appendix 6.9) also suggests

[77] Complete ranking, only the first choice, only the first two choices, using the first and fourth choices.

that individuals have stronger views about extreme choices. Finally and most importantly, the results presented in this chapter are robust to these different specifications. Overall, these results lend credibility to the full ranking given by respondents.

Fourth, the cognitive complexity of the task may have introduced biases. The DCE presented here is one of the few choice experiments in the field of health economics to propose as many as four alternatives in each choice set to respondents, and each alternative comprised five attributes. Not only was this a demanding task, but it also took place towards the end of a long session of filling in questionnaires and making choices[78]. Therefore, this increased the cognitive burden and a fatigue effect might have accentuated some of the possible caveats commonly associated with DCEs. For example, some have suggested that respondents may in fact be using simple decision heuristics to choose rather than trading between attributes (Scott, 2002). This might have been aggravated by the presence of labels and the framing of the job descriptions as adverts. For example, the systematic formatting of each type of job with a designated font size and style (see Figure 6.1) could have resulted in some people's choice making being influenced by the appearance of the job advert.

Finally, because they rely on responses given about hypothetical scenarios, DCEs might suffer from hypothetical biases and mis-represent individual preferences. This relates to the main criticism addressed to stated preference techniques, where individuals virtual decisions, with no real consequence. This problem has been particularly recognised in the contingent valuation literature, where there the lack of financial implications of answers often led to over-estimating willingness-to-pay[79]. Because DCEs more closely mirror actual choices and real situations, they are often thought to be less prone to hypothetical biases. However, the external validity of DCEs, defined as their ability to predict real choices (or revealed preferences) remains under-researched. The majority of studies that have explored the "external validity" of stated preference methods, including choice experiments, come from transport economics and marketing. Louviere (1988) describes several studies where the predictions of DCEs (brand market shares, individual choice predictions) are well correlated with actual measures or revealed preferences. However, it is not obvious that these results carry over into DCEs done in health economics, where similar work is still missing (Ryan and Gerard, 2003, Ryan et al., 2008). Most of the DCE sceptics underline the hypothetical bias that is likely to arise from choice experiments: because the

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[78] This choice experiment was the fourth task respondents had to undertake. It was administrated about an hour and 15 minutes after the beginning of the interview, following two experimental economic games and another DCE (presented in the next chapter).

[79] As Harrison and Rutström (2008) put it: "*As a matter of logic, if you do not have to pay for the good but a higher verbal willingness to pay response increases the chance of its provision, then verbalize away to increase your expected utility*!"

scenarios are fictitious, people will not pay attention as much as they would do in a real situation. This bias might be even more problematic in situations where respondents are not familiar with the scenarios presented. However, because choosing between job offers is relatively natural, this bias might be less problematic in DCEs eliciting job preferences compared to DCEs eliciting preferences for different health states. To limit the hypothetical bias even further in the DCE presented here, a real effort was made to frame the task in a very realistic way. Although this was certainly better achieved in this choice experiment than in any other job DCEs of this nascent literature, doubts subsist concerning the external validity of the tool.

These caveats highlight the caution required when interpreting the results and particularly when drawing policy recommendations.

6.5.4. Implications for policy and research

A. Implications for policy

The findings presented in this chapter have some direct implications for three major health policy concerns in South Africa: the loss of nurses to emigration, the lack of nurses in the public sector in general and the shortage of nurses in rural areas in particular.
First, the results of the DCE point to a number of concrete policy measures that could be taken to tackle the acute issue of health worker emigration. Their lack of status in overseas positions deterred nurses from choosing these positions in the DCE. Yet, very often the image emigration candidates have in mind is an idealised work environment conveyed by international recruitment agencies. Allowing returning nurses to share publically the challenges encountered when working overseas and allowing these stories to resonate through the media as much as the more idealistic portrayals of overseas work could help curb the enthusiasm of South African nurses for overseas jobs and positions.

Second, the results of the DCE indicate possible strategies for the recruitment of nurses into the public sector. The findings emphasised that improved working conditions could increase the willingness of nurses to take up such posts. The DCE found that nurses wanted to be compensated by an additional R25,500 to take up a position in rural areas with regular shortages of drugs or medical material, and they would require R6,600 more every year to work in hospitals in rural areas. Beyond the job characteristics, the analysis showed that students from universities were less likely to choose the public sector. This result could be explained by a selection bias of university students, who probably come from better-off and more educated families, which could explain higher salary expectations or different career expectations. This result could also mean that some aspects of the training approach (the content of the curriculum or the nature of practical exposure) might shape job preferences and expectations. A final important result exposed here was the link between pro-social norms and public sector motivation. To capitalise on this, individuals demonstrating such pro-social norms during the selection process (for example during an interview) could be particularly encouraged or sponsored to undertake training. Alternatively, nursing training could attempt to cultivate and reinforce these values within the nursing culture, through mentoring arrangements for example.

Finally, the DCE has highlighted that a number of individual and training characteristics are associated with a greater willingness to choose to work in rural areas. These findings can serve as a basis for designing policies to attract more nurses to rural areas. The preference for rural sector posts of those born in rural areas is particularly significant. This indicates the value of offering scholarships to students originating from rural areas, or reserving quotas for them, as has been implemented already in some countries (see Table 2.3). The greater preference of nursing college students for rural posts than university students suggests that the increased production of nurses should emanate from nursing colleges rather than universities. The training capacity of these institutes should therefore be strengthened. Finally, locating nursing colleges in rural areas will increase nursing graduate willingness to work in rural areas, as has also been evidenced in other countries, such as Thailand (Wibulpolprasert and Pengpaiboon, 2003).

B. Implications for research

The study presented here has shown how DCEs can be used to better understand the job preferences of health workers, as well as try to predict their deployment in the labour market. As such, these methods could allow researchers to investigate labour market issues in developing country settings where alternative datasets (such as labour market surveys or longitudinal datasets providing detailed information on career paths) are scarce or non-existent. Moreover, this research suggests that greater use could be made of labelled experiments in the analysis of labour market issues. These designs indeed provide more flexibility and scope to address some of the reputational effects that characterise different types of employment.

Furthermore, as noted before, one of the unanswered questions about DCEs is their capacity to predict actual preferences (Ryan and Gerard, 2003, Fiebig et al., 2005, Ryan et al., 2008). Yet, if DCE outputs are to inform health policies, it is essential to know whether they can predict actual choices made by individuals. Comparisons between stated and revealed preferences have been done in transport economics or marketing (Louviere, 1988). One of the reasons why this has not been done in the health economics literature is the greater difficulty to observe the revealed preferences corresponding to the choices presented in the DCEs. Indeed, DCEs in health care have often been used to value non-marketed goods or services, whose demand, by definition, cannot be observed. However, in their application to labour markets, there are more opportunities to compare revealed and stated preferences. The DCE presented in this chapter is particularly fit for this purpose, as the objective of the design was to try and reproduce some of the main opportunities offered to nurses in the labour market. The project within which the current DCE is embedded will provide an opportunity to do so, by following up nurses over time and gathering information on their actual career choices.

6.6. Conclusion

Initially, this thesis highlighted the theoretical role of concern for others on individual behaviour. Having measured altruism and pro-social concerns amongst nurses (Chapter 4), the present chapter set out to explore their role on the job preferences expressed by South African nurses, as well as to understand the role of other individual characteristics. The chapter has revealed a series of interesting and useful findings in order to address some of the key HR issues in South Africa.

However, because the tools used were not specifically designed to assess the potential effectiveness of policy levers, the policy implications may seem quite general. The next chapter aims to provide further insight into the likely effects of various policy options to address the shortage of nurses in rural areas.

Chapter 7 - Effects of policy interventions to attract nurses to rural areas

7.1. Introduction

Although available data do not allow breakdown by rural and urban areas, the disparities between the different provinces in South Africa provides indirect evidence of the rural/urban imbalance in the distribution of nurses. For example, while Western Cape and Gauteng have a nurse-to-population ratio of 123.4 and 111.7 per 100,000 population respectively, the more rural province of North-West only has 81.1 nurses per 100,000 (see Appendix 4.3).

As noted in Chapter 4, redressing the imbalance in the geographic distribution of health workers has been a priority for the National Department of Health since the end of Apartheid (De Vries and Reid, 2003). In recent years, health policy initiatives have included the recruitment of foreign doctors to rural posts (Kotzee and Couper, 2006), the creation of incentives for national health workers including rural allowances representing 10% monthly salary and finally, the introduction of mandatory community service for nurses (De Vries and Reid, 2003, Gilson and Erasmus, 2005).

Whilst there has not been any systematic evidence collected as to these policies' effects, large geographical inequalities in the distribution of staff have persisted. Therefore, finding a way to address this issue is still key to ensuring equitable access to health services. Beyond the identification of different policy levers that could be used to attract nurses to rural areas, there are theoretical and empirical reasons (see respectively Chapters 2 and 6) to believe that there might be heterogeneity in preferences between individuals. This is important to explore, as it could mean that some individuals are naturally more inclined to choose rural areas, and need less strong incentives to accept a job there. Therefore, selecting these individuals into the nursing profession (i.e. "upstream measure) is another strategy that can be adopted.

This chapter aims to study the effectiveness of various potential policy options that could be designed to alter the geographic distribution of nurses in the public sector in South Africa. The chapter builds upon stated preference data from a discrete choice experiment designed to reflect possible policy scenarios, and builds a Markov model to model the distribution of nurses on the South African labour market and to predict the effects, in the long run of various policy options. In terms of empirical approach, the use of stated preferences is justified in two ways. First, there is no data allowing the evaluation of existing interventions. Second, stated preferences give the possibility to introduce hypothetical interventions.

7.2. Data and methods used

This section briefly presents the stated preference methods used to predict the effects of policy interventions. It will start by highlighting some of the study context under which these methods were developed. The presentation of the methods themselves, as well as the econometric tools used for their analysis will be relatively brief, as detailed discussion of those issues were already presented in Chapter 5.

7.2.1. Context of the study

Unlike the model presented in Chapter 5, the Discrete Choice Experiment (DCE) choice experiment presented here was developed in collaboration with others for purposes other than for this thesis (see Table 3.2 for a presentation of my role in the development of the tool). One of the objectives of this project was to use similar methodologies in the three countries involved in the project (South Africa, Kenya and Thailand), for the purposes of comparative analysis. This translated into a common design for a DCE with similar attributes and levels. Although the objective of this work is not to provide an account of the constraints and objectives of this other project, the presentation of the main design characteristics of the choice experiment in this section will sometimes need refer to them.

7.2.2. Design of the choice experiment

A. <u>A labelled discrete choice experiment</u>

One of the objectives of the 'cohort study' project was to help policy-makers craft policies that would improve the uptake of rural positions, in the public sector (Blaauw et al., 2007). Stated preference methods were used to allow the researchers in each country to introduce some policy options that were not yet available, but viewed as possibly relevant and effective.

In addition, it was decided to utilise a labelled choice experiment for the following reasons (for a more in-depth discussions of similar motives, please refer to the previous chapter):

- The labelled experiment allowed researchers to introduce alternative-specific attributes and levels, thereby providing a flexible framework to develop specific policy packages for rural areas. Because the objective would be to develop policies specifically crafted for attracting nurses to rural positions, some attributes and/or levels would only be relevant to rural positions.

- It was assumed that individuals would have different valuation of the same attributes across alternatives. For example, it was hypothesised that clinics in urban areas would be valued in a different manner as clinics in rural areas.
- The labelled experiment enabled the calculation of market shares of the available job options, under different simulated conditions. In a generic experiment, the probability of choosing a particular job can be simulated, but one cannot at the same time define what the other job alternative would be.

Moreover, it was decided that respondents would be asked to choose between a rural and an urban job, both in the public sector. Restricting the job choices to public positions only was made for several over-lapping reasons:

- The importance of other job market options varied a lot from one country to another, so that no compromise was ever found acceptable. For example, in Thailand, virtually all beginning nurses work in the public sector, with the private sector not being a very realistic option in most areas. In addition, an "overseas" label would only have made sense for South African respondents.
- Although it could have increased its market realism in some countries, including other options would have added too much complexity to the design of the choice experiment. Indeed, for a given number of task choices done by each respondent (for example 16), adding one additional label (e.g. a "private position") would have decreased the number of policy scenarios to be tested for rural jobs. Alternatively, a blocked design could have been used, but budget constraints prevented the possibility of using a bigger sample size.
- In the end, it was agreed that the choice experiment would rely on the assumption that it would reflect the choices made by nurses, who would have chosen the public sector. Furthermore, the rural and urban labels were then chosen because of their policy relevance in all three countries, where there is an imbalance in nurse distribution and where the primary health policy objective is to make rural positions more attractive.

Finally, an opt-out option was discounted for several reasons:

- For fear that respondents would choose that option out of fatigue or boredom, more than because neither option would appeal to them (see discussion in the previous chapter);

- Because in one country (Kenya) there is an over-supply of nurses compared to the shortfall of positions in the public sector, so that any available position would be accepted by nurses there, hence the "neither" option was not felt to be relevant;
- Given that the choice experiments would at least represent the current conditions in the public sector (and some improvements), it was argued that the choice experiment was meant to represent the potential trade-offs that a nurse who would have decided to work in the public sector could then make.

B. Definition of attributes and levels

The DCE design involved several steps. The literature review from developed and developing countries presented in section 2.5 allowed the project team to draw a list of possible policies that had been used in other settings to influence employment preferences. These possibilities were then discussed in each country with policy-makers and key stake-holders to assess their feasibility and desirability in each context. Finally, FGDs took place in Baragwanath Nursing College in Johannesburg where nurses were asked to comment on possible ways that the government could improve the attractiveness of rural positions. The objective of the FGDs was to inform the perceived relevance and opportunity of the list of policies envisaged, as well as to understand what wording would be most appropriate for the nurses.

The final DCE also partly reflected the compromises made to accommodate the need for a unique design across the three countries for the project. For example, although it would have been meaningful to add an attribute on working conditions in Kenya and South Africa (e.g. lack of equipment and drug supply, which is usually cited as one of the key disincentives for rural positions in those countries), it was excluded because 1) it was not relevant for Thailand and 2) it was decided to focus only (if possible) on attributes that would be actionable HR policy levers. For South Africa, the following seven attributes were retained (see Table 7.1 below for a quick summary):

- The type of facility, either a hospital or a clinic. This was kept in all countries, and was deemed a determinant job characteristic.
- The salary offered, which presented four levels: basic salary (for urban and rural positions), and a rural allowance of 10%, 20% or 30% of the basic salary.
- The number of years nurses would have to work at the describe post before getting study leave to specialise. What was agreed to be the current state of practice (six years) was opposed to a better situation (two years) in rural areas.

- Subsidised housing available with the position offered. In urban positions, there was either nothing or just a flat shared with someone else. In rural areas, the two levels were either the shared flat or a self-contained two-bedroom house.
- The time nurses would have to spend in the position offered before they could be promoted. In South Africa, the rule is that nurses move up the salary scale every two years. This was the base level, and a better one was proposed with a promotion obtained only after one year.
- Some jobs in rural areas also included a monthly car allowance which is a perk not usually available to professional nurses (so far only doctors are eligible for it). This was meant to capture a financial benefit, to which a particular symbolic value would be associated (i.e. a better status).
- The organisational culture and management style in the facility. This attribute was chosen to reflect findings from a number of studies showing that health workers were more likely to be attracted by and remain in a position where the management is supportive. The common situation in South Africa would be a management that is more formal and emphasize rules.

The full factorial design of the experiment produced $2^{11} \times 4^{1} = 8{,}192$ possible profiles. The use of the SAS macros to produce a fractional factorial design with 16 profiles ensured an orthogonal design maximising D-efficiency (Street et al., 2005). This design assumed that the interaction effects between attributes were not significant (main effects design). Four versions of the questionnaires were produced and randomly allocated to respondents, to avoid order effects of the questions. As shown in the example of the questionnaire below, the framing of this questionnaire was very neutral.

Table 7.1: Attributes and levels of the 'policy' discrete choice experiment

ATTRIBUTES	LEVELS	
	RURAL POSITION	URBAN POSITION
Type of facility	1. Clinic 2. Hospital	1. Clinic 2. Hospital
Annual salary	1. R120,000 / year 2. R120,000 + an additional R12,000 /year 3. R120,000 + an additional R24,000 / year 4. R120,000 + an additional R36,000 / year	1. R120,000 /year
Provision of subsidised housing	1. Basic: single room with a shared kitchen and shared toilet. 2. Superior: small two bedroom house for you and your family.	1. None 2. Basic: single room with a shared kitchen and shared toilet.
Time to wait before getting study leave to specialise	1. Normal: 6 years 2. Improved: 2 years	1. Normal: 6 years
Car Allowance	1. None 2. R500 per month	1. None
Number of years to be spent in the facility until being eligible for promotion	1. Normal: 2 years 2. Improved: 1 year	1. Normal: 2 years 2. Improved: 1 year
Workplace management and culture	1. Hierarchical: this facility is formal and structured. The managers emphasise stability, following rules, and keeping things running smoothly. 2. Relational: this facility is personal and supportive. The managers emphasise teamwork, loyalty, and developing the full potential of staff.	1. Hierarchical: this facility is formal and structured. The managers emphasise stability, following rules, and keeping things running smoothly. 2. Relational: this facility is personal and supportive. The managers emphasise teamwork, loyalty, and developing the full potential of staff.

The introduction to the questionnaire used during the data collection can be found in Appendix 7.1. These instructions emphasised that respondents were to imagine that they were about to enter the job market and choose a position in the public sector.

Figure 7.1: Example of a question posed to respondents in the choice experiment

Question 1 : Which of these two public sector facilities would you choose to work in?

	RURAL Facility	URBAN Facility
Type of facility	Clinic	Hospital
Monthly salary	R120,000 per year	R120,000 per year
Rural allowance	An additional R12,000 per year	None
The number of years you would have to work before getting study leave to specialise	2 years	2 years
The housing provided	You can choose to stay in the subsidised accommodation provided which is a single room with a shared kitchen and shared toilet.	None
The number of years you would have to work before being eligible for promotion	2 years	2 years
The car allowance offered	None	None
The workplace culture and style of management	This facility is formal and structured. The managers emphasise stability, following rules, and keeping things running smoothly.	This facility is personal and supportive. The managers emphasise teamwork, loyalty, and developing the full potential of staff.
Which facility would you choose?	Rural Facility ☐	Urban Facility ☐

7.2.3. Analysis of the choice experiment

This section presents the methods used to analyse the data obtained from the choice experiment.

A. Description of the Random Parameter Model

To analyse this binary choice experiment it was decided to use a Mixed Logit or Random Parameter model. This model controls for serial correlation between the choices made by respondents. This feature was shown to be important in the estimation of better (unbiased) results in terms of overall fit and welfare estimates (Carlsson et al., 2003, Lusk et al., 2003, Morey and Rossmann, 2003). The RPL model also allows for heterogeneity in tastes in various ways (Layton and Brown, 1998, Greene et al., 2006). In an RPL model, there are two sources of heterogeneity. The first one is random unobserved heterogeneity, which is captured by the random parameters. In a MNL model, the utility that individual j receives from the choice S in choice set N defined by L attributes is defined as follows:

$$U_{jsn} = \alpha_{jn} + \beta^A X^A_{jsn} + \ ... + \beta^L X^L_{jsn} + Z_j + \ e_{jsn}$$

Instead of estimating a single parameter β^A at the population level representing the impact of attribute A on the utility, the RPL model allows for individual heterogeneity, and estimation of individual parameters β^A_j:

$$\beta^A_{jk} = \beta^A_k + \ \sigma_k \upsilon_{jk}$$

Where β^A_k is the population mean and υ_{jk} is the source of individual heterogeneity – that is a random variable following an *a priori* defined distribution with mean 0 and standard deviation 1. Finally σ_k is the standard deviation of the distribution of β_{jk} around the population mean β_k. This means that if σ_k is not significant, there are homogenous preferences in the population.

The second source of heterogeneity in a RPL is conditional on respondents' characteristics. It can be included in two ways in a model:

- Through interaction terms, as in a traditional conditional logit model. Interaction terms are created between respondents' social, demographic and attitudinal characteristics and one of the alternative (here the constant term for rural jobs) to estimate general preferences for these jobs.
- Through heterogeneity in the mean of the distribution of random parameters, by introducing an additional term that is conditional on individual characteristics.

Formally, this means in the former example:

$$\beta^A_{jk} = \beta^A_k + \delta^A_k Z_j + \ \sigma_k \upsilon_{jk}$$

where Z_i: are observed individual characteristics.

Due to the complexity of its specification, the interpretation of model estimates is not straightforward (Greene, 2007). Indeed, the RPL model aims to identify the parameters of the distributions from which the individual-specific parameters are drawn – the model identifies β_k δ_k and σ_k. Yet, it is essential to examine the distribution of $(\hat{\beta}_{jk}^{A} |\, Z_j, \upsilon_{jk})$ across all observations in the sample (Greene, 2007). To do that, Greene suggests computing the average of the conditional individual means $E(\hat{\beta}_{jk}^{A} |\, Z_j, \upsilon_{jk})$, as an approximation of the population mean effect of attribute A. It is also possible to compute the variance of the population estimates as follows (Greene, 2007):

$$V(\hat{\beta}_{jk}^{A} |\, Z_j, \upsilon_{jk}) = E\left[V\left(\hat{\beta}_{jk}^{A} |\,\right)\right] + V\left(\hat{\beta}_{jk}^{A} |\right)$$

which is the average of the conditional variance plus the variance of the conditional means.

Finally it is possible to examine the distribution of conditional means with a kernel density estimator. In the results, this is done across different population groups to illustrate the significant differences found.

B. Definition of the random parameters

There are two main issues with the specification of an RPL model:

- Which parameters should have a random distribution?
- What is the underlying distribution that those specified random parameters should follow?

Here, as the objective was to provide good estimates of policy intervention effects and understand the heterogeneity in sensitivity to these incentives, only attribute parameters for rural jobs were potential candidates to be random parameters. It was also decided to investigate only the heterogeneity in sensitivity to policy incentives that 1) was found initially significant for the whole sample and 2) was easily actionable. The first criterion excluded the promotion coefficient which was not significant, and the second criterion excluded the management and facility variables. Therefore the parameters that were set random are salary (the three levels), car allowance, housing and training.

The problem associated with the *ex ante* selection of the coefficient distributions' functional forms have been highlighted in the literature. The random parameters can follow a number of pre-defined functional forms (Hensher et al., 2005, Train and Sonnier, 2005): normal, lognormal, triangular, Weibull, gamma, beta, uniform, dome, etc. So far, researchers have favoured the normal distribution for random terms, while problems with the use of normal distributions regarding the potential length and sign of the tails of the distribution of willingness-to-pay estimates have motivated some researchers to try to use bounded distributions, such as the triangle distribution or the log-normal ones (Balcombe et al., 2009). However, the latter have also been criticized, particularly in regards to their interpretation (Greene, 2007).

Several distribution specifications were tested here. Log-normal distributions were used for the salaries, and triangle distributions were used for all coefficients. Since the choice of distributions did not modify the results obtained, normal distributions were eventually chosen due to the ease of interpretation and computation of population-level coefficients (Greene, 2007).

C. Model specification

In the present case, the RPL model was used to investigate whether the impact of different policy packages varies across individuals and in particular whether the policy effects were affected by pro-social attitudes (altruism) and rural backgrounds.

Table 7.2: Effects associated with independent variables

Variable	Expected sign	
	Rural	Urban
Job characteristics		
Higher salary	+	+
Clinic [hospital]	+	+
Waiting longer for promotion	-	-
Informal type of Management	?	?
Better housing	+	+
Car allowance	+	+
Waiting longer for study leave	-	-
Socio-Demographic characteristics		
Male	+	n/a
White	-	n/a
Young (<25 y.)	?	n/a
Born in rural areas	+	n/a
Training characteristics		
Trained in university	-	n/a
Trained in NW province	+	n/a
Attitudinal variables and individual values		
DG student	?	n/a
DG patient	+	n/a
DG poor	+	n/a
Rural lifestyle score	+	n/a
Conservative attitude	-	n/a
Pro 'Welfare state' attitude	+	n/a
Pro-poor attitude	+	n/a

n/a: not applicable (the urban category is the reference category in the regression)

All quantitative job attributes (car allowance, years to wait until promotion or study leave) were kept quantitative (see Appendix 7.2). A notable exception was the salary variable, which was dummy-coded to investigate non-linear effects. The model was augmented by individual-level characteristics, as used in the analysis of labour market preferences (see Table 6.4). Attitudinal variables and experimental measures of social preferences were also included in the models. As in the previous chapters, to avoid problems of collinearity between survey and experimental variables capturing similar constructs, two models were estimated separately.

The models included all the main attributes and several interaction terms that multiplied each alternative-specific job characteristic with each variable of interest (see Table 7.2). For example, the interaction terms between the rural label and gender measures the extent to which the preference for rural jobs depends on gender.

The RPL model was estimated using NLOGIT 4.0. Distribution simulations were based on 100 Halton draws[80].

D. Predicting the uptake of rural positions

Based on the parameter estimates obtained from the RPL model, it is possible to simulate the market shares predicted by the model for the alternatives. For example the predicted market share, or proportion of nurses who would take up a rural position, is predicted by the model as follows:

$$S_{r1} = N \times \sum_{i=1}^{N} \hat{P}_{ir1}$$

Where $\hat{P}_{ir}$ is the probability that individual *i* will choose a particular rural job (r_1) vs. a given urban job (u_1), based on the utilities derived from job r_1 and u_1.

What matters in the present analysis is the effect of various policy packages, compared to the current situation. Therefore, market shares are initially calculated for the circumstances that reflect current conditions both for urban and rural jobs (the base scenario, see below) and then compared to predicted shares calculated for a number of policy scenarios. The base scenario reflects the current conditions of employment offered in the public sector in South Africa. This means a similar salary in urban and rural areas (R120,000/year), a similar average waiting time until nurses get promoted (two years in post), no car allowance, a basic housing opportunity

[80] This is recognised as being enough to provide robust estimates.

offered in rural areas but nothing offered in urban areas, the possibility to obtain study leave after six years in a post, and a hierarchical style of management.

Because there are 128 ways to combine the six policy levers[81] presented in the rural alternative of the choice experiments, it was decided to model the effects of only a sub-set of these. The following choices were made:

- Not to use "type of management" as a policy lever, as it appeared unclear what steps would have to be taken to enforce a change in management style;
- To simulate the effects of all single-incentive policies. In other words, the effect of each policy lever (except the management one) would be simulated separately;
- To simulate the effects of a few "thematic" policy packages that could be provided at different cost levels (as the cost-effectiveness of each policy package would later be computed – see Chapter 9).

The final job attribute to be defined in the simulations was the type of facility where the job is offered. The difficulty is that no particular level can be considered as reflecting the current situation more than the other, as there are jobs available both in clinics and hospitals, for urban and rural areas. Furthermore, because the type of facility is a significant attribute, it is not possible to ignore it either, setting its level to one particular type of facility (e.g. clinics). Making a particular decision about where the two job offers in the base scenario should be could potentially lead to particular results. For example, as it appears that clinics are increasing the utility associated with a job, if one job opportunity was situated in a hospital and the other in a clinic, the former would attract fewer nurses, all other job characteristics being equal. In fact, on the South African labour market, nurses would have to choose between all four types of offers: jobs in rural clinics, jobs in urban clinics, jobs in rural hospitals, jobs in urban hospitals. Although here the choice is only made between a pair of jobs, it is important to reflect this diversity. Therefore all four possible combinations of pairs of jobs[82] were used to simulate the effects of different policy scenarios.

[81] Salary (4 levels), car allowance (2 levels), training opportunities (2 levels), housing provision (2 levels), promotion paths (2 levels), type of management (2 levels).

[82] Rural clinic vs. urban clinic, rural clinic vs. urban hospital, rural hospital vs. urban clinic and rural hospital vs. urban hospital.

7.3. Results

7.3.1. Results from a random parameter model

Table 7.3 presents the results of the analysis of the choice experiment. Model I and model II differ in the way individual altruistic motives were incorporated in the analysis (through experimental measures in model I and survey measures in model II). Whilst model II appears a slightly better model (predicting correctly a greater number of observations), both sets of estimates are similar. All coefficients of the job characteristics are in the direction hypothesised in Table 7.2 which is a satisfying result with regard to the theoretical validity of the method. All job characteristics have a significant impact on the utility associated with a job in rural areas, except for two: being offered a promotion quicker does not seem to have an impact on a rural job's utility, while the type of management is barely significant in both specifications. Furthermore, the standard errors associated with the random coefficients of salary increases of 20% and 30%, car allowance and training opportunities are all highly significant, which means that individuals in the sample have different sensitivity to these incentives.

The salary coefficients also show a non-linear effect: the utility of a rural job is increased by 1.4 on average at the population level for a 10% increase in salary, by 2.1 for a 20% increase but only by 2.4 for a 30% increase in salary.

Interaction terms between individual characteristics and rural label show that people with rural background and positive attitudes towards rural areas are more likely to prefer rural jobs than others. Having trained in a more rural province (North-West rather than Gauteng) is also associated with a greater preference for rural jobs. However, all other individual characteristics in the model do not appear to have a significant impact on preferences for rural jobs. For instance, even a more altruistic nature (either measured by survey or experimental tools) does not correlate to a greater willingness to take up rural jobs.

Table 7.3: Random Parameter model estimates

Variable	Description	Model I			Model II		
		Coeff.	St. Error	p-value	Coeff.	St. Error	p-value
Rural job – determinants of job characteristics							
FIXED PARAMETERS							
Alternative-specific constant		**-2.349**	**0.326**	**0.000**	**-2.451**	**0.284**	**0.000**
Being posted in a clinic [hospital]		**0.320**	**0.081**	**0.000**	**0.295**	**0.083**	**0.000**
Time to wait for promotion (in years)		-0.104	0.082	0.206	-0.124	0.084	0.142
Relational management [rule-oriented management]		**0.160**	**0.077**	**0.038**	0.150	0.079	0.058
RANDOM PARAMETERS							
Salary increase by 10%	Population average effect	**1.427**	**0.238**	**0.000**	**1.449**	**0.153**	**0.000**
	Random parameter mean	***1.431***	***0.111***	***0.000***	***1.452***	***0.113***	***0.000***
	Random parameter standard deviation	*0.246*	*0.289*	*0.394*	*0.161*	*0.377*	*0.669*
Salary increase by 20%	Population average effect	**2.068**	**0.834**	**0.007**	**2.030**	**0.791**	**0.005**
	Random parameter mean	***2.090***	***0.138***	***0.000***	***2.072***	***0.140***	***0.000***
	Random parameter standard deviation	***0.782***	***0.182***	***0.000***	***0.742***	***0.191***	***0.000***
Salary increase by 30%	Population average effect	**2.386**	**0.597**	**0.000**	**2.388**	**0.546**	**0.000**
	Random parameter mean	***2.369***	***0.132***	***0.000***	***2.383***	***0.135***	***0.000***
	Random parameter standard deviation	***0.600***	***0.195***	***0.002***	***0.554***	***0.204***	***0.007***
Better housing	Population average effect	**0.391**	**0.070**	**0.000**	**0.408**	**0.037**	**0.000**
	Random parameter mean	***0.393***	***0.080***	***0.000***	***0.408***	***0.082***	***0.000***
	Random parameter standard deviation	*0.072*	*0.195*	*0.710*	*0.039*	*0.193*	*0.840*
Car allowance	Population average effect	**0.175**	**0.065**	**0.004**	**0.178**	**0.054**	**0.001**
	Random parameter mean	***0.175***	***0.015***	***0.000***	***0.178***	***0.015***	***0.000***
	Random parameter standard deviation	*0.071*	*0.028*	*0.011*	*0.060*	*0.031*	*0.052*
Time to wait to obtain study leave (in years)	Population average effect	**-0.416**	**0.237**	**0.040**	**-0.412**	**0.234**	**0.040**
	Random parameter mean	***-0.407***	***0.028***	***0.000***	***-0.411***	***0.028***	***0.000***
	Random parameter standard deviation	***0.330***	***0.021***	***0.000***	***0.330***	***0.021***	***0.000***

Rural job – Demographic, Education and attitudinal individual characteristics						
Male	0.077	0.188	0.683	-0.004	0.194	0.982
White	0.235	0.282	0.405	0.251	0.288	0.384
Young (<25 y.)	0.179	0.163	0.271	0.267	0.168	0.112
Born in rural area	0.514	0.147	0.001	0.538	0.152	0.000
Trained in university	-0.178	0.196	0.364	-0.262	0.200	0.190
Trained in NW province	**0.647**	**0.149**	**0.000**	**0.641**	**0.150**	**0.000**
Rural lifestyle score	**0.281**	**0.045**	**0.000**	**0.270**	**0.046**	**0.000**
Pro 'Welfare state' attitude				0.023	0.045	0.606
Pro-poor attitude				0.079	0.061	0.197
Conservative attitude				-0.064	0.049	0.190
DG Student	-0.355	0.346	0.305			
DG patient	0.460	0.406	0.257			
DG poor	-0.268	0.337	0.427			
Urban job – determinants of job characteristics						
Being posted in a clinic [hospital]	**0.361**	**0.080**	**0.000**	**0.346**	**0.082**	**0.000**
Provision of housing [no housing]	**0.472**	**0.085**	**0.000**	**0.489**	**0.087**	**0.000**
Time to wait to obtain study leave (in years)	**-0.446**	**0.022**	**0.000**	**-0.448**	**0.023**	**0.000**
Time to wait for promotion (in years)	**-0.310**	**0.079**	**0.000**	**-0.317**	**0.081**	**0.000**
Relational management [rule-oriented management]	**-0.427**	**0.082**	**0.000**	**-0.452**	**0.084**	**0.000**

Note: for dummy variable in job characteristics, the reference category is indicated in brackets.

Model I: LL=-2766.488 LL(null)= -4065.308 MacFadden's pseudo R^2=0.31 1s correctly predicted: 64.60%

Model II: LL= -2619.098; LL(null)= -3866.375; MacFadden's pseudo R^2= 0.32; 1s correctly predicted:64.76%

7.3.2. Exploring heterogeneity of tastes

To investigate further the source of heterogeneity detected by the random parameter distribution, another model was estimated to test whether rural backgrounds influenced the sensitivity to the various policy incentives (see Table 7.4). Other models were tested to see whether altruism had an influence, but as in models presented in Table 7.3, no other individual characteristics was found significant.

The model reveals that individuals from rural backgrounds have a different sensitivity to policy incentives compared to people from urban backgrounds. Indeed, the statistical significance of the rural background dummy in the mean of the random parameters means that the sensitivity if people from rural backgrounds to some rural job characteristics is different from that of individuals from urban backgrounds. More specifically, the results show that people who come from rural areas are significantly less sensitive[83] to a salary increase by 10% or 30%, to the possibility of obtaining a better accommodation or to obtain a car allowance. A graphic illustration of this variation in job preferences between rural and urban nursing graduates is shown clearly in the bimodal distribution of coefficients (beta) associated with an increase in salary by 10% and 30% (see Figure 7.2).

Otherwise, the results in Table 7.4 are very similar to model II in Table 7.3. The only notable difference is that male nursing graduates are found to be significantly more attracted by rural posts in Table 7.4. People with pro-social attitudes are still equally likely to prefer rural posts as people who are less concerned with others' well being. Another consistent finding comes from the role of rural background on the general preference for rural posts. Overall, people from rural backgrounds are more likely to choose a rural job than people from urban backgrounds (the interaction term of rural background with rural label is highly significant). Associated to the results on the lesser sensitivity to policy levers highlighted above, these results suggest that because people from rural backgrounds are naturally more inclined towards rural areas and thus, they require less incentive to be sent there. They also support a differentiated sub-group analysis for people with rural backgrounds and those with urban backgrounds (this analysis is presented in Appendix 7.3).

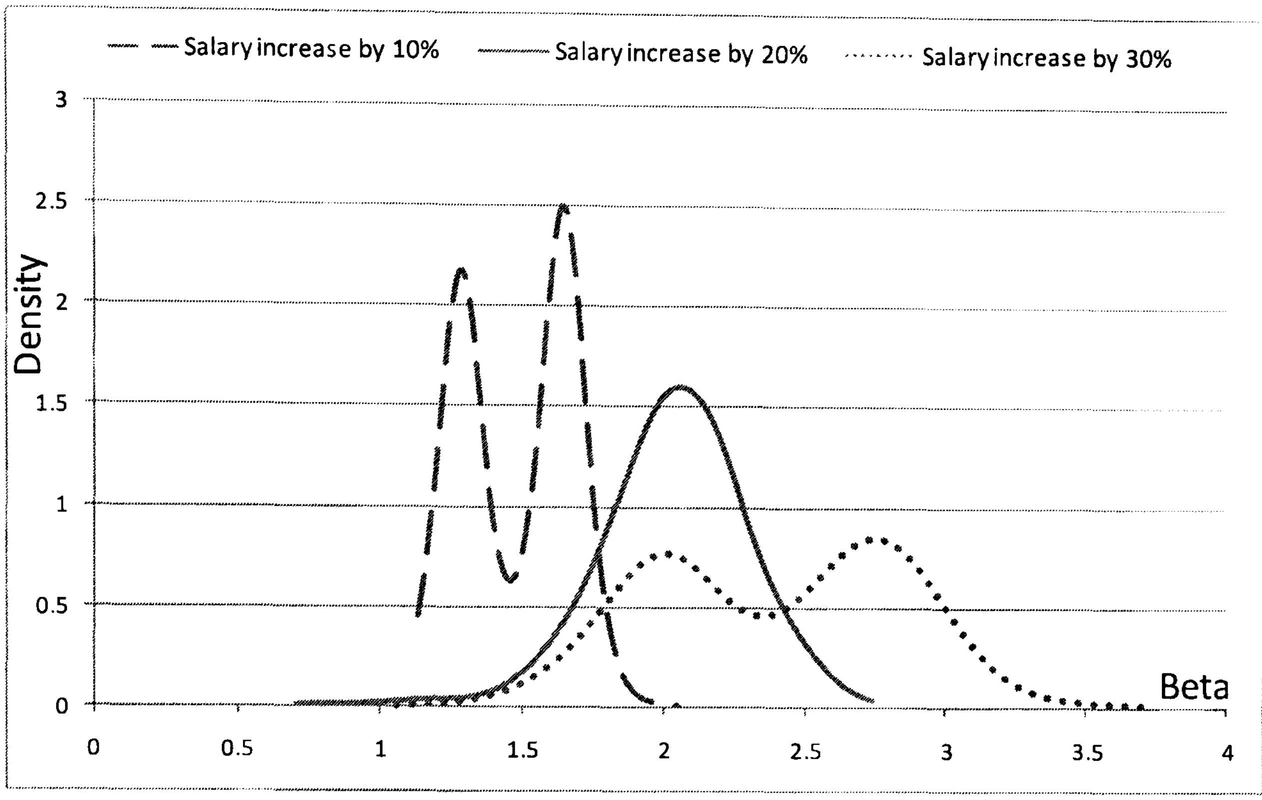
[83] The parameters associated with rural background in each of the random parameters are highly significant.

Table 7.4: Influence of rural background on the effects of policies – estimates from a random parameter logit model

Variable	Description	Coeff.	St. Error	P-value
Rural job –job characteristics				
FIXED PARAMETERS				
Alternative-specific constant		-2.823	0.309	0.000
Post in a clinic [hospital]		0.256	0.083	0.002
Time to wait for promotion (in years)		-0.106	0.084	0.206
Relational management [rule-oriented management]		0.170	0.079	0.032
RANDOM PARAMETERS				
Salary increase by 10%	Population average effect	1.477	0.172	0.000
	Random parameter mean	*1.647*	*0.151*	*0.000*
	Random parameter standard deviation	*0.146*	*0.348*	*0.674*
	Heterogeneity in mean - Being born in rural areas	*-0.786*	*0.227*	*0.001*
Salary increase by 20%	Population average effect	2.036	0.565	0.000
	Random parameter mean	*2.134*	*0.172*	*0.000*
	Random parameter standard deviation	*0.566*	*0.241*	*0.019*
	Heterogeneity in mean - Being born in rural areas	*-0.171*	*0.239*	*0.474*
Salary increase by 30%	Population average effect	2.398	0.616	0.000
	Random parameter mean	*2.765*	*0.175*	*0.000*
	Random parameter standard deviation	*0.475*	*0.219*	*0.030*
	Heterogeneity in mean - Being born in rural areas	*-0.786*	*0.227*	*0.001*
Provision of 2-bed house [shared flat]	Population average effect	0.407	0.235	0.042
	Random parameter mean	*0.607*	*0.108*	*0.000*
	Random parameter standard deviation	*0.197*	*0.179*	*0.273*
	Heterogeneity in mean - Being born in rural areas	*-0.438*	*0.157*	*0.005*
Car allowance	Population average effect	0.179	0.071	0.006
	Random parameter mean	*0.204*	*0.020*	*0.000*
	Random parameter standard deviation	*0.077*	*0.026*	*0.003*
	Heterogeneity in mean - Being born in rural areas	*-0.056*	*0.028*	*0.042*
Time to wait to obtain study leave (in years)	Population average effect	-0.413	0.233	0.038
	Random parameter mean	*-0.442*	*0.038*	*0.000*
	Random parameter standard deviation	*0.330*	*0.022*	*0.000*
	Heterogeneity in mean - Being born in rural areas	*0.047*	*0.053*	*0.383*
Rural job - Demographic, Education and attitudinal individual characteristics				
Rural job	Male	0.054	0.196	0.781
	White	0.427	0.293	0.145
	Young (<25 y.)	0.320	0.169	0.059
	Born in rural area	1.168	0.255	0.000
	Trained in university	-0.445	0.200	0.026
	Trained in NW province	0.649	0.151	0.000
	Rural lifestyle score	0.273	0.047	0.000
	Pro 'Welfare state' attitude	0.031	0.045	0.483
	Pro-poor attitude	0.090	0.061	0.138
	Conservative attitude	-0.054	0.049	0.273
Urban job – job characteristics				
Being posted in a clinic [hospital]		0.342	0.081	0.000
Provision of housing [no housing]		0.548	0.087	0.000
Time to wait to obtain study leave (in years)		-0.445	0.022	0.000
Time to wait for promotion (in years)		-0.342	0.082	0.000
Relational management [rule-oriented management]		-0.484	0.084	0.000

Note: for dummy variable in job characteristics, the reference category is indicated in brackets.
LL=-2618.83 LL(null)= --3866.37 ; χ^2=2495.084 ; MacFadden's pseudo R^2=0.32 ; 1s well predicted: 64.8%

Figure 7.2: Illustration of the heterogeneity in the distribution of random parameter estimates for salary increases (model R1)



7.3.3. Simulating policy effects

A. Policy effects on the sampled nursing population

To illustrate the effects of the different HR interventions, the relative uptake of rural and urban posts under different conditions was calculated. These distributions were calculated based using the results of model II presented in Table 7.3. The effects of different interventions were simulated by changing the job characteristics offered in posts in rural areas. The job scenario in urban areas was unchanged, and kept to what is thought to reflect the current situation (as detailed earlier). Table 7.5 presents the simulated average distribution of nurses between rural and urban jobs (the average being calculated across all four possible facility combinations, while Appendix 7.4 reports the complete results of the four series of simulations) in the base scenario and in simulated conditions mimicking different policy interventions. The base scenario corresponds to the most commonly found situation at the moment (equal salaries of R120,000/year in both urban and rural areas, promotion and study leave opportunities respectively within two and six years, hierarchical type of management, no housing in urban areas and possibility to have a room in a shared house in rural, no car allowance in rural areas).

Table 7.5: Simulated effects of different policy scenarios on rural job uptake

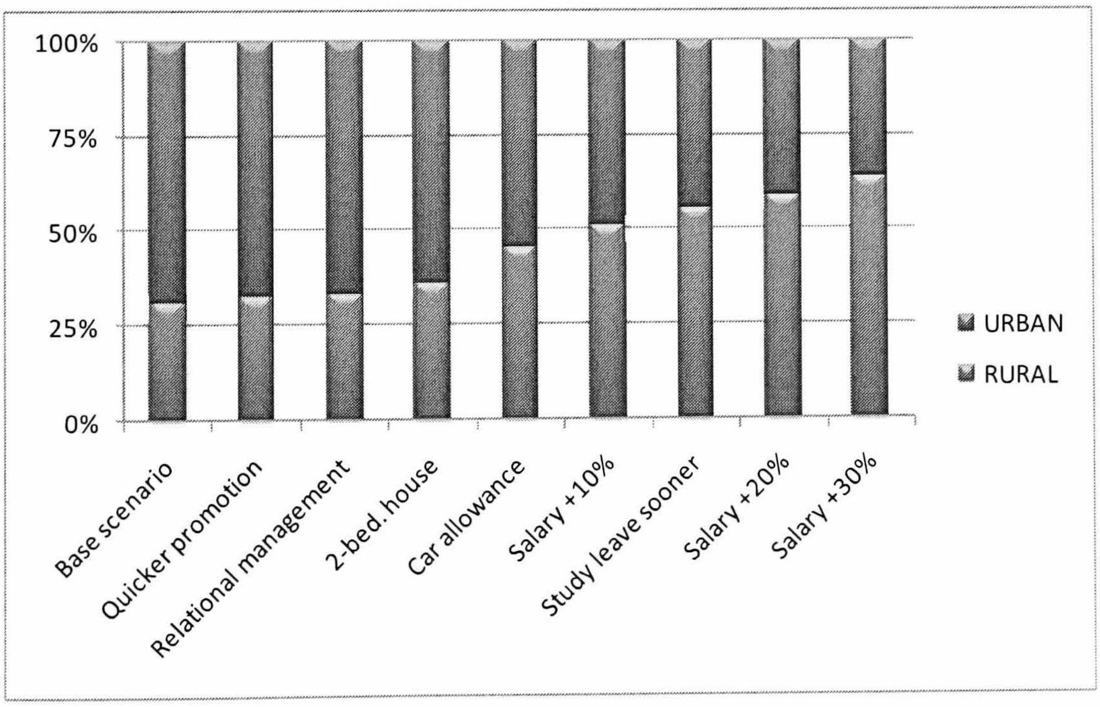
Scenario description	Predicted (average) distribution		Impact measures on proportion of rural uptake	
	% in rural posts	% in urban posts	Absolute change[a]	relative change (%)[b]
Base scenario	31.36	68.64	-	-
SINGLE INCENTIVES				
Salary increases				
10% rural allowance	51.30	48.70	19.94	63.58%
20% rural allowance	59.16	40.84	27.80	88.66%
30% rural allowance	64.19	35.81	32.83	104.69%
Additional allowances				
Car allowance of R500/month	45.50	54.50	14.14	45.09%
Housing opportunities				
2-bedroom house	36.23	63.77	4.87	15.52%
Better training opportunities				
Study leave in 2 years	55.57	44.43	24.21	77.20%
Better career path				
Promoted after 1 year in post	32.69	67.32	1.33	4.23%
Better management				
Relational type of management	33.49	66.51	2.13	6.80%
MULTIPLE INCENTIVE PACKAGES				
Financial packages				
10% salary increase + car allowance	66.06	33.95	34.70	110.63%
20% salary increase + car allowance	72.69	27.32	41.33	131.78%
30% salary increase + car allowance	77.08	22.92	45.72	145.79%
"Status" packages				
Better housing + car	51.18	48.83	19.82	63.19%
Better housing + car + 10% increase	71.35	28.65	39.99	127.53%
Better housing + car + 20% increase	77.41	22.59	46.05	146.84%
Career-related packages				
Quick promotion + car	46.98	53.02	15.62	49.80%
Quick promotion + 10% salary increase	52.81	47.19	21.45	68.41%
Quick promotion + 20% salary increase	60.59	39.41	29.23	93.20%
Quick promotion + 10% increase + car	67.43	32.57	36.07	115.03%
'Education' packages				
Study leave soon + car	74.48	25.52	43.12	137.50%
Study leave soon + 10% increase	81.00	19.01	49.64	158.27%
Study leave soon + 20% increase	86.35	13.65	54.99	175.35%
Study leave soon + 10% increase + car	91.53	8.48	60.17	191.85%

[a] the absolute change is measured as the difference in percentage points between the proportion of nurses in rural areas in the base scenario and in the simulated scenario.
[b] The relative change is calculated as the increase in the percentage of nurses who are in rural areas in the policy scenario, compared to the base scenario $(P_{scenario} - P_{base})/P_{base}$. The calculation in this column is based on the average proportions presented in this table.

Several results emerge from these simulations. First, under the conditions defined in the base scenario (reflecting the current situation), the model predicts that the majority of nurses would choose urban areas (68.6%). Second, several policy interventions that would improve the rural job offers have little effect on this distribution. Indeed, informal management, better housing and accelerated promotion increased the uptake of rural posts, but by less than 5%. Third, financial incentives (salary increases and car allowance) have strong effects. Interestingly, although the car allowance represents half the money offered than a 10% salary increase, both incentives have comparable effects. This is certainly because the car allowance also provides a "status" effect, as this is currently only offered to doctors. The non-linear effect of the salary increases are reflected here by the close effects obtained by an increase in salary by 20% or 30% (respectively 59.2% and 64.2% of nurses choosing rural jobs). Finally, the impact of offering study leave to nurses sooner is the third most effective intervention (see Figure 7.3 where some of the single incentives are ranked from the least to most effective).

The simulated effects of different combinations of incentives are presented in the second half of Table 7.5[84]. Three of the four most effective policy packages selected here are the ones that offer better training opportunities and direct financial incentives. The combination of several incentives suggests that a high level of rural post uptake can be achieved.

Figure 7.3: Relative uptake of rural vs. urban jobs under different policy scenarios (single incentives)



84 The effects of the combination of two or three incentives are different that the sum of effects of the three individual incentives taken separately. For further evidence of that, see Appendix 7.5.

B. Policy effects on simulated nursing populations

Given the impact of rural backgrounds on the preferences for rural jobs, it was important to investigate the impact of potential "upstream" interventions (i.e. selecting more nurses from rural graduates), without or in combination with downstream policy interventions. To do that, four populations that varied in the proportion of individuals from rural backgrounds were simulated (see Appendix 7.6 provides further detail on how that was done) and the uptake of rural positions was predicted under different policy scenarios, using the estimates of model II from Table 7.3.

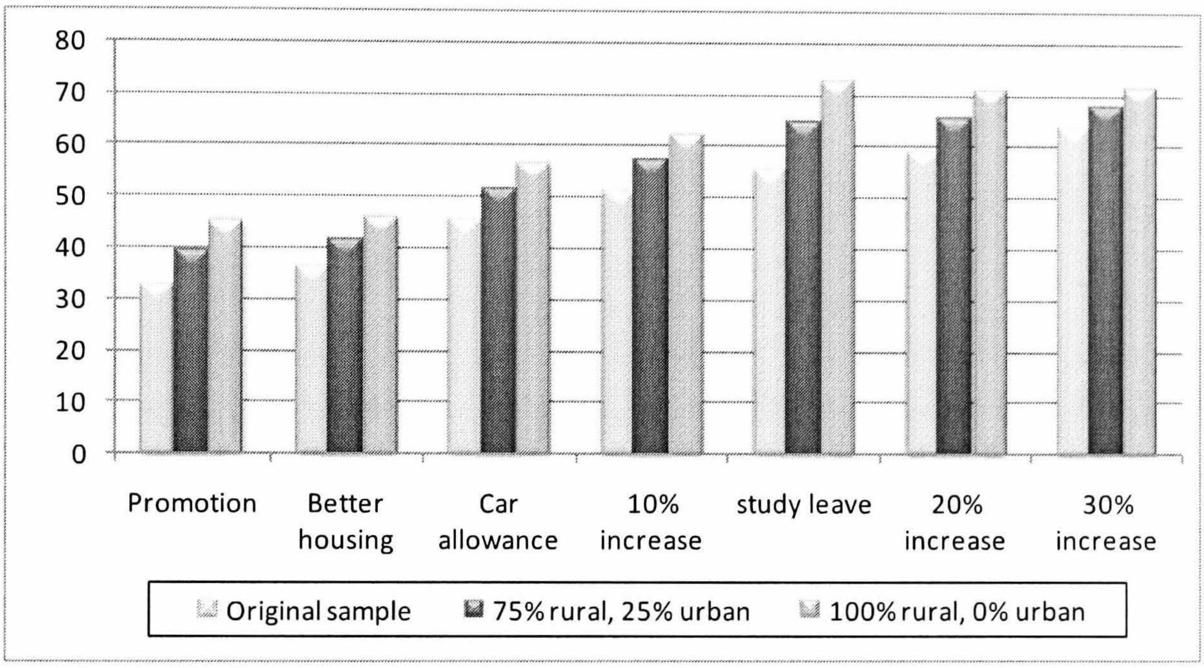
Table 7.6: Simulated effects of different policy scenarios on rural job uptake for different nursing populations

Scenario description	Predicted uptake of rural posts (%)				
	0% rural, 100% urban	**25% rural, 75% urban**	**Original sample**	**75% rural, 25% urban**	**100% rural, 0% urban**
Base scenario*	20.46	25.73	31.36	38.08	43.81
Single incentive policies					
Salary increases					
10% rural allowance	41.43	46.19	51.30	57.45	62.57
20% rural allowance	48.61	53.76	59.16	65.74	71.21
30% rural allowance	57.76	60.79	64.19	68.26	71.53
Additional allowances					
Car allowance of R500/month	35.63	40.38	45.50	51.63	56.76
Housing opportunities					
2-bedroom house	27.40	31.60	36.23	41.70	46.30
Better training opportunities					
Study leave in 2 years	40.20	47.73	55.57	65.12	73.11
Better career path					
Promoted after 1 year in post	21.58	26.96	32.69	39.53	45.36
Better management					
Relational type of management	22.27	27.71	33.49	40.42	46.31
Multiple incentive policies					
Financial packages					
10% salary increase + car allowance	59.26	62.49	66.06	70.35	73.81
20% salary increase + car allowance	65.69	69.07	72.69	77.09	80.67
30% salary increase + car allowance	73.67	75.20	77.08	79.29	80.97
"Status" packages					
Better housing + car	44.19	47.46	51.18	55.57	59.15
Better housing + car + 10% increase	67.53	69.24	71.35	73.82	75.71
Better housing + car + 20% increase	73.22	75.16	77.41	80.10	82.20
Career-related packages					
Quick promotion + car	37.08	41.85	46.98	53.14	58.28
Quick promotion + 10% salary	42.97	47.72	52.81	58.95	64.05
Quick promotion + 20% salary	50.15	55.25	60.59	67.09	72.51
Quick promotion + 10% increase + car	60.76	63.93	67.43	71.65	75.05
Training packages					
Study leave soon + car	65.29	69.77	74.48	80.30	84.97
Study leave soon + 10% increase	73.50	77.17	81.00	85.77	89.55
Study leave soon + 20% increase	80.04	83.17	86.35	90.37	93.55
Study leave soon + 10% increase + car	88.69	90.04	91.53	93.38	94.77

Note: as for the sampled populations, the figures in this table represent an average of the results obtained for four different combinations of facilities (see rationale in section 7.2.3.D and Appendix 7.7 for the complete results.

Three findings emerge from these results. First, the more rural nurses in the population the higher the proportion of nurses who will choose to work in rural areas (see Table 7.6). This means that with a more "rural" population than the one surveyed (the original sample had about 50% of nurses from rural areas), the proportion of graduates who choose a job in rural areas is systematically higher under all scenarios, as evidenced by the comparison for single incentives plotted in Figure 7.4.

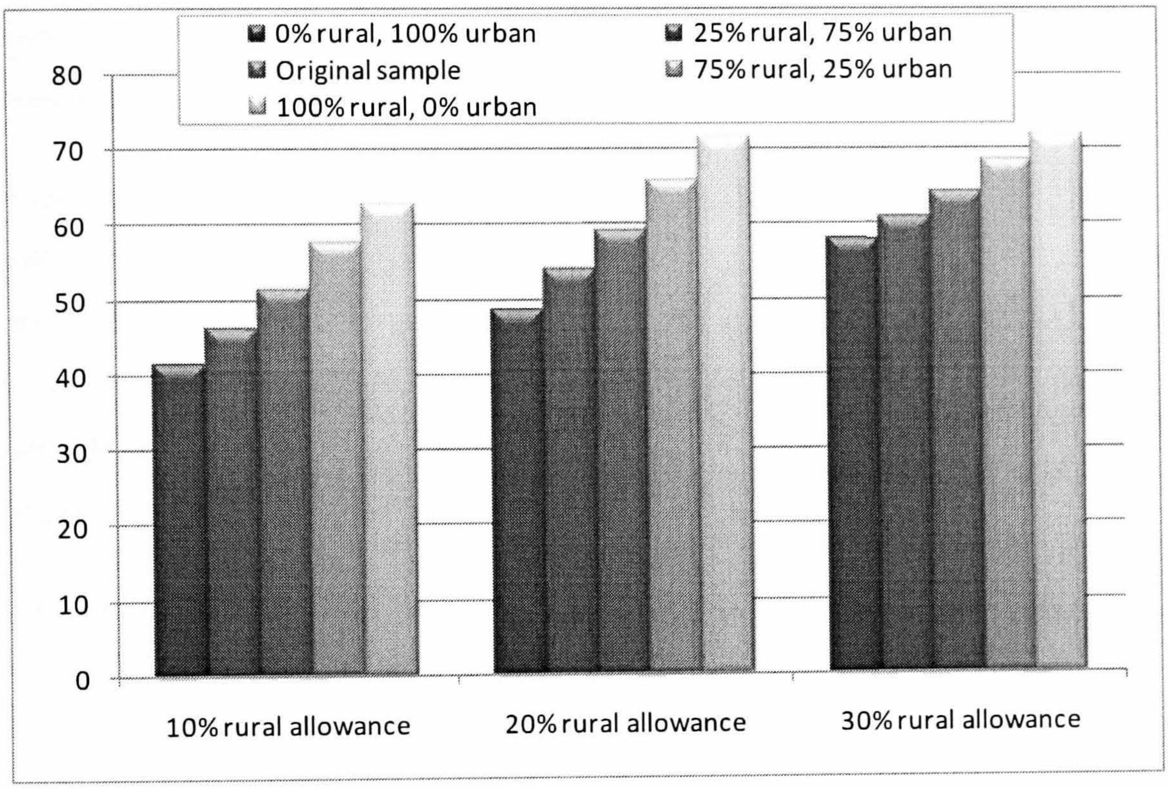
Figure 7.4: Proportion of nurses choosing rural jobs under different policy scenarios, by population type



Second, policy interventions are relatively less effective to increase the proportion of nurses in rural areas when it comes to people with rural backgrounds. For example, the car allowance increased the uptake of rural posts in the sampled population by 45% (from 31.4% to 45.5%), while it only increased it by about 30% amongst a population comprise of rural nurses only (from 43.8% to 56.7%). Obviously, this is due to an initial strong preference for rural jobs, which limits the marginal effectiveness of incentives. This differential in initial preferences for rural jobs also means that smaller incentives will be needed to obtain a given uptake of rural jobs with a population composed by a greater number of nurses of rural origins (see Figure 7.5). For example, a 60% uptake of rural jobs is enabled by a 30% rural allowance if the population is composed of only 25% of rural graduates – an effect which is achieved (by a 10% increase only) if all the nursing population comes from rural areas.

The third finding relates to differences in the relative effectiveness of policy interventions. As noted earlier, nurses with rural backgrounds are less sensitive to financial incentives and more sensitive to educational opportunities. Amongst 'single' incentives, the most effective policy lever in the general population is the 30% salary increase, followed by the 20% salary increase, and finally the study leave offered after two years in post. For a population composed entirely or mostly of nurses with rural backgrounds, the highest uptake of rural posts is achieved for the education policy, followed by the 20% and 30% salary increases. The latter two are almost identical, even though the 30% increase in salary is less effective.

Figure 7.5: Proportion of nurses choosing rural jobs with 3 types of financial incentives, by population type



7.4. Discussion

7.4.1. Summary of key findings

Overall, the relationships between utility and job characteristics obtained in the analysis concur with the assumptions made in Table 7.2. This correlation provides theoretical validation of the tool. In particular, a modest job promotion and a change in management style were not found significant. In contrast, while effect of salary increases was found to be non-linear (decreasing effects), all other possible policy levers were found to be potentially powerful incentives to attract nurses to rural jobs.

Very few socio-economic and individual characteristics were found to be significantly associated with a preference for one type of job or another. Males, individuals with rural backgrounds, those who had trained in a more rural province or who had positive attitudes towards rural areas were more likely to prefer rural jobs than others. However, gender and race were not significant, nor was altruism or any other measure of pro-social attitude (although a pro-poor attitude was associated with a preference for rural posts, at $p<0.13$).

The use of complex modelling of individual preferences in a mixed logit model revealed the presence of heterogeneous tastes within the population regarding the different policy levers. A further analysis showed that the origin of nurses was a key factor in producing that heterogeneity. In effect, people from rural areas are significantly less sensitive to most of the incentives used to attract nurses to rural areas.

The estimated model was then used to predict different uptake of rural vs. urban posts. Under baseline (current) conditions, 70% of nurses choose a position in an urban area, while 30% would choose one in rural areas. As expected from the regression results, different management or quicker promotion would not affect this distribution much. In contrast, financial incentives (salary increases and car allowance) have strong effects, and the guarantee to obtain study leave four years sooner than is usual provides the third most powerful policy lever (after the salary increases of 20% or 30%). The simulations also showed that a combination of different incentives could lead to high uptakes of rural posts can be achieved.

To conclude with the analysis, different policy simulations were undertaken with various populations, which varied in their proportion of rural nurses (0%, 25%, 75% or 100%). This analysis clearly demonstrated the potential positive effect of upstream policy measures that would seek to recruit more rural graduates. Indeed, it showed that the more rural nurses in the population the higher the proportion of nurses who will choose to work in rural areas.

7.4.2. Discussion of results

The predictions of the model under current circumstances show that more than two thirds of nurses would choose a position in urban areas. Unfortunately, the scarce data available on the geographic distribution of nurses in South Africa cannot contradict or confirm this result. Indeed, data at the provincial level presented in Chapter 4 do not reflect well the urban/rural divide. That said, as noted in Chapter 4, the unequal distribution of public nurses between provinces suggests that the majority of nurses choose posts in more urban settings.

This study is the first to use a labelled DCE to simulate the effects of policy interventions on the uptake of rural posts, yet some of the results presented here echo those found in other DCE studies in developing countries. A study on clinical officers in Tanzania concluded that educational opportunities and salary increases were also some of the most influential policy levers to attract clinical officers in rural and remote areas (Kolstad, 2010). Other DCE studies from low and middle-income countries have underlined the effects of salary increases, usually unmatched by other job characteristics (Lagarde and Blaauw, 2009).

The results from the DCE analysis also confirm the role of rural backgrounds as a positive factor associated with greater preference for rural posts (see hypothesis H6). This has already been stated in various reviews of evidence on developed countries (Brooks et al., 2002) and developing countries (Lehmann et al., 2008). However, this dimension has not been investigated precisely by the recent DCE literature as no model was computed allowing for interactions between rural backgrounds and a rural attribute (Chomitz et al., 1998, Penn-Kekana et al., 2005, Hanson and Jack, 2008, Mangham and Hanson, 2008)[85]. However the findings from this study provide some complementary elements to the results found in a DCE study on clinical officers in Tanzania (Kolstad, 2010). In concert with the present study, they found that people from rural areas were less sensitive to incentives designed to attract them to rural areas (Kolstad, 2010). The author hypothesised that this finding might be related to the initial preference of clinical officers with rural origins for rural areas. The findings presented here concur with this assumption.

[85] Indeed, none of these recent studies employed a labelled design. Therefore testing the effects of rural backgrounds on preference for rural jobs in a generic design requires introduction of an interaction term between the rural background variable and a location attribute that contains the level "rural" (or a similar level).

7.4.3. Limitations

Several limitations in the design of the DCE should be recognised, along with the questions on the external validity of DCEs already mentioned.

A first problem that might compromise the reliability of the policy effects modelled relates to the possibility that respondents may have followed non-compensatory decision-making rules, for example through heuristic rules. This is a classic problem that has been underlined several times in the DCE literature (Scott, 2002, Lloyd, 2003), and several reasons make it a likely issue here. First, the length of the questionnaire (16 choice sets) might have contributed to respondents' fatigue, which makes them more likely to choose simple heuristics to answer difficult tasks. Second, respondents might have followed the cue provided by the various rural incentives and followed what they thought was expected of them (framing bias). Finally, the use of labels might increase the occurrence of non-compensatory decision-making, as attributes unknown to the researchers and strongly associated with the labels can be used by individuals to make inferences and ignore other attributes. Yet, as indicated in the last chapter (section 6.4.1.B), establishing lexicographic preferences in a labelled DCE is difficult as there is often an overlap between the labels and alternative-specific levels. Besides, if this is an issue here, it is a minor one since only 2.7% of respondents systematically chose the urban option across the 16 choice sets, while 4.6% systematically chose the rural option (see Appendix 7.8). Overall, it is difficult to identify the existence of compensatory decision-making that might have compromised some of the consumer theory axioms. Besides, some authors have argued that heuristics or "irrational" decisions might in fact be more rational than researchers can identify and should therefore be considered as legitimate representations of individual preferences (Lancsar and Louviere, 2006).

Second, the design employed for this DCE might be unbalanced. This issue can arise when the utility of alternatives presented to the respondents is systematically unequal. In this DCE, the rural jobs all presented better employment conditions than the ones offered in the alternative. By transforming the rural jobs into (unrealistically) attractive alternatives, these incentives may have altered the utility balance between alternatives. As a result, there is a risk that this utility imbalance might have compromised the compensatory decision-making behaviour by creating 'inferior' and less attractive urban jobs. Yet, the descriptive analysis presented above showed that this might only have been the case for 2.7% respondents. Utility imbalance can also violate some of the assumptions on which the DCE analysis relies, decreasing the efficiency of the choice design and ultimately, compromising the statistical efficiency of parameter estimates (Huber and Zwerina, 1996). Overall this suggests that the effects of rural incentives might have been over-estimated. However, offering more attractive positions in rural areas was motivated by the need to compensate the 'natural' disadvantages inherent to rural jobs, thereby restoring the utility balance between urban and rural job offers. The difficult working conditions and negative utility associated to rural positions are encapsulated in the label, and the negative sign of the alternative-specific constant associated with the rural alternatives provides evidence of that assumption. In sum, it is unclear whether the design suffers from utility unbalance or not, but it is possible that the statistical estimates of policy effects might not be robust.

A third problem of the DCE design is the absence of an opt-out option, which forces respondents to choose between a rural and an urban public position. Estimates of policy effects may be biased since they implicitly rely on the assumption that all individuals in the sample would indeed have chosen the public sector, had they been given the choice to opt out. Although the two choice experiments are not comparable, in particular due to the differences in rural jobs proposed in the two designs, the findings of the choice experiment presented in Chapter 5 clearly contradict this assumption. Indeed, in this choice experiment which was more representative of the conditions on the labour market, only around half of respondents chose public jobs. Consequently the 'forced choice' design is likely to have over-estimated the effects of rural incentives to attract nurses to rural areas. Although this is a major drawback of the choice experiment, the Markov model was constructed in an attempt to remedy this flaw. By replacing the findings of this "policy" DCE into the broader perspective of the whole labour market given by the other "market" DCE, there is an attempt to rectify the estimations of effects provided by the forced choice design.

Finally, as in the case of the DCE presented in the last chapter, the results and policy formulations are limited by the lack of certainty concerning the external validity of these stated preference tools. The reservations detailed in the last chapter still hold (see section 6.5.3), and the hypothetical bias described there might be more an issue in this DCE compared to the one presented in the last chapter. Indeed, while the DCE in Chapter 6 was purposefully mimicking the real labour market, the one in this chapter decisively deviates from working conditions currently offered in public jobs to test the effect of *potential future* incentives. Hence it is possible that respondents might have envisaged to take up rural positions that seemed more advantageous "on paper", without taking into consideration the more difficult living and working conditions. In order to limit that effect, a short description of some of the difficult conditions that could be expected from "rural areas" was given in oral and written instructions (see Appendix 7.1). It is hoped that this will have limited the hypothetical bias, although it is likely that individuals will have over-estimated their willingness to take up rural posts.

7.4.4. *Implications for policy and research*

A. Implications for policy

The analysis of the choice experiment and the policy simulations leads to concrete recommendations for the recruitment of nursing students and the implementation of HR policies to attract nurses to rural areas, both through upstream and downstream measures.

The investigation of preference heterogeneity has demonstrated that there is scope for policy-makers to increase the uptake of rural positions by increasing the proportion of certain groups of nursing students. Amongst those, students from rural background seem to be the most obvious group. The analysis presented here has demonstrated that they are not only more inclined to take rural posts in general, but also need less incentive to work in those areas. The increase of nursing (or medical) students with rural origins has been actively sought in several countries through the creation of training centres in rural areas or the creation of bursaries or quotas (Rabinowitz, 1988, Inoue et al., 1997, Wibulpolprasert and Pengpaiboon, 2003). Similar actions could be taken by the South African government. The creation of training centres in rural areas is also supported by findings showing that nurses who trained in the North-West province (more rural than Gauteng) are more likely to accept rural positions.

In addition, the results of the DCE identify a set of policy levers that would increase the availability of nurses in rural areas. In particular, offering higher salaries and study leave to nurses earlier in their careers will increase the number of nurses in rural posts. Yet, some of these levers are not equally easy to implement. For example, it should not be forgotten that the success of education policies relies on the government capacity to be able to deliver such promises. This is not a negligible guarantee, as suggested by the current low proportion of students from rural areas who specialise[86]. Being able to implement such policy might mean introducing quotas in specialised courses for rural students, or creating and upgrading training courses in rural nursing colleges. Such initiatives would certainly contribute to the global improvement of career paths in rural areas, and thereby participate in addressing the rural-urban gap in the public sector.

B. Implications for research

The work presented here sought to build upon the DCE to simulate the effects of potential HR levers on the labour market dynamics of nurses. However, some of the limitations of the DCE design (absence of opt-out option in the choice experiment, lack of market realism of the

[86] See Chapter 8 for more information provided in interviews with key stake-holders.

rural/urban choice) might preclude the generalizability of the results. To a large extent, these design characteristics are relatively typical of what has been done in the DCE literature applied to HR problems (Lagarde and Blaauw, 2009). In particular, most applications of DCE in low and middle-income countries have presented job choices in the public sector only. Yet, this practice raises concerns about the extent to which the absence of some alternatives (e.g. private jobs) may have biased the overall choices and in particular, in the context of a labelled choice experiment (where the labels may drive some of the choices). The effect of the choice architecture, or menu effect on individual decisions has been underlined by behavioural economists (Benartzi and Thaler, 2001, Benartzi et al., 2007), but remains untested for labelled choice experiments.

These issues highlight the need for researchers using DCEs for labour market decisions to try and improve the market realism of their design, which is the only way to enhance the generalizability of market simulations, on which to base robust policy recommendations. At the same time, more market realism can increase the cognitive burden on respondents (more job characteristics, more job profiles, more choice sets) or, at the very least, can make DCEs more unwieldy and expensive as bigger sample sizes would be required. Yet market realism is needed to limit the risks of hypothetical bias posed by DCEs. As long as this external validity of DCEs remains uncertain, it is important to design the choice sets and frame the task in a way that increases market realism and decreases the risk of hypothetical bias.

Finally, the study of the heterogeneity of preferences would provide another critical area for future research. Recent developments in choice experiments have attempted to develop individual-level models to reflect individual-level preferences perfectly. So far, applications have focused on the effects on willingness-to-pay and welfare estimates (Lancsar and Louviere, 2008), but an extension to predicted probabilities is easily feasible. That would give more flexibility to the computation of predictions, and would most certainly better account for the disparity of individual tastes. However, such analyses often require more demanding[87] designs (e.g. best/worst designs), as there is a need to collect a lot of information for each survey respondent. Finally, so far, such designs have mainly been developed for unlabelled experiments.

[87] Both in terms of sample size and challenges to administer them in a simple manner.

7.5. Conclusion

This chapter has demonstrated the interest of stated choice preferences for the design of policy interventions. This is a particularly appealing tool in a resource-constrained setting, as such surveys are relatively cheap and easy to carry out, and most important, provide useful information that can help policy-makers tackle some of the key HR problems.

However, the analysis presented here is limited in two ways. First, as the model only pertains to the nurses' decision to take a job or not, its predictive capacity is limited to the immediate effects of policy decisions. This leaves the question of how long they would remain in their rural job unanswered. In other words, the modelling predicts short-term outcomes of job preference but not the long-term distribution of nurses. Second, in order to make an informed choice between alternative interventions, policy-makers need to know the cost implications of their various options. Computing the costs of most interventions presented here also requires predicting how many nurses still work in rural areas after a few years. Indeed, some of the incentives provide some differed benefits (e.g. study leave after two years, promotion after one year). The next chapter takes up this question and sets out to build a model upon the simulated probabilities that predicts the distribution of nurses on the labour market over time.

Chapter 8 - Projecting the long-term effects of HR interventions

8.1. Introduction

In the last chapter, a stated preference method was used to predict the potential effects of policy interventions on the location chosen by nurses. Those predictions can only simulate the immediate impact of those policies, through the predicted probabilities of taking up a job in a rural area. Yet, future consequences of those policies should also be taken into consideration. Indeed, some of the policy interventions simulated have distant implications that could have an impact on the future distributions of nurses. For example, allowing nurses to obtain study leave earlier will, *ceteris paribus*, decrease the number of nurses working in rural areas sooner (i.e. during their year of training). It is also likely that if a large proportion of nurses who choose to specialise leave the public sector to work in the private sector where more lucrative opportunities are available. Hence policy interventions that look effective in the short run, might not be so effective in the long run.

Furthermore, to be able to carry out a cost-effectiveness study based on the simulated effects of various policies, it is essential to go beyond the immediate effects, considering that the costs of the incentives offered are not necessarily incurred immediately. In particular the education and promotion incentives both contain the seeds of future costs for governments, which can only be more accurately assessed by modelling the future distribution of nurses.

Finally, as underlined in the presentation of the choice experiment, the predicted market shares assume that all nurses in the sample will have chosen to work in the public sector. But it is evident that in South Africa this assumption does not hold, considering that currently half of the nursing population work in the private sector. Therefore, to be able to model the effects of the HR policies and understand their repercussions on the overall distribution of nurses at the national level, one should use a framework that would better mimic the structure of the labour market and not be restricted to the public sector.

To better predict the effectiveness of HR policies, one should be able to forecast the future distribution of nurses across segments of the South African health care job market over time. To do so, one needs to model the movements of nurses from one segment of the health care job market to another. In the literature on manpower planning (Bartholomew et al., 1991), most of the models used to predict the flows of individuals within the structure of a dynamic system are based on Markov models. This chapter presents the construction of a Markov model designed to predict the dynamics of the labour market for nurses.

8.2. Using a Markov model to model the effects of HR policies

8.2.1. Model structure and data

Markov models, commonly used in the study of the dynamic evolution of diseases, are basically constructed on the following elements (Sonnenberg and Beck, 1993):

- A set of mutually exclusive (health) states (here the health care labour market);
- An initial distribution of individuals across the various states of the model (initial probabilities);
- A transition probability matrix that determines movements between one state to another over time;
- An absorbing state (typically death).
- The cycle length;

The first step in the construction of a Markov model is to determine the various states of the model. In the present application, the definition of the various states was governed by the need to mimic the health care labour market and, within it, predict correctly the presence of nurses in rural posts. Considering the current distribution of South African nurses (see Chapter 4), there were four obvious segments of the health care labour markets that seemed to encompass the large majority of nurses' positions: public rural, public urban, private and overseas. In addition, some nurses decide to leave the labour market, voluntarily (for example to take up a position as a nursing lecturer) or because they retire or die. This state can be assumed to be an absorbing state, which means that once nurses enter it, they no longer move back to any of the other segments of the health care labour market[88].

Finally, because the population of interest consists of professional nurses, there is one last element to consider: the fact that a non negligible proportion of nurses will choose to specialise, through a one-year training course. Neglecting this flow would overestimate the presence of nurses in the other various sectors, as, by definition, when nurses do specialise, they are no longer in post.

In summary, the Markov model used here included six states: public rural, public urban, private, overseas, study leave (training) and exit. The diagram below summarises these various states.

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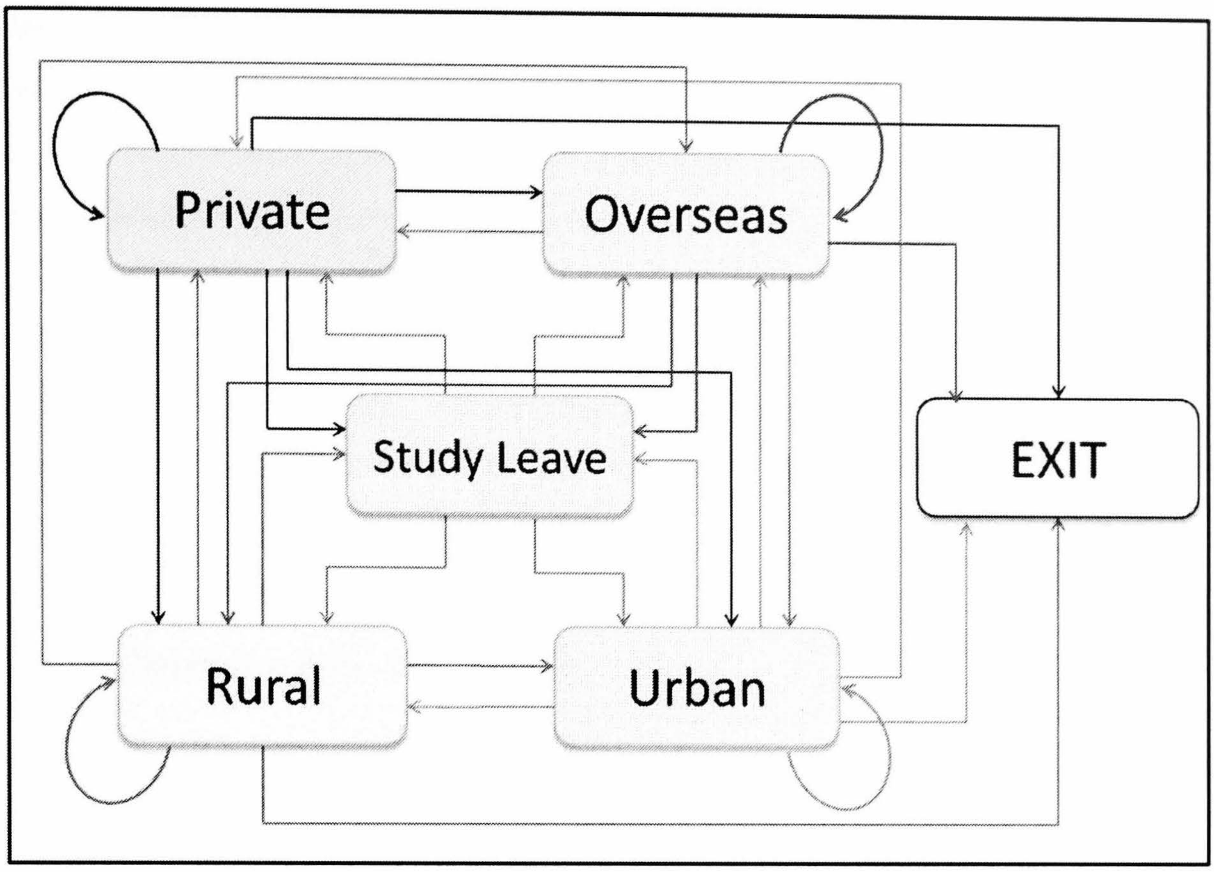
[88] Although this assumption is probably not realistic, it is used here to make the model tractable.

Figure 8.1: Markov model structure



The next key parameter in the Markov model was the initial distribution of individuals across the various segments of the model. Although there were some data on the current distribution of nurses across some of these segments, this distribution represented the result of the accumulated flows and movements of nurses over time. It might provide some indication of the current equilibrium of the system, but it did not necessarily provide any indication relative to the initial choices made by nurses when they graduate (unless one assumes that they never move, which is the very assumption the Markov model tries to avoid).

In the absence of actual data on the choices made by nurses over time, and in particular at the beginning of their career, the stated preferences of the cohort of graduate nurses that are part of the present study are a good second best. Indeed, the choice experiment mimicking the current labour market conditions provides the predicted choices nurses would make between employment in the public sector, and private and overseas jobs. The second choice experiment (presented in the first half of this chapter) also provides specific elements on the allocation of nurses between rural and urban public jobs, under different policy simulations. Under the (very plausible) assumption that no one is either training to specialise or already out of the nursing labour market just after the graduation, these stated preference results provide the elements to compute the initial probabilities (for a more detailed discussion of the assumptions made by the use of such data, please refer to the appropriate section below).

The final set of parameters in a Markov model is the matrix containing the probabilities of moving between different states of the system, i.e. the transition probabilities. In the present application to the labour market, estimating the actual transitions between the states identified was not possible because of the lack of accurate data on human resources in South Africa. Therefore a number of assumptions were made and are described below.

To finish, it was assumed in this model that each cycle lasts for one year. This seemed a reasonable assumption to make, as it fit with the main career stages of a nurse in the public sector (promotions and salary scales are based on a yearly calendar), as well as the length of the post-basic training courses.

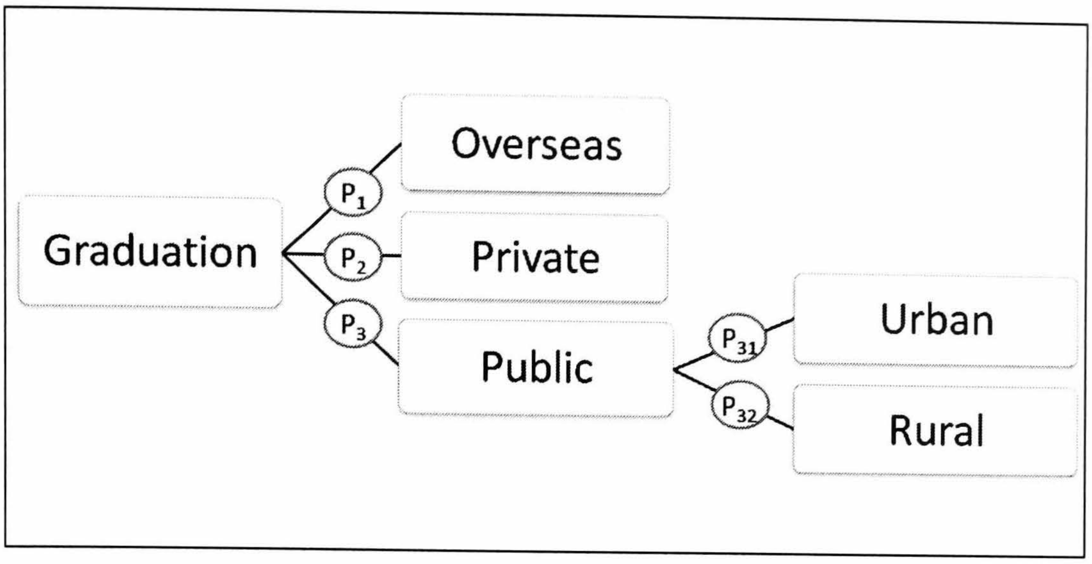
8.2.2. Parameters of the Markov model

A. Initial distribution of individuals

The first step in a Markov model is to determine the initial distribution of individuals across the different states before the first cycle starts. The starting point of the model corresponds to the entry of Professional Nurses in the labour market, after their graduation, when they make a decision about their first employment position. It was assumed that no nurse has yet left the labour market or gone on study leave. While the latter assumption is quite obvious, it could be argued that the former one is less evident. However, for simplification purposes, and because there is a shortage of nurses in the labour market, we assumed that initially no graduating nurse would leave the market (or die).

As noted above, this initial distribution was modelled as a two-step decision rule, as presented in the figure below. Upon graduation, nurses decide to work in the public sector, in the private sector or overseas. The results of the DCE presented in Chapter 6 were used to allocate individuals between public jobs (aggregated) and private and overseas positions. Once the choice of taking up a public position is made, individuals are then influenced in their allocation between rural or urban jobs by the prevailing conditions in those jobs. The result of the second DCE (Chapter 7) were used to model the distribution between the two public job alternatives.

Figure 8.2: Summary of the initial decision model



Formally, the initial distribution across the five states of the Markov model is:

$N_{Overseas} = N_o = P_1 \times N$ where P_1 is the market share obtained from Table 6.13

$N_{Private} = N_p = P_2 \times N$ where P_2 is the market share obtained from Table 6.13

As a result:

$N_{Public} = N_{PU} = P_3 \times N = (1 - P_1 - P_2) \times N$

Then it follows:

$N_{Urban} = N_u = (P(Urban) \mid P_3) \times N = (P_{31} \times P_3) \times N$ where P_{31} is obtained from Table 7.5

$N_{Rural} = N_r = (P(Rural) \mid P_3) \times N = (P_{32} \times P_3) \times N$ where P_{31} is obtained from Table 7.5

This approach applied in all instances, that is for the base scenario (corresponding to the current market conditions), or whether it simulates the distributional effects of a possible HR policy. If it is fairly reasonable to think that this 2-step approach can hold for the base scenario (as both the first and second stated choice experiments used are supposed to reflect the current market conditions). However, the modelling is less obvious in a case where the second choice experiment departs from the current market conditions. Indeed, the underlying assumption of this two-step decision-making model is that the initial choice between public and other positions is independent from the prevailing working conditions in the two public jobs, therefore unaffected by a change in those working conditions. In other words, the policies to attract nurses to rural public positions are assumed not to have an effect on the probability of choosing a position overseas or in a private facility. Although this remains a restrictive assumption, the results of policy simulations presented in Chapter 6 (see Table 6.13) suggested that the cross-elasticity between public jobs is quite high, while substitution patterns between public jobs and private or overseas ones are much less significant.

B. Decomposition of the transition matrix

Given the six states of the model described in Figure 8.1, there are four groups of parameters in the transition matrix, which determines the movements of individuals between states.

The first parameter of the Markov model is the *exit rate* (E), defined as the proportion of individuals, in any state, who leave the nursing labour market, either because they die, retire or decide to give up work as a nurse. For simplification purposes, it is assumed that this rate is the same for all working states in the Markov model. Another hypothesis is that this rate varies over time. Therefore a unique exit rate E_t is defined for a given cycle t.

The second set of parameters relate to the *training uptake rates* (TU). They are defined as the proportion of nurses currently working who decide to specialise, and as a result join the "training" state for one cycle. Similarly to the retention rates, the probability of specialising changes over time. Consequently for nurses in a given state *i* during period *t* of the model, the training rate is noted $TU_{it.}$

A set of parameters then determines the destination of nurses after they have specialised – the *post-training destination rates* (PT_i). By definition, nurses can only go into one of the four 'working' states of the model after they have trained – they do not exit the labour market nor do they keep on training. Therefore for a given class of nurses who specialise, they are divided into the ones who take a position in a rural area in the public sector (PT_r), those who decide to work in urban areas in the public sector (PT_u), those who choose the private (PT_p) sector and those who emigrate (PT_o). By definition, the four proportions sum to one ($PT_o + PT_p + PT_u + PT_r = 1$). For simplification purposes, it is assumed that these preferences remain constant over time.

Considering the structure of the model, those individuals who do not exit the nursing labour market or decide to specialise, can only decide to remain in the state where they are or take a nursing job in one of the three other "working" states. Therefore, the next important set of parameters is the *turnover rates* (T), defined as the probability for an individual who is currently in a working state to leave for another *working* state in the next cycle. Therefore, by definition, the proportion of nurses who remain in their current working employment (sometimes called retention rate) is equal to 1-T. For the other four states, it is assumed that the probability of a nurse to remain in a particular state varies over time (more details on this assumption will be given below). Therefore for a particular state i and a given period t the retention rate is noted $1\text{-}T_{it}$.

The final set of parameters is given by the *mobility rates* (M_{ij}), defined as the proportion of individuals who will move from a working state i to another working state j. This proportion is obtained by multiplying the turnover rate for a particular working state i (T_{it}), by the proportion of leavers from that state i who choose to work in working state j. The latter proportions are called the *destination rates* (d_j).

$$M_{ijt} = T_{it} \times d_{ij}$$

To simplify, it is assumed that the destination rates d_{ij} remain constant over time. In other words, when working in a given sector, a nurse is always attracted in the same way by job opportunities in the other three sectors if they decide to leave. Yet, because T_{it} varies with time, in the end the mobility rates vary with time as well. By definition, all destination rates sum to one, meaning therefore:

$$\forall i \sum_j d_{ij} = 1$$

Table 8.1: Summary of transition matrix parameters

Origin \ Destination	Rural public	Urban public	Private	Overseas	Training	Exit
Rural public	$1\text{-}T_{rt}$	M_{rut}	M_{rpt}	M_{rot}	TU_{rt}	E_t
Urban public	M_{urt}	$1\text{-}T_{ut}$	M_{upt}	M_{uot}	TU_{ut}	E_t
Private	M_{pr}	M_{put}	$1\text{-}T_{pt}$	M_{pot}	TU_{pt}	E_t
Overseas	M_{ort}	M_{out}	M_{opt}	$1\text{-}T_{ot}$	TU_{ot}	E_t
Training	PT_r	PT_u	PT_p	PT_o	0	0
Exit	0	0	0	0	0	1

Table 8.1 summarises the various parameters that determine the movements of individuals in the Markov model. The rural public sector is noted *r*, the urban public sector is noted *u*, the private one is noted *p*, and finally *o* denotes the overseas destination.

The following section presents in detail the data sources and assumptions that were used to determine each of these parameters.

8.2.3. Defining transition matrix parameters

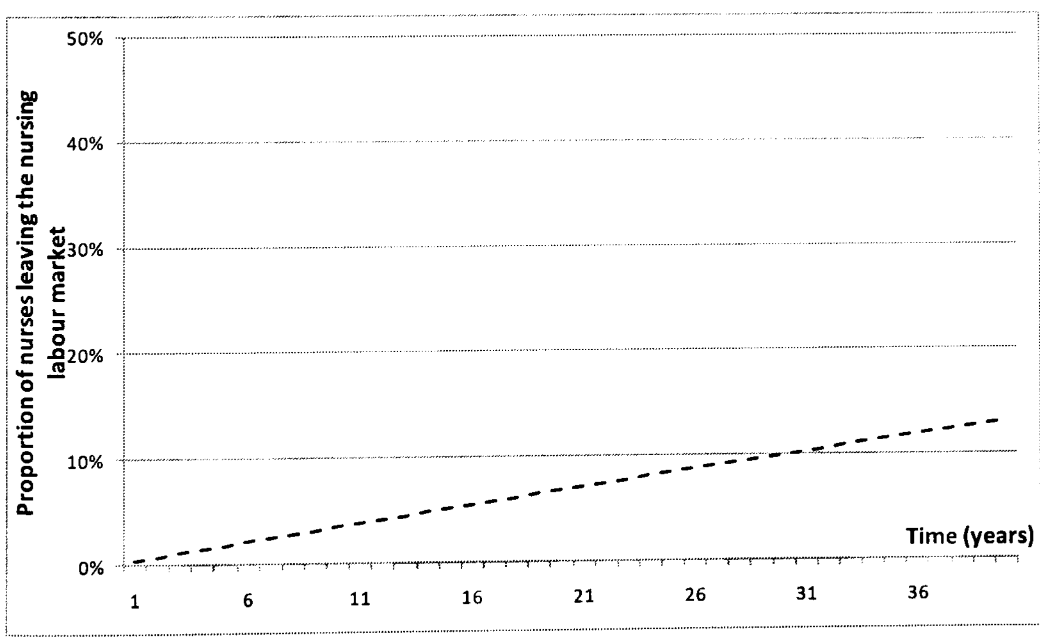
A. <u>Exit rates</u>

Given the absence of data that can provide such information, some assumptions have to be made. First, as stated before, the proportion of nurses leaving the labour market can be assumed to be the same across origin states. Indeed, retirement and mortality rates should be roughly the same across all sectors, and nurses should also have equal opportunities to move on towards more senior and administrative functions as their experience increases. Second, as noted before, the probability of leaving the nursing labour market, and in particular to retire or die, is clearly an increasing function of time. To model the exit rate, it is easier to model its complement, the probability of remaining in the labour market, as a simple exponential function of time:

$$E_t = 1 - e^{-\Lambda t}$$

Due to the lack of data, as well as the complexity of the model dynamics, defining a value of Λ is not straightforward. To do so, assumptions are based on *post-hoc* observations of the model predictions. In other words, given some available information, some *a priori* assumptions can be formed on the proportion of nurses who will have left the nursing labour market after 40 years. Overall, it is safe to assume that by the time a given cohort reaches the end of the model time horizon (40 years), the quasi-totality of the initial generation of nurses should have retired, died or stopped working as a nurse (nurses do not start their career as professional nurses before the age of 25 years, while the retirement age is 65 years old).

Figure 8.3: Evolution of the proportion of working nurses leaving the labour market each year (exit rate) over time



Using the Markov model, the parameter Λ was adjusted so that at the end of the model, about 95% of nurses have left the nursing labour market. This is achieved for Λ =0.0025. The resulting exit rate is plotted in the Figure 8.3.

B. Training uptake rates

In the absence of data on the proportion of students specialising each year, some facts were gathered to try and approximate the shape of the training uptake curves, defined as the evolution over time of the turning uptake rate for a given cohort. An interview realised with people in charge of post-basic training in Gauteng provided a number of elements to base the assumptions of the model.

First, the interview provided some clarifications about key 'structural' facts:

- The vast majority of students who attend post-basic courses in nursing colleges are from the public sector (either rural or urban areas). From this information, it can be assumed for simplification purposes that $TU_{pt}=0$ and $TU_{ot}=0\ \forall t$.
- From the interviews it was found that it is more difficult to obtain study leave and therefore to specialise when working in a rural area[89]. Therefore it can be assumed that $TU_{rt} < TU_{ut}$.

Second, information gathered in the interview provided some useful elements to determine the shape of training uptake rates over time:

- Nurses cannot specialise before they have completed two years of work. This means that for $t=0$ and $t=1$, $TU_u=0$ and $TU_r=0$.
- Most nurses specialise between five to 10 years into their career. Applications for specialised training decreases with age, but they are never totally non-existent (older nurses aged 50 to 60 years have also applied successfully for post-basic training).
  This means that the training uptake curve will be left-skewed, and therefore suggests that the training uptake function follows a distribution similar to the lognormal distribution.
- Approximately 50% of a given class of nurses specialise at some point in time, the rest remaining in general nursing. This final element is used to calibrate the parameters of the function.

[89] This lack of opportunities is partly due to geographical preference in post-basic training selection criteria that is detrimental for nurses from rural areas where there are fewer nursing colleges. For example in nursing colleges in Gauteng, they have to give priority to candidates from Gauteng province, although they train from the whole of the former Transvaal. Therefore they can only take a minority of students from the more rural areas (5-7%).

To account for these different constraints, the following functional form was used to mimic the evolution of the rate of training uptake from urban areas over time:

$$TU_u(t) = \eta \times \phi\left[\ln\left(\frac{t-1}{4}\right)\right] \qquad \forall t > 1$$

Where ϕ (x) is a normal density function with mean $\mu=0$ and standard deviation $\sigma=0.7$, defined as:

$$\phi(x) = \frac{1}{x\sigma\sqrt{2\pi}} e^{\left(\frac{-x^2}{2\sigma^2}\right)}$$

Therefore $f\left(\frac{t-1}{4}\right) \sim$ Log-normal (μ, σ) with $\mu=0$ and $\sigma=0.7$

These values of μ and σ were chosen to obtain the required shape for the curve. A brief graphical illustration of other coefficients can be found in Appendix 8.1.

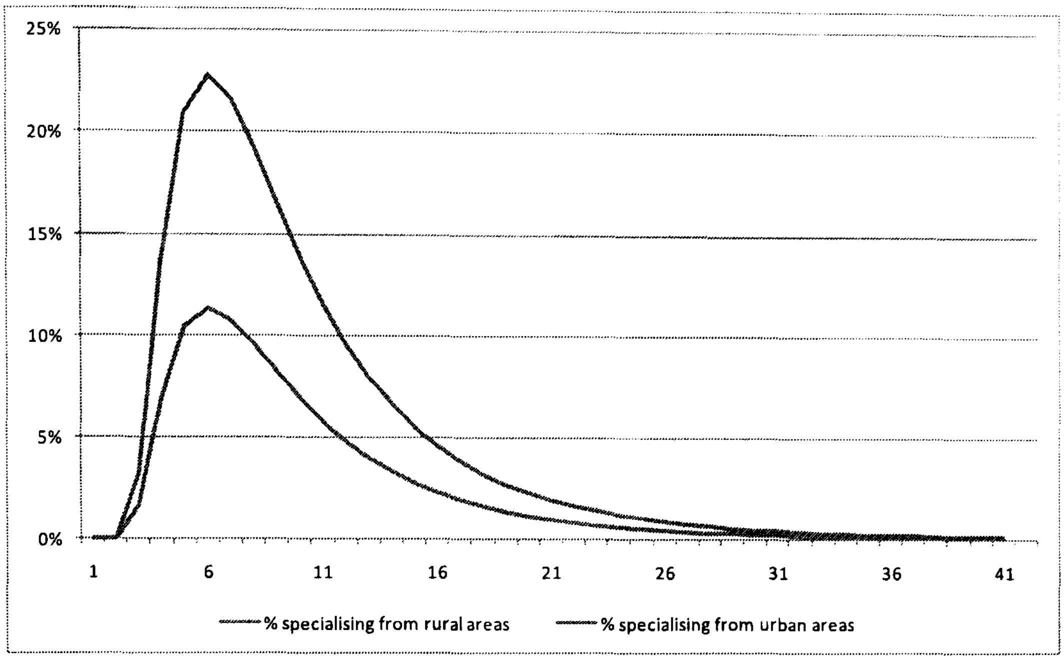
Because the basic functional form of a log-normal distribution cannot provide very well a training uptake curve corresponding to these specifications, some functional arrangements are used:

- $\frac{t-1}{4}$ is used instead of t to allow the function to spreads nicely over the interval of interest, which is $t \in [0;40]$, with a left-skewed distribution.
- a scaling factor η is introduced to decrease the training uptake rates by a proportional factor over the entire period. This parameter is set so that the uptake rates are not too high and therefore guarantee plausible estimates. The value of η is set to $\eta=0.4$

Finally it is assumed that the rural training uptake is proportional to the urban training uptake:
$TU_r(t) = \gamma \times TU_u(t)$ with $\gamma = 0.5$ so that by construction there is two thirds of urban students for one third of rural students. With such parameters (and other assumptions presented in this chapter for the other base parameters), 49.6% of nursing students end up specialising.

The resulting training uptake curves are shown below.

Figure 8.4: Evolution of post-basic training uptake in the public sector



C. Post-Training destination rates

Next, one must define the post-training destination rates, which govern the destination of nurses who will have specialised. To simplify, it is hypothesised that nurses can choose between the four sectors of employments (rural, urban, private, overseas) but cannot leave the market at that stage. As noted earlier, it is also postulated that the career preferences of specialising nurses will not vary with age and experience.

Based on information collected in nursing colleges and from the Department of Health, it was found that:

- The quasi-totality of nurses benefit from study leave to specialise;
- A student who gets study leave to specialise has to stay for at least one year in the public sector.

To simplify, assume that all nurses who specialise benefit from study leave. The consequence is that after the training state, they enter a "tunnel state"[90], composed of two sub-states: rural areas for the students initially coming from rural areas and urban areas for the others.

[90] Individuals in that state cannot move to other states of the model

Once nurses get out of the tunnel state, they can make a decision where to work. These post-training destination rates were defined based on the following information:

- Before the government decided to increase the salary of nurses, a large proportion of nurses who had specialised would go overseas or to the private sector for monetary reasons. The strong push in public salaries decided in 2007 seems to have rendered these two sectors seem less financially attractive.
- Nurses who have done a Primary Health Care specialty (which represent 15-20% of the class each year) would be likely to work in rural areas after their specialty, but others would be less likely to apply for a job there.

Taking into account this information, the following assumptions are made:

- $PT_r=0.15$ to reflect the proportion of nurses choosing a rural-oriented specialty;
- $PT_p=0.40$ and $PT_u=0.35$ to reflect the fact that the new salary structure in the public sector makes urban posts almost as attractive as private positions;
- $PT_o=0.10$ to reflect the attractiveness of overseas positions after specialising, but accounting for the fact that the decision to emigrate still remains a minor option.

D. Turnover rates

In the absence of any observational data to identify the average retention rates of nurses in each of the four working states of the Markov model, turnover rates had to be approximated based on a series of information.

First, based on the standard theoretical framework and stylised facts on nursing turnover developed in the health care literature (Price, 1997, Tai et al., 1998, Antonazzo et al., 2003, Hayes et al., 2006), it was assumed that retention rates would be based on the evidence available on intentions to leave and job satisfaction (Hall, 2004, Uys et al., 2004, Walker and Gilson, 2004, Erasmus and Brevis, 2005, Penn-Kekana et al., 2005, Lephoko et al., 2006, Thutse, 2006, Xego, 2006, Klaas, 2007, Mavhandu-Mudzusi et al., 2007, Mokoka, 2007, Pillay, 2009), as well as what is known of the distribution of health personnel in South Africa at the time of the study:

- Working conditions are better in the private than the public sector (Pillay, 2009), so the probability of leaving one's job when working in the private sector will be lower than in the public sector (therefore the retention rate will be higher in private jobs);
- Working conditions are more difficult in rural areas than elsewhere, where health personnel are reportedly less supported and have to cope with more difficult working conditions

(shortage of drugs and medical supply). Therefore the lowest retention rates should probably be for rural posts.

- A limited number of studies report that foreign nurses working in Anglophone countries are faced with difficulties. There is also anecdotal evidence suggesting that nurses who have left South Africa stay overseas for a few years and then come back with better experience (Breier et al., 2009). Therefore the retention rate in foreign positions will not be very high.

The following inequality can therefore be hypothesised about the turnover rates on the four market segments:

$$T_r \geq T_u \geq T_o \geq T_p$$

Second, to anchor those values on some real estimates, some studies from the nursing literature quantifying retention rates were investigated (Jones, 1990, Gray and Phillips, 1994, Toyoshi-Hamada, 2007, Chen et al., 2008, Christmas, 2008, Karlowicz and Ternus, 2009). These studies report annual turnover rates, ranging from 7.5% to 54% in the public sector. Yet, due to the variety of time frames and definitions used, it was difficult to use any particular number[91]. Nonetheless, this suggests that at the very least, half of the personnel would remain in post every year.

As a first approximation, the following assumptions were formulated about the turnover rates on the four segments of the labour market for South African nurses:

$T_r = 0.20$

$T_u = \kappa_u * T_r$	with $\kappa_u = 0.90$	therefore $T_u = 0.18$	(1)
$T_o = \kappa_o * T_r$	with $\kappa_o = 0.85$	therefore $T_o = 0.17$	(2)
$T_p = \kappa_p * T_r$	with $\kappa_p = 0.75$	therefore $T_p = 0.15$	(3)

The equalities (1) to (3) linking the turnover rates to each other are assumed to remain constant over time (see the evolution of departure rates over time in Figure 8.5):

$$T_{ut} = \kappa_u * T_{rt}, \quad T_o = \kappa_o * T_r \quad \text{and} \quad T_p = \kappa_p * T_r$$

Assuming constant retention rates would not be justified, as empirical evidence from labour economics and other social sciences show that departure rates are a decreasing function of the years of experience (Borjas, 2005). In other words, health workers are more likely to leave a job when they are young. To model this effect, and avoid a crude linear trend, the probability of leaving each state over time can be modelled as a smoothed exponential function[92]:

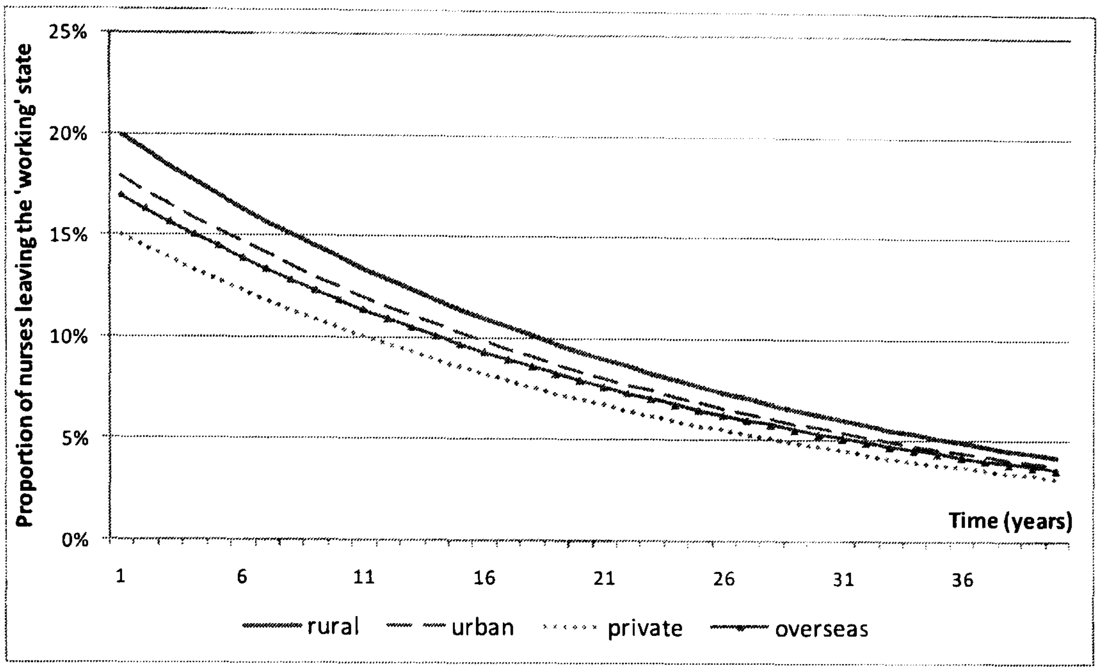
$$T_{rt} = \lambda e^{-\lambda^2 t}$$

[91] Some studies refer to the turnover rate without further definition; others report the resignation rate, or the leaving rate. Overall it is difficult to ensure that the statistics provided actually measure the same phenomenon.

[92] Squaring the parameter λ in the exponent provides a smoother effect.

with the parameter λ=0.2 defining the initial retention rate (for t=0),as defined above.

Figure 8.5: Evolution of turnover rates over time



E. Destination rates

The final parameters to be defined are the destination rates d_{ij} which determine the destination of nurses who leave their current working state for another working state.

According to the few reliable data available, only a small proportion of South African nurses choose to emigrate, as reflected by the low rate of emigration (1-2% of nurses every year). It is likely that this flow originates mainly from nurses coming from urban areas, most likely from the private sector (nurses dissatisfied with their jobs in the public sector would first try to take up a job in the private sector).

Furthermore, few nurses will decide to move to a position in rural areas when coming from any of the other three labour market segments if this choice was not made before, even less so for nurses returning from overseas – the only motive could be seeking a more rural lifestyle, or getting closer to one's family.

Finally, it is possible to assume that the majority of nurses leaving rural areas (and public positions) might first do so through internal promotion in the public sector. Joining the private sector, which would constitute a double change (in living and working environment), might come at a later stage.

This series of hypotheses led to broad assumptions on the 'destination matrix' presented in Table 8.2.

Table 8.2: Distribution across possible destinations of nurses who leave their current working state

Origin / Destination	Rural public	Urban public	Private	Overseas
Rural public	-	0.50	0.475	0.025
Urban public	0.20	-	0.75	0.05
Private	0.15	0.75	-	0.10
Overseas	0.05	0.10	0.85	-

F. Impact of policies on the model parameters

All model parameters presented above provided the structure of the base scenario, which was the situation modelling the current conditions in the labour market. This section explains why and how some parameters were modified under the new conditions defined by simulated policy interventions.

Impact of policies on initial probabilities

The first model parameter affected by the policy scenarios is the initial set of probabilities allocating nurses across the six states. As explained by the two-step decision-making model detailed in section 8.2.2, it is assumed that the initial breakdown between public and other jobs will not change (this hypothesis being made mainly because of lack of simultaneous data on all four labour market segments). Therefore, only the distribution between rural and urban jobs in the public sector will be affected by the change of working conditions conveyed by the new rural incentive policy.

This new breakdown in the public sector is provided by the predicted probabilities relative to the new working conditions of interest (i.e. the rural job description corresponding to the policy package simulated), based on the DCE presented at the beginning of this chapter.

Impact of policies on transition matrices

Making the rural positions more attractive for nurses is likely to affect other parameters than just the initial probabilities of taking up a position in a rural area. Hence two other types of parameters that would be affected to reflect a greater attractiveness of rural public jobs:

- The willingness of nurses to leave their current positions to take up a position in a rural area could increase;

- The retention rate of in rural positions could increase (or the turnover rate decrease).

To simplify the model, the greater attractiveness of rural positions is assumed to only impact initial choices. In other words, if a nurse is not sensitive initially to the incentive package, there is no reason to be more attracted later. Therefore one assumes that the destination matrix established in Table 8.2 will remain unaffected by the various policy scenarios.

However, the policies are likely to affect the propensity of nurses who chose to take up rural positions to stay in these rural positions. Because rural jobs are more attractive, it is reasonable to assume that, *ceteris paribus*, nurses will be less likely to leave. The increased attractiveness of the rural job is measured by the change in the proportion of nurses who initially take up rural positions, denoted τ. Therefore, a simple modelling of changes in turnover rate over time could be:

$$T'_{rt} = (1 - \tau)\, T_{rt}$$

where τ is the policy effect, so that if the policy increases the initial probability of choosing rural areas by 50%, the turnover rate will be reduced by the same amount for each cycle. But this model is rather crude, because it assumes that the effect would be constant over time (while the benefits of the policy might seem less attractive after they have been in place for a few years).

A more sophisticated option consists in modelling smoother effects, decreasing over time. Such effects can be modelled easily as follows:

$$T'_{rt} = T_{rt} \times \left(1 - \tau^{\left(1+\frac{t}{5}\right)}\right)$$

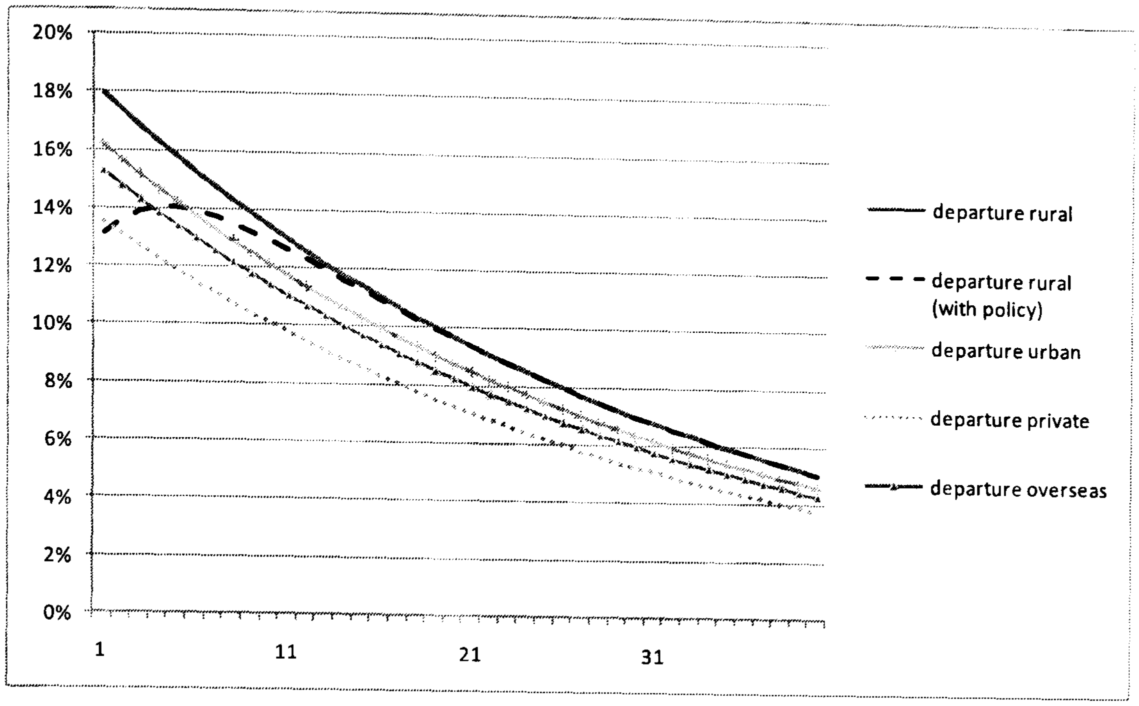
Where the exponentiated term $\left(1 + \frac{t}{5}\right)$ introduces the desired smoothed effect (see Figure 8.6).

This modelling leaves one problem, arising when $\tau > 1$. In order to solve that issue, it is possible to rescale all the policy effects on an index comprised between 0 and 1. This is achieved by the following transformation of a given policy effect τ_s for scenario S:

$$\tau'_s = \frac{\tau_s}{\left(\max\limits_i \tau_i + \varepsilon\right)}$$

where $(\max_i \tau_i)$ ensures that all policy effects are rescaled according to the one policy that has the biggest effect. The additional term ε is introduced to avoid having values of the recalibrated policy effects τ' too close to 1. Indeed, the closer τ' is to 1, the stronger the hysteresis effect on the turnover rate (see Appendix 8.2 for an illustration). Therefore, here ε was set to ε=0.5.

Figure 8.6: Impact of a policy intervention on rural turnover rates



Note: For a given distribution of the propensity of leaving over time (base curves), the graph represents the effects in rural areas of a policy that increases initial uptake of rural jobs by τ=0.73, transformed into τ'=0.33

Impact of policies on the decision of nurses to specialise

The last parameter that is likely to be affected by some policies is the proportion of nurses who decide to specialise. The decision to specialise is unlikely to be affected by most policy packages. For example, there is no reason why the provision of better housing would increase the willingness to specialise. Moreover, given that specialising relies on the availability of study leave[93] only new structural conditions guaranteeing access to study leave (sooner or not) can affect the proportion of nurses who specialise.

Therefore, only the policy packages that entail an "education component" guaranteeing study leave after two years in rural positions should see an increase in training uptake. It is assumed that the majority of nurses who choose rural positions with these education incentives do so to benefit from the training opportunity. It is thus assumed that the additional nurses who want to specialise after two years (in the education scenario compared to the baseline scenario) will equal the difference in the number of nurses who initially choose a rural career in the education scenario and the corresponding figure in the base scenario. Formally, if $N_r(S)$ denotes the number of nurses initially choosing a rural post under the conditions offered by scenario S, then

[93] The vast majority of nurses coming from the public sector specialise only when they are offered study leave (due to lack of financial resources), as resigning from one's position and specialising with one's own resources is exceptional for nurses from the public sector. This represents probably less than 1% of all post-basic students according to the person in charge of training in a Gauteng nursing college.

for a given education package E there is an additional $\mathrm{N_T}$ nurses who will specialise, with $\mathrm{N_T}$ defined as follows:

$$\mathrm{N_T} = \theta\ (\mathrm{N}_r(E) - \mathrm{N}_r\ (B))$$

where θ is an adjustment factor accounting for the fact that not all nurses will eventually want to specialise or not all will obtain study leave. Assume for the time being that θ=0.85.

G. Summary of parameters

Table 8.3 summarises the assumptions made about each parameters, and recapitulates the value of some of the fixed parameters in the functions used.

Table 8.3: Summary of all parameters used in the Markov model

Name	Description	Varying parameter or function	Set parameters
	Initial distribution rates		
N_p	Number of nurses choosing the private sector	N_p=N x P_1	N=2000
N_o	Number of nurses choosing overseas	N_o=N x P_2	P_1=0.28 and P_2= 0.12 (from Table 6.13)
N_r	Number of nurses choosing the rural public sector	N_r=N x (1-P_1-P_2) x P_r	P_r and P_u are found in Table 7.5, and vary according to policy scenarios
N_u	Number of nurses choosing the urban public sector	N_u=N x (1-P_1-P_2) x P_u	
	Exit rate		
E_t	Proportion of nurses who die/retire/quit nursing	$E_t = e^{-\Lambda t}$	Λ =0.0025
	Training uptake rates		
TU_{ut}	Training uptake in urban areas	$TU_{ut} = \eta . \phi\left[\ln\left(\frac{t-1}{4}\right)\right] \ \forall t > 1$	$TU_{u0} = TU_{u1} = 0$ η=0.4 $\phi(X) \sim \mathcal{N}(\mu,\sigma)$ with μ=0 , σ=0.7
TU_{rt}	Training uptake in rural areas	$TU_{rt} = \gamma\ TU_{ut}\ \forall t > 1$	$TU_{r0} = TU_{r1} = 0$ γ =0.5
	Post-Training destination rates		
PT_r	Proportion of nurses choosing the private sector	-	PT_r = 0.15
PT_u	Proportion of nurses choosing overseas	-	PT_u = 0.35
PT_p	Proportion of nurses choosing the rural public sector	-	PT_p = 0.40
PT_o	Proportion of nurses choosing the urban public sector	-	PT_o = 0.10
	Turnover rates		
T_{rt}	Turnover rate in the rural public sector	$T_{rt} = \lambda e^{-\lambda^2 t}$	λ =0.2
T_{ut}	Turnover rate in the urban public sector	$T_{ut} = \kappa_u * T_{rt}$	κ_u =0.90
T_{pt}	Turnover rate in the private sector	$T_{ot} = \kappa_o * T_{rt}$	κ_o =0.85
T_{ot}	Turnover rate in overseas posts	$T_{pt} = \kappa_p * T_{rt}$	κ_p =0.75
	Destination rates from the rural public state		
d_{ru}	Proportion of nurses leaving rural for urban posts	-	d_{ru} =0.50
d_{rp}	Proportion of nurses leaving rural for private posts	-	d_{rp} =0.475
d_{ro}	Proportion of nurses leaving rural for overseas posts	-	d_{ro} =0.025

	Destination rates from the urban public state		
d_{ur}	Proportion of nurses leaving urban for rural posts	-	$d_{ur}=0.20$
d_{up}	Proportion of nurses leaving urban for private posts	-	$d_{up}=0.75$
d_{uo}	Proportion of nurses leaving urban for overseas posts	-	$d_{uo}=0.05$
	Destination rates from the private state		
d_{pr}	Proportion of nurses leaving private for rural posts	-	$d_{pr}=0.15$
d_{pu}	Proportion of nurses leaving private for urban posts	-	$d_{pu}=0.75$
d_{po}	Proportion of nurses leaving private for overseas posts	-	$d_{po}=0.10$
	Destination rates from the overseas state		
d_{or}	Proportion of nurses leaving overseas for rural posts	-	$d_{or}=0.05$
d_{ou}	Proportion of nurses leaving overseas for urban posts	-	$d_{ou}=0.10$
d_{op}	Proportion of nurses leaving overseas for private posts	-	$d_{op}=0.85$
	Impact of policies		
τ_s	Increase in the proportion of nurses in rural areas in scenario s	$\tau_s = \frac{P_r^S - P_r^B}{P_r^B}$	
T_{rt}^S	New turnover rate in rural areas in scenario s	$T_{rt}^S = T_{rt}\left[1 - \tau_S'^{\left(1+\frac{t}{5}\right)}\right]$	$\tau_s' = \frac{\tau_s}{\max_i \tau_i + \varepsilon}$
ε	Adjustment factor to policy effect on turnover rate		ε = 0.5
θ	Proportion of additional nurses who will specialise		θ = 0.9

8.2.4. Model outputs

A. Flows vs. stocks of nurses

By definition, a Markov model forecasts the dynamics over time of a *cohort* of individuals, who can move through a defined number of states. If the predictions of such a model provide essential insights into the trickling-down effects of policies over the career of nurses, they do not give a clear picture of the likely equilibrium in the labour market. In other words, in addition to showing the career paths of a cohort of nursing graduates, one needs to predict the cumulative effects of the simulated policies by modelling a series of subsequent cohorts of graduating nurses, in order to obtain the long-term distributional effects of the policies in the labour market.

Here the (strong) underlying assumption is that all graduating cohorts starting after the implementation of the policy reforms will be affected in exactly the same manner by the policies.

In terms of modelling, this simply means that, to obtain the number of nurses who will be working in a particular state on a given year T, one needs to calculate the cumulative sum of the annual stocks of nurses as follows:

$$\mathcal{N}_T = \sum_{t=0}^{T} N_t$$

where N_t is the number of nurses predicted to be in the state of interest during cycle *t* of the Markov model.

For example, after 3 years, three cohorts will have started: the first year, there are N_0 nurses (from cohort 1) in rural areas, the second year there are N_0 (from cohort 2) and N_1 (from cohort 1) nurses in rural areas; and the third year there are N_0 (from cohort 3) N_1 (from cohort 2) and N_2 nurses (from cohort 1) overall in rural areas.

Given that the Markov model was originally defined with a 40 year horizon, the distribution of stocks of nurses across the different labour segments will be calculated for T=40, or 40 cohorts that will have started working. All 4o simulated cohorts were set up to 2,000 nurses, which correspondents to a small increase in the current production of the South African education system.

Finally, it should be noted that headcounts were used as outcome measures, not only because they were the obvious outputs of the models, but also because part-time work does not appear to be a relevant option in rural areas (where moonlighting is typically not possible due to the absence of private sector). Therefore using alternative measures such as Full-Time Equivalent would not have made sense.

B. Distribution of nurses in the health sector

In this chapter the objective is to understand the impact of policies on the distribution of the nursing workforce between the different segments of the labour market. Various dimensions are interesting in this respect:

- The distribution of South African nurses across all four main career opportunities: overseas (N_o) , private sector in South Africa(N_p), in public rural positions (N_r) and in public urban positions (N_u);
- The breakdown of the nursing workforce in the domestic labour market between the private sector (N_p), the public sector in rural areas (N_r) and the public sector in urban areas (N_u);
- The rural (N_r) vs. urban divide (N_p+N_u) within South Africa;
- The private (N_p) vs. public divide (N_r+N_u) in the domestic labour market

Therefore, the outcomes of interest of the Markov model will be the number of nurses in each of the four labour market segments.

In addition, in order to capture the short-term and long-term effects of policy interventions, these measures are done at regular intervals in time:

N_{rt}, N_{ut}, N_{ot} and N_{pt} for $t \in [0;5;10;15;20;25;30;35;40]$.

C. Probabilistic Sensitivity analysis

Since a large number of assumptions were made to construct the Markov model, it is necessary to account for the uncertainty around the model parameters. The probabilistic sensitivity analysis (PSA) used here is concerned with parameter uncertainty only. This means that structural uncertainty, which relates to the assumptions imposed by the modelling framework presented here, is not accounted for. This PSA also treats the data as homogeneous, meaning that it does not account for heterogeneity in individuals' preferences and parameters. However, computing the results of a particular sub-group in the population (individuals with rural backgrounds) provides some insight into heterogeneity of results.

To account for parameter uncertainty, the PSA follows standard assumptions to reflect the possible distribution of parameters, while accounting for probability constraints emerging from the model structure. Table 8.4 below summarises the different parameters accounted for in the PSA as well as the assumptions made.

Table 8.4: **Summary of parameter distributions used in the probabilistic sensitivity analysis**

Name	Description	Parameter value	Distribution in the PSA
	Initial distribution rates		
P_p	Proportion of nurses choosing the private sector	$P_p = 0.36$	
P_o	Proportion of nurses choosing overseas	$P_o = 0.08$	Dirichlet distribution
P_{PU}	Proportion of nurses choosing the public sector	$P_{PU} = 0.56$	
P_r	Proportion of nurses choosing the rural public sector	P_r varies for each scenario	Beta distribution
P_u	Proportion of nurses choosing the urban public sector	$P_u = 1 - P_r$	
	Exit rate		
E_t	Proportion of nurses who die/retire/quit nursing	$\Lambda = 0.0025$	Beta distribution
	Training uptake rates		
TU_{ut}	Training uptake in urban areas	$\eta = 0.4$	Beta distribution
		$\sigma = 0.7$	Beta distribution
TU_{rt}	Training uptake in rural areas as a proportion of urban training uptake	$\gamma = 0.5$	Beta distribution
	Post-Training destination rates		
PT_r	Proportion of nurses choosing the private sector	$PT_r = 0.15$	
PT_u	Proportion of nurses choosing overseas	$PT_u = 0.35$	Dirichlet distribution
PT_p	Proportion of nurses choosing the rural public sector	$PT_p = 0.40$	
PT_o	Proportion of nurses choosing the urban public sector	$PT_o = 0.10$	
	Turnover rates		
T_{rt}	Turnover rate in the rural public sector	$\lambda = 0.2$	Beta distribution
T_{ut}	Turnover rate in the urban public sector	$\kappa_u = 0.90$	Beta distribution
T_{pt}	Turnover rate in the private sector	$\kappa_o = 0.85$	Beta distribution
T_{ot}	Turnover rate in overseas posts	$\kappa_p = 0.75$	Beta distribution
	Destination rates from the rural public state		
d_{ru}	Proportion of nurses leaving rural for urban posts	$d_{ru} = 0.50$	Dirichlet distribution

d_{rp}	Proportion of nurses leaving rural for private posts	$d_{rp}=0.475$	
d_{ro}	Proportion of nurses leaving rural for overseas posts	$d_{ro}=0.025$	
	Destination rates from the urban public state		
d_{ur}	Proportion of nurses leaving urban for rural posts	$d_{ur}=0.20$	
d_{up}	Proportion of nurses leaving urban for private posts	$d_{up}=0.75$	Dirichlet distribution
d_{uo}	Proportion of nurses leaving urban for overseas posts	$d_{uo}=0.05$	
	Destination rates from the private state		
d_{pr}	Proportion of nurses leaving private for rural posts	$d_{pr}=0.15$	
d_{pu}	Proportion of nurses leaving private for urban posts	$d_{pu}=0.75$	Dirichlet distribution
d_{po}	Proportion of nurses leaving private for overseas posts	$d_{po}=0.10$	
	Destination rates from the overseas state		
d_{or}	Proportion of nurses leaving overseas for rural posts	$d_{or}=0.05$	
d_{ou}	Proportion of nurses leaving overseas for urban posts	$d_{ou}=0.10$	Dirichlet distribution
d_{op}	Proportion of nurses leaving overseas for private posts	$d_{op}=0.85$	
	Impact of policies		
θ	Proportion of additional nurses who will specialise	$\theta = 0.9$	Beta distribution

Two types of parameter distribution are used:

- Beta distributions for binomial data. This applies to any parameter that estimates the probability of a given event to occur (e.g. the probability of leaving a rural job each year). The parameter which is assumed to be equal to a given proportion p* can then be drawn from a beta distribution beta (α,β) where α=p* and β=1- p*.
- Dirichlet distributions for multinomial data. This distribution is used to model interdependent probabilities that model more than two events. Typically, transition probabilities that model the destination of a given group of individuals are such parameters. The Dirichlet distribution, which is a generalisation of the beta distribution, is then used to model these parameters (Briggs et al., 2006).

All the results below represent the average outputs obtained from the 2,000 Monte-Carlo replications based on a random draw of each of the parameter in the model.

8.3. Results

8.3.1. Dynamics of nurses' career paths

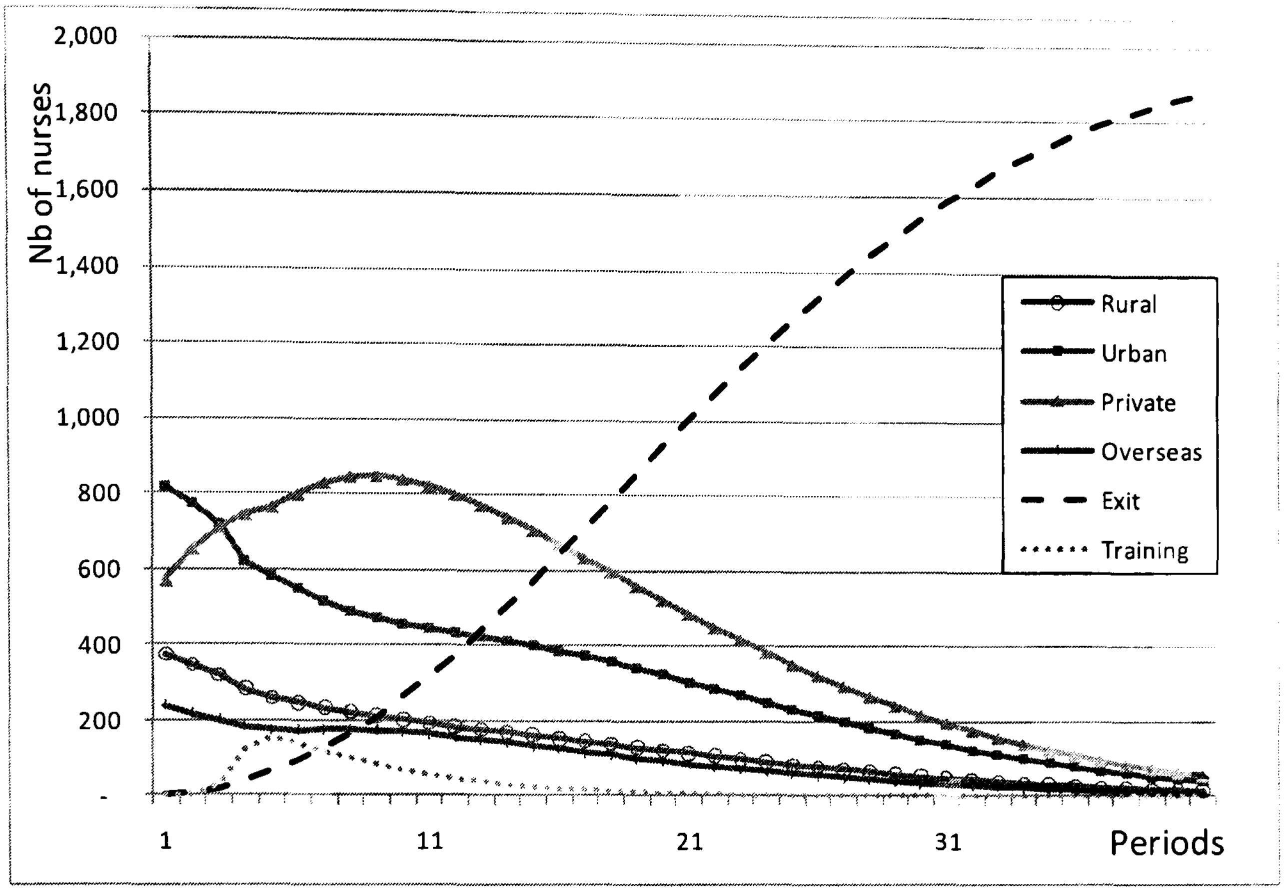
The following results describe the output of the Markov model projecting the distribution over time of nurses under the current working situation (with the target values of all parameters). These are important to understand as they provide the structural elements of the model. First the dynamic of a single cohort is described, and then the cumulative effects of 40 stacked cohorts are detailed.

A. Dynamics for one cohort

Figure 8.7 below provides a detailed account of the distribution of individuals across the six states of the model over the simulated 40 periods. Because some of the model parameters were calibrated to obtain the results below (e.g. the training uptake profile or the exit rate[94]), these results do not contain 'new' information. Yet, to understand the structure of the model, it is interesting to unpack the dynamics of the nursing workforce in each of the working states.

[94] In particular, the exit rate was adjusted so that at the end of the 40 time periods, less than 10% of nurses would still be on the nursing labour market.

Figure 8.7: Career paths of a cohort of nurses under baseline conditions

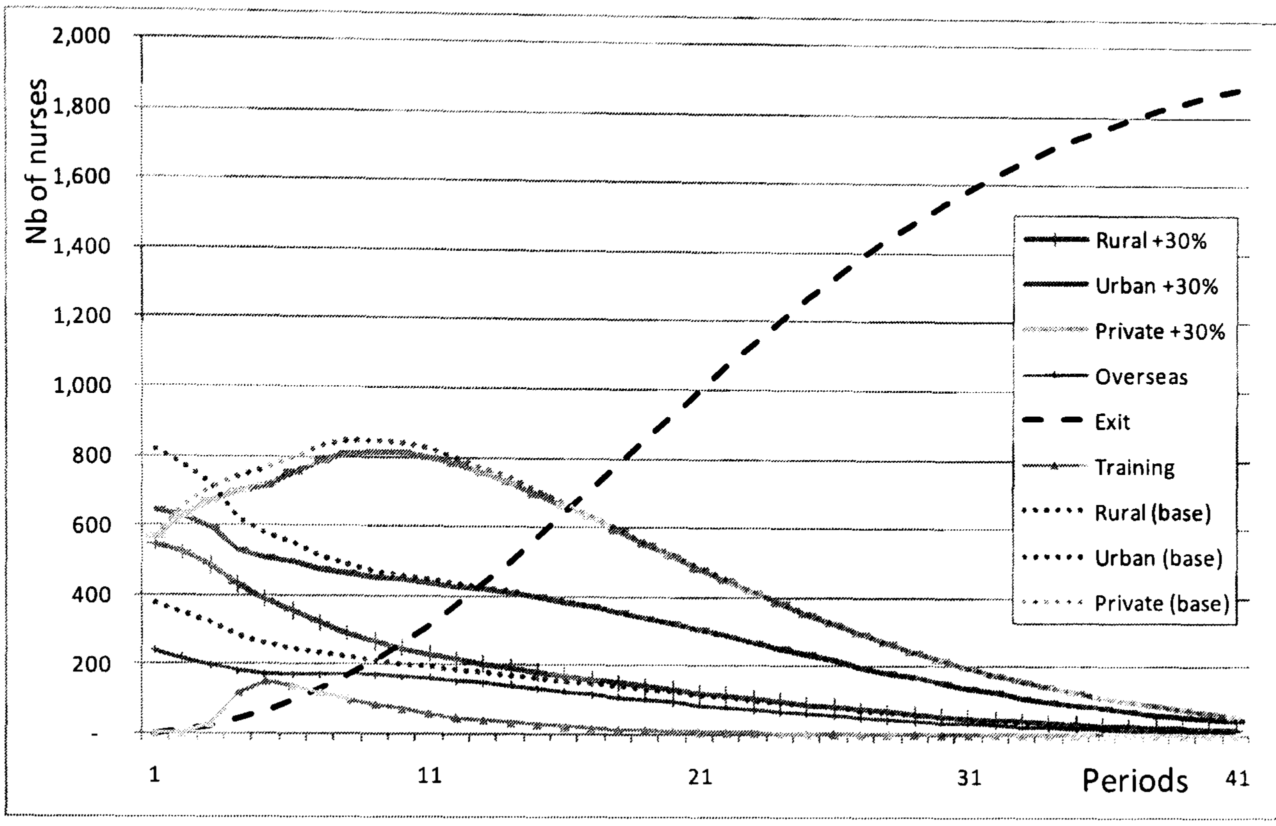


Three trends emerge. First, all working states except the private sector have their maximum number of nurses at the beginning of the period. This reflects the influence of the high turnover rates, and that the flow of leavers is not compensated by a higher flow of entrants (except in the private sector until the 8th period). Second, there is a sharper decrease in the number of nurses in rural and urban areas in the public sector around the 3rd period, induced by the uptake of specialised training. Third, this sharp outflow of nurses from rural and urban areas seems to feed into the private sector, as the number of nurses rises in this sector soon after the observed decrease in the public sector.

These dynamics suggest that if the assumptions about turnover rates are correct, it is important to try and attract as many nurses as possible immediately after their graduation. Indeed, the long-term dynamics suggest that there is no gain in the long run for rural areas, as outflows systematically dominates inflows.

This effect is confirmed by Figure 8.8, which shows the same dynamics for a cohort of nurses who were offered a salary top-up of 30% for rural posts, compared to the baseline situation (represented in dotted lines for the three domestic job opportunities). Despite the short-term effects in the distribution of nurses (the proportion of nurses choosing rural posts increases from 18.7% under 'normal' conditions to 27.4%), the graph shows that the increase in the presence of nurses in rural areas almost reverts back to the "baseline" situation after about 15 years. This derives from the model assumption that turnover rates are initially lower in rural areas for some time (due to the policy effect modelled), and then gradually return to their baseline levels.

Figure 8.8: Career paths of a cohort of nurses, when a 30% rural allowance is offered



The graph also displays the crowding-out effect of rural incentives on the uptake of public urban posts. This dynamic, particularly salient at the beginning of the model, is a direct consequence of the structure of the Markov model (which assumes an independence between choosing public jobs or not). In contrast, the crowding out effect that is observed on the uptake of private jobs is an indirect effect of rural incentives, as it is a consequence of the lower attractiveness of urban positions (fewer nurses in urban posts leaving their public jobs for private ones).

B. Dynamics for forty cohorts

As noted before, a cohort fails to provide an adequate perspective on the equilibrium of the labour market. This is obtained through the analysis of the cumulated effects of successive (identical) cohorts of nurses. Figure 8.9 presents this result for the base model, the long-term equilibrium in the labour market, through a graphic presentation of the distribution of nurses across the six states of the Markov model over time. This graph underlines the importance of anticipating the long-term effects of attrition of the nursing workforce due to voluntary or involuntary exit from the nursing profession. It also provides some clearer vision of the long-term imbalance between the different working states. Based on this output, it is possible to calculate the distribution of new nurses trained in South African across the four main employers (see Figure 8.10).

Figure 8.9: Distribution of nurses from 40 successive cohorts in the different states of the Markov model

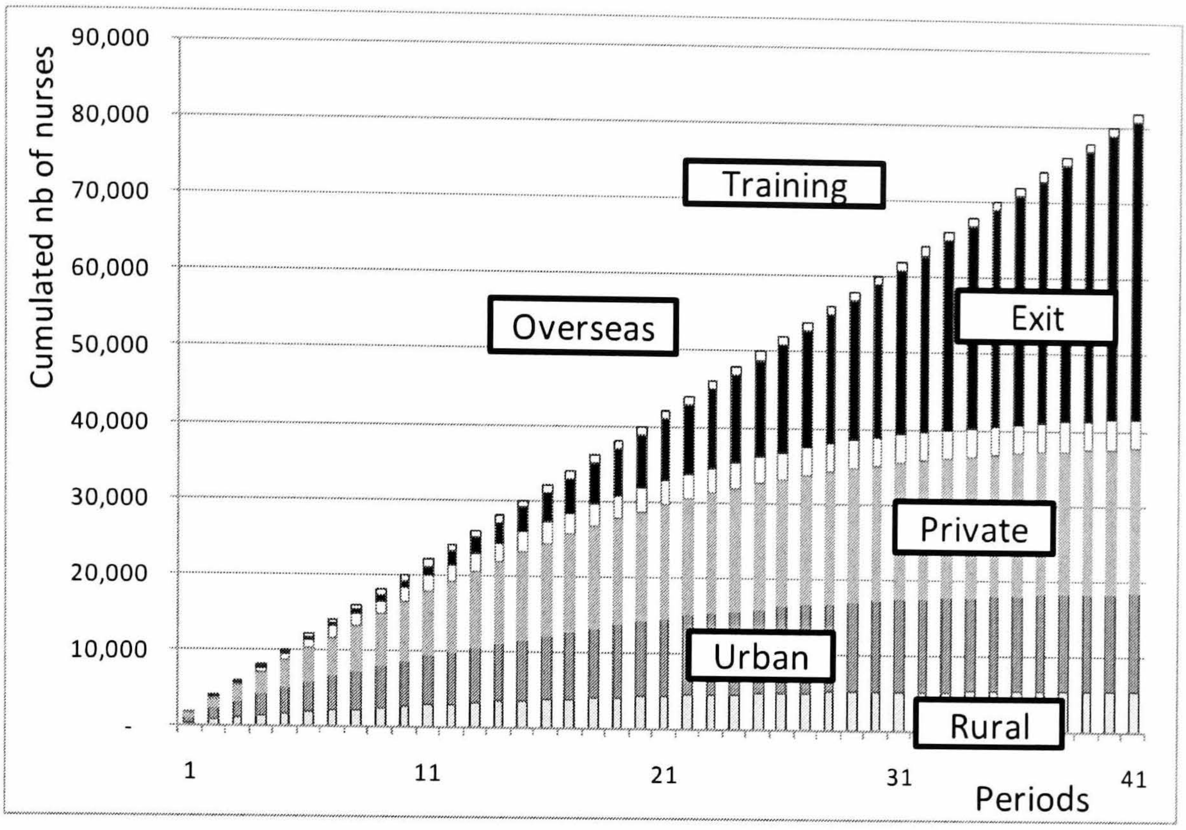


Figure 8.10: Distribution of nurses in the international labour market

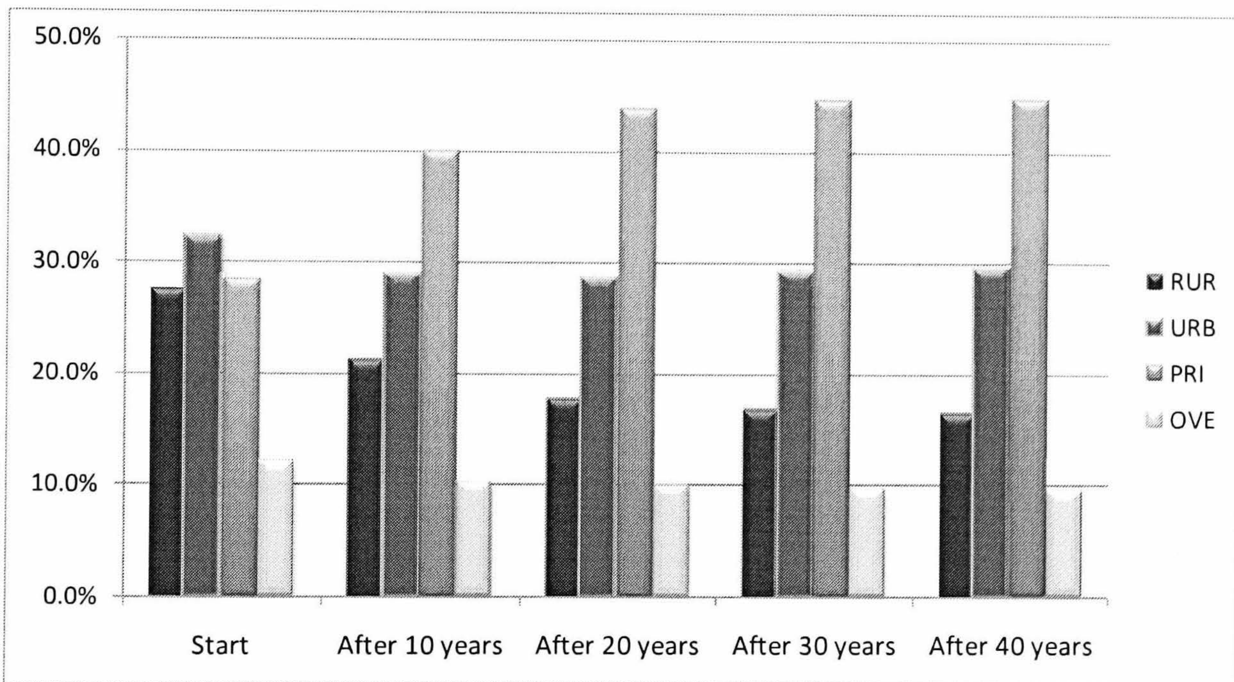


Figure 8.10 indicates that after 40 years of producing successive generations of nurses who respond in the same fashion to the job offers[95], the majority of working nurses are in the private sector (46%), followed by the public sector in urban areas (31.4%), in public areas (about 13%) and lastly overseas positions (9.5%). This result contrasts with the initial distribution of nurses at

[95] Under baseline conditions.

the beginning of the model, where nurses were almost equally distributed between the three domestic options.

Similar outcomes can be computed for each policy, putting the results of the DCE presented in the last chapter into the broader context of the labour market.

8.3.2. Effects of rural incentives in the broader labour market context

The first advantage of building the Markov model is that it places the policy levers into the broader context of the labour market dynamics. Table 8.5 shows the distribution of nurses in the labour market immediately after the implementation of various policies. Compared to the results presented in the previous chapter, the policy levers attract fewer nurses to rural areas since the modelling here takes into account other job opportunities (private or overseas positions). The most effective policy only increases the proportion of nurses in rural posts up to 39.3% (in the domestic labour market), and ten out of 19 policies increase that proportion to more than 30%. The identical proportions of nurses in private and overseas jobs underline the assumption made in the model that public and private career choices are independent (see Figure 8.2). Otherwise, the results concur with previous results: the most effective policies are the packages that include study leave and salary increases.

Table 8.5: Average distribution of nurses immediately after policy implementation, ranked in ascending order of rural post uptake

Policy ID	Rural incentives	Domestic market			International market			
		Rural	Urban	Private	Rural	Urban	Private	Overseas
Base	Base scenario (no incentive)	21.22%	46.45%	32.32%	18.69%	40.90%	28.46%	11.95%
#1	Promoted after 1 year in post	21.62%	46.05%	32.32%	19.04%	40.55%	28.46%	11.95%
#2	2-bedroom house	22.69%	44.99%	32.32%	19.98%	39.61%	28.46%	11.95%
#3	Car allowance of R500/month	25.47%	42.21%	32.32%	22.43%	37.16%	28.46%	11.95%
#4	Quick promotion + car allowance	25.91%	41.76%	32.32%	22.82%	36.77%	28.46%	11.95%
#5	Better housing + car allowance	27.18%	40.50%	32.32%	23.93%	35.66%	28.46%	11.95%
#6	10% rural allowance	27.21%	40.47%	32.32%	23.96%	35.63%	28.46%	11.95%
#7	Quick promotion + 10% salary increase	27.67%	40.01%	32.32%	24.36%	35.23%	28.46%	11.95%
#8	Study leave in 2 years	28.49%	39.18%	32.32%	25.09%	34.50%	28.46%	11.95%
#9	20% rural allowance	29.57%	38.10%	32.32%	26.04%	33.55%	28.46%	11.95%
#10	Quick promotion + 20% salary increase	30.00%	37.68%	32.32%	26.42%	33.17%	28.46%	11.95%
#11	30% rural allowance	31.08%	36.59%	32.32%	27.37%	32.22%	28.46%	11.95%
#12	10% salary increase + car allowance	31.64%	36.03%	32.32%	27.86%	31.73%	28.46%	11.95%
#13	Better housing + car all. + 10% increase	33.23%	34.44%	32.32%	29.26%	30.33%	28.46%	11.95%
#14	20% salary increase + car allowance	33.64%	34.04%	32.32%	29.62%	29.97%	28.46%	11.95%
#15	Study leave soon + car allowance	34.17%	33.50%	32.32%	30.09%	29.50%	28.46%	11.95%
#16	Better housing + car all. + 20% increase	35.05%	32.62%	32.32%	30.86%	28.73%	28.46%	11.95%
#17	Study leave soon + 10% increase	36.13%	31.55%	32.32%	31.81%	27.78%	28.46%	11.95%
#18	Study leave soon + 10% increase + car all.	37.74%	29.94%	32.32%	33.23%	26.36%	28.46%	11.95%
#19	Study leave soon + 20% increase	39.29%	28.38%	32.32%	34.60%	24.99%	28.46%	11.95%

Note: results obtained from 2,000 Monte-Carlo simulations.

8.3.3. Long-term effects of policy interventions

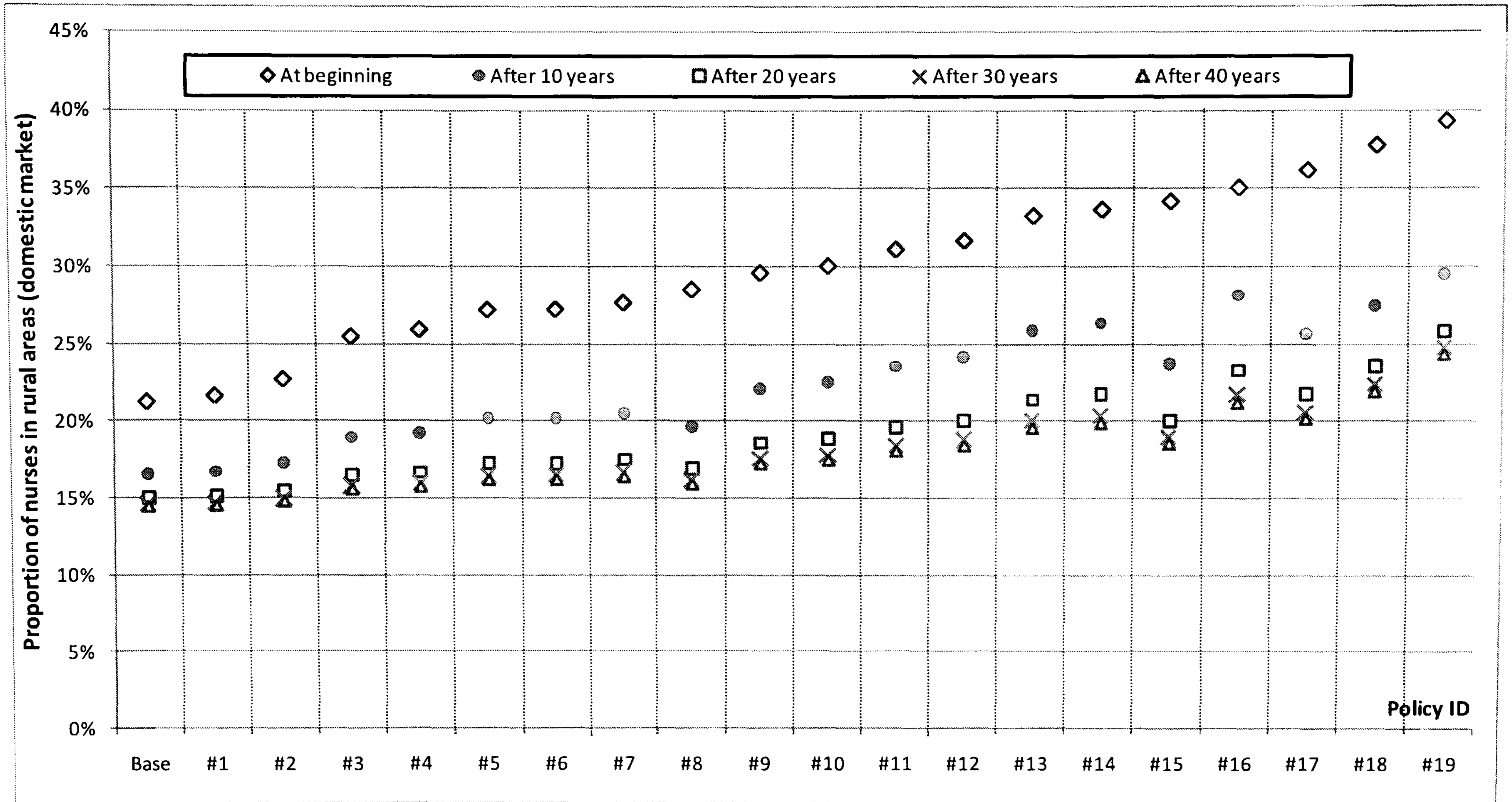
This section presents the main expected output from the Markov model: the long-term effects of HR policies.

A. Downstream interventions

The results of the effects of downstream interventions over time (with the cumulative effect of cohorts) are summarised in Figure 8.11, which shows the proportion of nurses in the domestic labour market who are in post in rural areas (all data can be found in Appendix 8.3).

Three facts emerge from the results summarised by Figure 8.11.
First, time erodes the positive effects of policy interventions. For all nineteen policy interventions (and the base scenario) the proportion of nurses present in rural areas decreases over time.
Second, the hierarchy in policy effectiveness changes over time. In particular, if education policies are particularly effective at the beginning of the cycle, they are less effective in the long run. This is a consequence of the adverse effects of education policies. Indeed, although new graduates are attracted in rural areas, once they obtain their study leave and specialise, the majority are likely to move away from rural areas and take up positions in urban areas or in the private sector (see section 8.2.3.C in this chapter on the post-training destination rates).
Third, although there are some clear differences in the policy effects in the short run (there are 17.7 percentage points of difference between the least and most effective policies at the beginning), these disparities are less important in the long run (the same gap is only of 9.8 percentage points).

Figure 8.11: Proportion of nurses in rural jobs in the domestic labour market, at 10-year intervals, for the 19 simulated policies



Note: refer to Table 8.5 for a detailed explanation of what each policy ID corresponds to.

B. Upstream interventions

Similar results can be computed for upstream policy interventions, which involve intervening before the entry of nurses on the labour market, here through the selection of more graduate nurses likely to choose rural posts (see Chapters 2 and 7).

The modelling of upstream interventions hinges on a change in the initial distribution of nurses across the four states of the model. The new distributions are obtained by running new simulations with both DCEs with a sub-sample of the population, as explained in section 7.3.3.B[96].

Table 8.6: Average distributions of nurses in the labour market with different population structures (under current circumstances), with cumulated cohorts

	Rural	Urban	Private	Overseas
Original sample (46.9% rural)				
Initial distribution	18.69%	40.90%	28.46%	11.95%
Distribution after 10 years	14.83%	32.98%	41.83%	10.36%
Distribution after 20 years	13.45%	31.14%	45.42%	10.00%
Distribution after 30 years	13.12%	31.26%	45.95%	9.67%
Distribution after 40 years	13.04%	31.40%	46.02%	9.54%
Sample #3 (75% rural)				
Initial distribution	22.71%	36.93%	28.20%	12.16%
Distribution after 10 years	16.53%	31.52%	41.51%	10.44%
Distribution after 20 years	14.47%	30.29%	45.20%	10.04%
Distribution after 30 years	13.96%	30.56%	45.76%	9.71%
Distribution after 40 years	13.83%	30.75%	45.85%	9.57%
Sample #4 (100% rural)				
Initial distribution	26.16%	33.56%	28.13%	12.15%
Distribution after 10 years	18.00%	30.30%	41.30%	10.40%
Distribution after 20 years	15.35%	29.59%	45.05%	10.01%
Distribution after 30 years	14.69%	29.99%	45.64%	9.68%
Distribution after 40 years	14.51%	30.21%	45.73%	9.55%

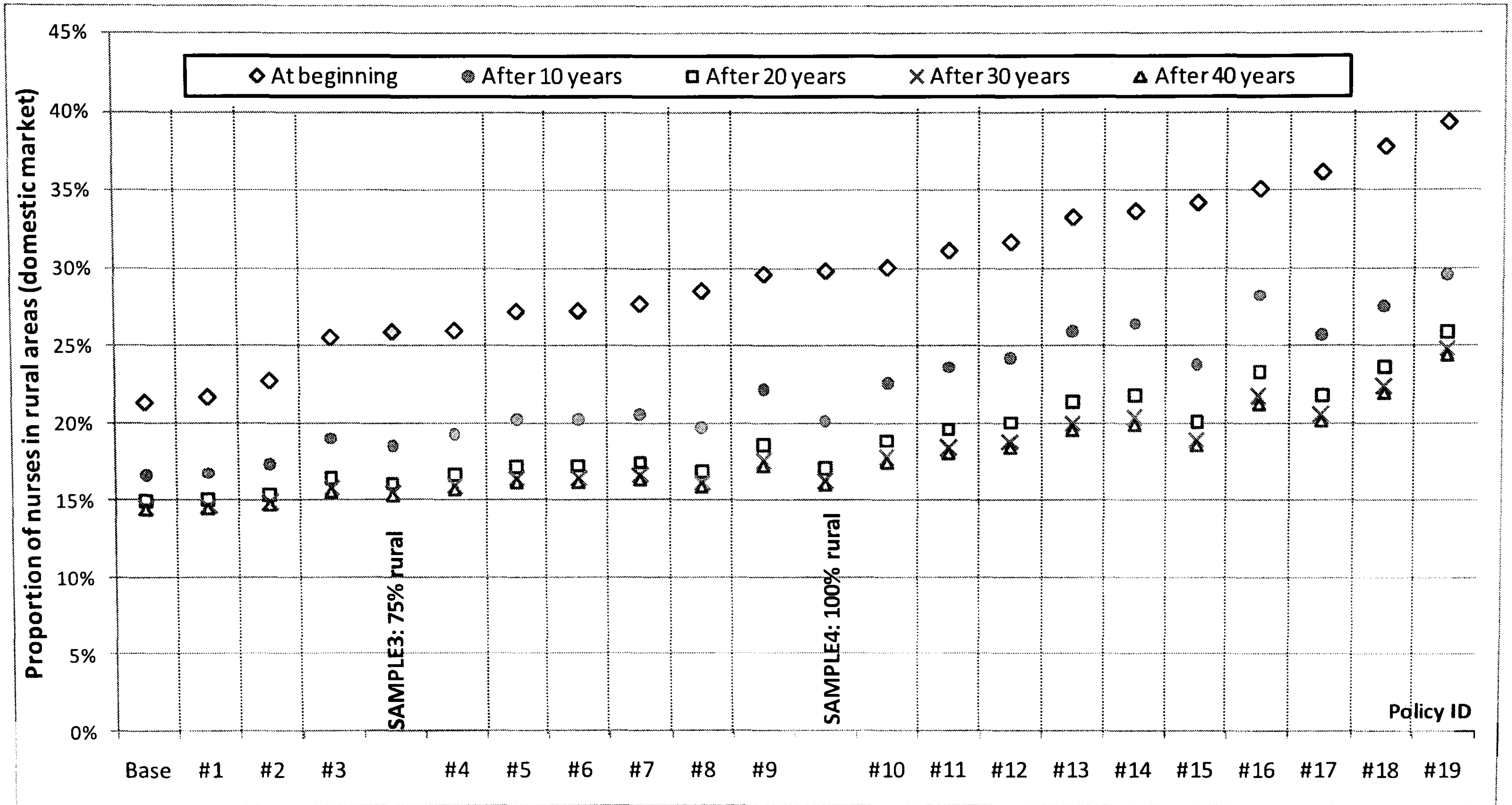
Note: average results obtained from 2,000 Monte-Carlo simulations

As expected, the results in Table 8.6 indicate that selecting more individuals from rural backgrounds increases the proportion of nurses in rural areas in the short run as seen in Chapter 7, but also in the long run, although that benefit decreases with time. There would be an increase by 4 percentage points in the uptake of rural posts if 75% of nurses were from rural origins (that increase drops to less than 1 percentage point after 30 years).

[96] Simulations of the "policy" DCE for each sub-sample are found in Chapter 7. Simulations for the "labour market" DCE (presented in Chapter 6) with different population structures can be found in Appendix 8.4.

Interestingly, increasing the proportion of rural nurses from about 50% (the current proportion in the sample) to 75% is a more effective way to increase the number of nurses in rural areas after 10 years than offering a car allowance a better housing or a quicker promotion (see Figure 8.12). Similarly, selecting only individuals from rural backgrounds is more effective than many incentives, including offering study leave sooner. This suggests that upstream measures could be effective to increase the number of rural nurses. This point will be discussed further in the next chapter.

Figure 8.12: Proportion of nurses in rural jobs in the domestic labour market, at 10-year intervals, for the 19 downstream policies and two upstream policies



Note: refer to Table 8.5 for a detailed explanation of what each policy ID corresponds to.

8.4. Discussion

8.4.1. Summary and discussion of the results

This chapter presented an innovative use of Markov models that was built upon the predicted probabilities of two choice experiments to infer the long-term effects of policy interventions in the labour market, accounting for the movements of individuals from one sector to another. The objective of the chapter was to build the model in detail and reflect on the methodology, rather than scrutinise the comparative strengths of the different interventions. However a few results emerge from the model.

Overall, the modelling of policy interventions underline the importance of considering long-term effects as well as immediate ones, to account for potential adverse effects. First, the effects of policy interventions to attract staff to rural areas wane over time. Due to movements across sectors, and in particular the low retention of staff in rural areas hypothesised in the model, most positive effects disappear after ten years after initiation of the policy. As a result of this erosion effect, the ranking of policy options according to their effectiveness evolves over time. For example, if education policies are particularly effective at the beginning of the cycle, they are less effective in the long run. Similarly, the absolute difference in effectiveness between alternative policy options diminishes over time. In the few results presented, although their effects decrease over time, salary increases and education opportunities are the most effective options to increase the number of nurses in rural posts. The results also show that some upstream interventions (selecting more individuals from rural areas) are more effective that other simple downstream incentives.

This is the first study in the health care literature that tries to predict the effects of different HR interventions on the uptake of rural jobs, but also on the distribution of health workers between different sectors over time. If some DCE studies have been able to comment on the likely effect of policy interventions to increase the uptake of rural positions (Blaauw et al., 2010, Kolstad, 2010), there are too many differences to compare their results to this study. First, unlike the work presented here, these two DCE studies have not taken into account the impact of other job opportunities available in the labour market, thereby over-estimating the uptake of rural posts. Second, the other major contribution of this work is to have used a (series of aggregated) Markov model to assess the effects of policy interventions on the distribution of health workers between different sectors *over time*. To summarise, the modelling presented in this chapter proposes a novel use of stated preference outputs, as it seeks to extend the simulation capacity of these tools to inform the long-term effects of policy interventions in the labour market.

By computing the movements of health personnel in the short and long-term, Markov models can be seen as innovative tools for researchers and policy-makers to better understand and predict staffing dynamics and shortages, in addition to their more standard applications. They do not require sophisticated computing skills, as everything can be relatively easily modelled in Excel. Combined with DCEs, they can assess the effectiveness of policy levers to increase the availability of nurses in rural areas. This analysis could easily be combined with cost estimates of policy interventions to produce an assessment of the cost-effectiveness of different options.

8.4.2. Limitations

The methods employed in this chapter present a number of limitations that might affect the quality and reliability of the presented findings.

First, a number of simplifying assumptions had to be made to model the effects of different policy scenarios. One structural limitation of the Markov model is the assumption of independence of choices made between the public jobs and others. This hypothesis was imposed by the stated preference data available on the effects of policy interventions[97]. An alternative would be to assume some cross-elasticity rates between different employers. Yet, this would have required making further 'educated guesses' as to what these rates might have been, given that existing data sources in South Africa would not have provided any indication of their real value. Another structural limitation of the model is the fact that 'everything else remains equal' for non rural jobs in the policy simulation. For example nothing changes in the working conditions offered in private and overseas jobs, or if they do the changes do not affect the proportion of nurses choosing these jobs. Although this simplification can be seen as unrealistic, it enables the isolation of the effects of rural incentives and their consequences.

Second, whilst the model outputs are greatly influenced by some key parameters of the Markov model, there is a lot of uncertainty surrounding the reliability of these parameters. Some parameters of the Markov model are particularly critical in the model outputs. For example, the influence of turnover rates and destination matrices is critical in the determination of nurses' long-term movements. Similarly, the effects of the policies modelled are composed of three cumulative effects: the increase in initial rural post uptake (determined by the DCE prediction), the decline in

[97] See preceding chapter for a more extensive discussion on that limitation.

turnover rates in rural areas by some decreasing rate (linked to the DCE output), and sometimes the increase in training uptake. Therefore by construction the model outputs partly depend on the one hand on the quality (or reliability) of the assumptions made about various model parameters, and on the other hand on the validity of DCE predictions. Until further research is carried out (see below), there are unanswered questions about the reliability of the DCE predictions on the one hand (for a longer discussion of the latter issue, see section 7.4.2 in the last chapter) and of some of the model assumptions on the other hand. To address this problem and account for the uncertainty around these model parameters, a probabilistic sensitivity analysis (PSA) was used, and the results presented are the average obtained from 2,000 simulations. Although the results presented here did not specifically present that level of uncertainty (the next chapter uses that feature more clearly), the PSA contributes to address that limitation.

Third, even though the PSA tried to account for the uncertainty of the model parameters, two sources of uncertainty were not well accounted for. First, some effects of structural uncertainty (relating to the assumptions of the model) were left unexplored. In particular, one did not investigate the effect of the strong assumption that policy interventions did not have an effect on the initial uptake of private and overseas jobs. Second, the heterogeneity in respondents' preferences was only moderately investigated. Heterogeneity of preferences was somewhat investigated through the DCE analysis, which emphasised the differences in taste of nurses with rural origins. This information was not directly incorporated in the generic Markov model, but instead separate simulations were run with hypothetical populations made up of different rural-urban distributions. Yet overall, estimates of the model do not adequately account for heterogeneity in preferences.

Fourth, the Markov model relied on a simplified structure, which obviously limits its ability to model reality. One of these simplified features is that the Markov model is not an individual-level simulation model. Therefore its ability to account for preference heterogeneity is limited. Another structural limitation of the model is the assumption made that each of the successive cohorts will behave exactly in the same manner as the first one. This means that the policies have the same effects for the graduates who enter the labour market 30 years after the policy was introduced as they had the first time they were implemented. Obviously, this assumption is unlikely to be correct, as preferences are likely to be adaptive and to follow some form of ratchet effect, where individuals revise their expectations based on past conditions.

Finally, due to the absence of data a large number of assumptions had to be made, without much more insight than the informed opinions of key individuals. This comes from the absence of available evidence from routine information systems or personnel databases, such as the turnover rates or the proportion of nurses who leave rural areas after one compulsory year following their specialty training. Therefore, the dearth of existing data on nurses' distribution and career choice dynamics weakens the evaluation of long-term effects of policy interventions, as one relies on educated guesses to compute the transition rates between the private and public sectors. Despite these caveats, it is important to highlight that all these assumptions were built as much as possible on existing information or data collected in interviews, so that the 'guesses' would be as educated as possible. In addition, as mentioned before, uncertainty around the parameter estimates was accounted for with the use of sensitivity analysis.

8.4.3. Implications for policy and research

A. Implication for policy

The results presented here have confirmed the policy recommendations already indicated in the last chapter. Two types of strategies could be considered by the government of South Africa (either separately or in combination) to attract nurses to rural areas:

- recruiting nursing students from rural backgrounds (upstream policy);
- offering study leave sooner to nurses who agree to take up rural posts (downstream policy).

More details on how this could be implemented and the caveats of such recommendations can be found in section 7.4.4.

B. Implication for research

This chapter has presented an innovative use of DCE results, to infer complex effects of policy interventions. It would be interesting to further explore this application in two ways:

First, it is hoped that routine data can be available in the future to provide more information on which to calibrate some of the model parameters. Given their importance in the model construction and its effect, it is urgent to obtain better data on turnover rates and in general about nurses' career paths that would inform the construction of transition matrices. Ad-hoc studies in hospitals or retrospective longitudinal studies could be used to estimate these model parameters. Similarly, further research on the capacity of DCEs to predict accurately individuals' actual choices[98] will provide more strength to the modelling presented here.

[98] See discussions presented earlier, for example in section 6.5.4

Second, a more sophisticated model could be built, in order to evaluate more refined and realistic effects. For example, the heterogeneity of behaviours could be built into the model with the use of individual-level estimates of policy effects, which could be obtained with mixed logit models. The corollary extension would therefore be an individual-level modelling of the entire population in the Markov model, such as compartment models used in epidemiology to model infectious diseases (Krämer et al., 2009). Another improvement to the model could be a propagation effect whereby the willingness of an individual to take up a rural post would be an increasing function of the proportion of nurses already present in rural areas. Finally, one could simulate the effects of policy interventions not only with respect to the number of future nurses, but also integrating the existing stock of. Obviously, some assumptions on the way they would react to the newly introduced incentives would have to be made. For example, their sensitivity to policies could be based on their work experience, or age. Such extension would be useful to increase the realism of the model and more clearly model the consequences for health services delivery in South Africa.

8.5. Conclusion

This chapter has presented in detail a new tool to estimate the effects of policy interventions that could be used to attract health staff to rural areas. The results of this model show that policies based on direct financial incentives (such as salary increases) and better education opportunities are the most effective methods of attracting workers to rural areas. However it should be noted that some of these policies might be easier to implement than others.

In addition to their 'implementability', the financial implications of the different strategies should be taken into account, in order to inform policy-makers' decisions. Indeed, although some financial incentives might be more effective to attract rural nurses, it is reasonable to assume than other policies might be less effective but also less costly. For example, it was already underlined that although a 10% increase in salary is more effective than a car allowance, the latter is half as costly. This calls for further systematic examination of the policy initiatives envisaged here, not only for their effects but also for their costs.

The next chapter addresses this question and presents the cost-effectiveness analysis of the various policy scenarios presented here.

Chapter 9 - Evaluating the cost-effectiveness of HR policy interventions

9.1. Introduction

The preceding chapter used a Markov model building on choice experiments to simulate the relative effectiveness of potential policy interventions to address the distribution of nurses between rural and urban areas in South Africa. By modelling their short-term and long-term effects, it highlighted the importance of taking into account the dynamics of the labour market to better ascertain the effects of possible policies. It also showed the dominance of a number of strategies to increase significantly the presence of nurses in rural areas, while certain job advantages showed no particular effectiveness. Yet these simulations are not sufficient to inform policy-makers on the best course of action regarding the HR interventions they should take into consideration. Information about the relative cost-effectiveness of policy interventions is essential for discussions over budgetary choices and trade-offs, within the framework of the Ministry of Health budget but also more broadly within the context of government spending.

In the previous two chapters, analysis has highlighted that the number of nurses working in rural areas could be increased through a selection of students with a greater preference for rural posts (those with rural background) and/or through the use of different financial and non-financial incentives. This range of policy levers suggests a wide variety of cost implications.

The present chapter aims to measure the cost-effectiveness of these various policy packages, and thereby provide direct policy recommendations about the desirability and feasibility of implementing some of these scenarios. A secondary objective is to assess the political and financial feasibility of these policy options in regard to the size and evolution of the budget allocated to health by South Africa.

The chapter starts with a presentation of the structure of the cost-effectiveness framework as well as the data used. Then it provides a detailed explanation of the methods and assumptions used to cost the incentive packages. The second half of the chapter presents the findings of the cost-effectiveness analysis, and discusses the results in the light of a sensitivity analysis and limitations of the methods used.

9.2. Methods

9.2.1. The decision problem

The primary objective of this chapter is to evaluate the relative cost-effectiveness of various policy options that could be implemented by the South African government to redress the current shortage of nurses in rural areas. More precisely it aims to evaluate which incentive packages are the most cost-effective to increase the number of nurses in rural positions. To evaluate the incremental cost-effectiveness of HR policies, a decision-analysis model needs be constructed. The analytic approach is designed to permit the evaluation of the cost effectiveness of discrete 'rural' policies. It is not concerned with the broader cost-effectiveness of configurations of governmental HR policies in the labour market (e.g. attracting more nurses to the public sector). As standard economic evaluation of health policies, this study is embedded in the framework of welfare economics. In this framework, it is assumed that in the public urban sector, the marginal value of a nurse is equal to the marginal cost of a nurse, while in the rural sector the marginal value of a nurse if greater than its (current) cost. Therefore it is hypothesised that there is no loss of welfare (for urban patients) in attracting urban nurses to rural posts. This assumption is discussed later in the chapter. This section presents the different interventions considered for the analysis, as well as the data used in the analysis.

A. <u>Downstream measures</u>

As explained in Chapter 2, downstream measures refer to policy levers that can be employed on the current nursing population. These policies are the same rural incentives that were presented in Chapter 7, whose effects were simulated in the stated choice experiment. They are briefly outlined here, along with their estimated costs.

No intervention

The strategy without any intervention follows the current conditions prevalent in the public sector. It means that when the nurse enters the labour market after graduation and has to choose between four alternative jobs, with the rural jobs characterised by an annual salary of R132,000, no car allowance, a normal promotion schedule (nurses automatically move up the ladder every two years), the possibility to benefit from a subsidised housing opportunity (shared flat), the guarantee to go on study leave on average after about six years spent in the post and a hierarchical type of management.

Immediate financial incentives

A number of the rural incentives entail a variety of direct financial incentives. Four of these interventions are modelled in the present cost-effectiveness study:

- Three different policies that would increase rural annual salaries respectively by 10%, 20% or 30% (all other job characteristics remaining unchanged compared to the base scenario);
- A policy that would offer a car allowance worth R500 every month (all other job characteristics remaining unchanged compared to the base scenario);

Deferred and indirect financial incentives

Some policy interventions modelled comprise indirect financial incentives. This means that each of these strategies offers some advantage which translates into some form of financial advantage, either immediate or deferred:

- A housing policy offers a better housing opportunity – instead of a shared flat, this policy offers a two-bedroom house to nurses.
- An education strategy guarantees study leave to rural nurses after two years in post. This involves the cost of nurses' salaries to be covered during the study leave, as well as the cost of providing the education;
- A quicker promotion track, which gives rural nurses the possibility to access the next grade quicker, after one year instead of two (this only applies to the first promotion).This translates into higher salaries offered to rural nurses.

Mixed packages

Chapter 7 showed the relative effectiveness of different policy scenarios to attract nurses to rural positions. The results highlighted the interest of using mixed incentives to achieve larger effects (see Table 7.5). It is equally interesting to try and assess the cost-effectiveness of these packages.

B. Upstream measures

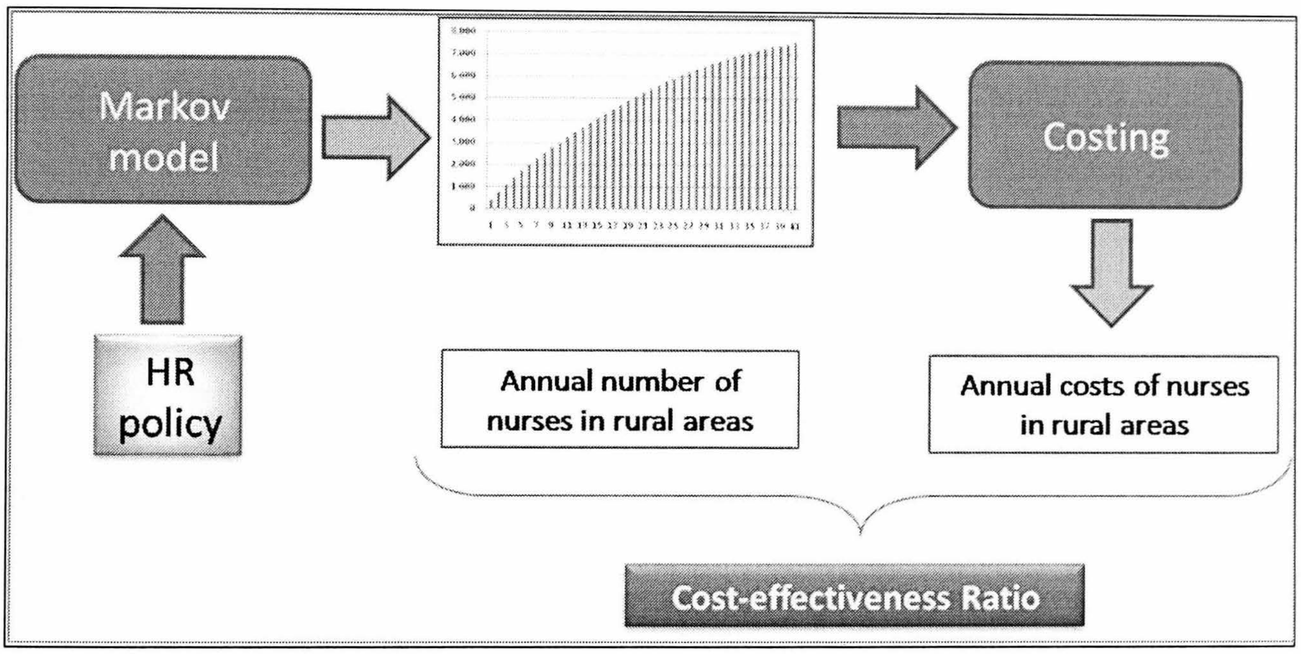
As explained in Chapter 2, upstream measures are the ones that seek to alter the structure of the nursing population, and attract more individuals who would be willing to work in rural areas, with or without a particular incentive. The analysis so far has demonstrated the existence of heterogeneity of preferences for rural jobs within the nursing population in South Africa, with nurses from rural background more eager to take up rural positions. Building upon some of the simulations in Chapter 7, this analysis looks at the cost-effectiveness of selecting more rural individuals into nursing, up to a proportion of 75% and 100% (compared to 46.9% in the sample population). It is assumed that the selection of more rural students through a purposive selection process in training colleges does not generate additional costs. Given the high number of applications received and discarded by nursing colleges each year, it is reasonable to think that there are good applicants from rural areas for whom quotas could be reserved, as has been done in other countries (see Chapter 2).

All the downstream measures presented above are simulated with these two hypothetical nursing populations.

C. Data used

The economic evaluation presented in this chapter builds upon two major elements: the Markov model presented in the last chapter provides the measures of effects, and a costing model that provides unit costs for all resource items.

Figure 9.1: Relationship between the Markov and cost model



The relationship between the Markov and cost models is shown in Figure 9.1. For a given HR strategy, the Markov model produces as outputs the annual number of nurses who work in rural areas and the annual number of nurses who decide to specialise. These results serve as an input for the costing model, which then estimates the yearly costs of nurses in rural areas.

9.2.2. Outcome measures

In Chapter 8, the Markov model simulated the effects of different policy interventions. The primary outputs of the model were the number of nurses in any given year in the various segments of the labour market. Other outcomes presented were a transformation of those outputs, showing the distribution of nurses at different points in time.

For the purpose of the economic analysis, a unique measure of effectiveness that can capture the long-term effects of each policy is needed. Because the objective is to evaluate the capacity of policies to increase the number of nurses in rural areas, a simple approach is to sum the number of nurses in rural areas over time. Because Markov model outputs are for each year, the measure is in fact a number of rural nurse-years.

The Markov model was calibrated as indicated in Chapter 8[99].

9.2.3. Costing policy interventions

Following the description of the decision problem in the first part, this section presents the final steps and assumptions of the costing model. It follows the final steps of the costing methodology usually described in the literature:

- Identification and measurement of the resource items;
- Calculation of their monetary value.

A. <u>Overview of resources used</u>

The first step in a costing exercise is to list the various elements required to implement the interventions of interest, in order to measure the costs that are relevant and decisive for the policy question of interest. In the present case, considering the perspective taken, only the actual costs incurred by the government to pay nurses in public positions are considered.

Here, all interventions of interest are individualised incentive packages for nurses[100]. It is assumed that any administrative costs to implement the interventions do not represent an additional cost to the usual functioning cost of the Department of Health services at the central and regional levels, or are negligible compared to other costs incurred by the HR policies. Similarly, the costs of health facilities where nurses work (both building and functioning costs) are not taken into account in this costing. Indeed, these costs are part of the provision of health services, which is exogenous to the HR interventions considered here, or at least not included in the perspective taken here.

Therefore, the cost of the interventions to the government depends on the job characteristics of the posts offered. As a result, five different elements drive the cost of the interventions:

- The salary level;

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99 Size of each cohort: 2000 nurses; time horizon: 40 years.

100 Indeed, the selection of more students with rural background is assumed to be cost-free, as indicated before.

- The type of subsidised housing offered; the subsidy is going to be proportional to the quality of the housing offered;
- The provision of a car allowance;
- The possibility to be promoted sooner, as this modifies the salary offered in the future;
- The provision of post-basic training to nurses. This entails both direct and indirect costs, which are detailed further later.

This list excludes the potential costs incurred by the type of management used in the facility. It is assumed that the type of management is the one currently often found in the South African health system (hierarchical style). Therefore the cost of providing these working conditions (if any) are not relevant to the policy interventions considered here since they are not affected by these interventions. To summarise, the cost items can be grouped into three categories:

- Salary costs,
- Other financial benefits (housing and car allowance),
- Training costs.

The next section presents in detail the assumptions made and data used to estimate the costs under the different interventions modelled.

B. Salary costs

Unit costs in the base scenario

Salary costs are certainly the main cost drivers of HR policies. Therefore, it is important to estimate them as accurately as possible.

As explained above, the outputs produced by the Markov model are used as inputs into the cost model. For each cohort of nurses simulated, the output is the distribution of the numbers of rural nurses over the 40 simulated years. Therefore to calculate the total costs of all nurses in a cohort, several types of information are needed:

- The average annual salary of a nurse, which evolves over the course of one's career;
- The benefit package paid by the government in addition to the salary (employers' contribution to pension and medical insurance).

The first difficulty relates to the absence of a typical career for nurses, and the fact that the succession of yearly salaries is a direct function of the type of career a nurse can have. For example, a nurse who stays a general nurse and either refuses or is not offered any promotion will have a very steady increase in salary, as her career path will basically be constituted by the legal salary increments. Conversely, a general nurse who obtains or seeks promotions can move quickly up the salary scale. Finally, a Professional Nurse who enters the market in South Africa can decide to do a post-basic year of training to become a specialised nurse. That choice, when made at an early stage of the career, will lead to a significant jump in salary. Some of these possible scenarios of Professional Nurses' career paths are represented in the Figure 9.2 below, which highlights some of the career "jumps" that can be made through promotions.

Unfortunately, there is no data about what can be considered as the typical career path of a professional nurse, nor is there any information about the proportion of nurses in each grade. Therefore, in the absence of information about the typical career paths of nurses in the public sector, the only way to compute the average annual cost of a nurse's base salary for a given year *t* ($\bar{s}_t^b$) is to compute a weighted average of a number of career paths for each year:

$$\bar{s}_t^b = \sum_k \omega_k s_{kt}^b$$

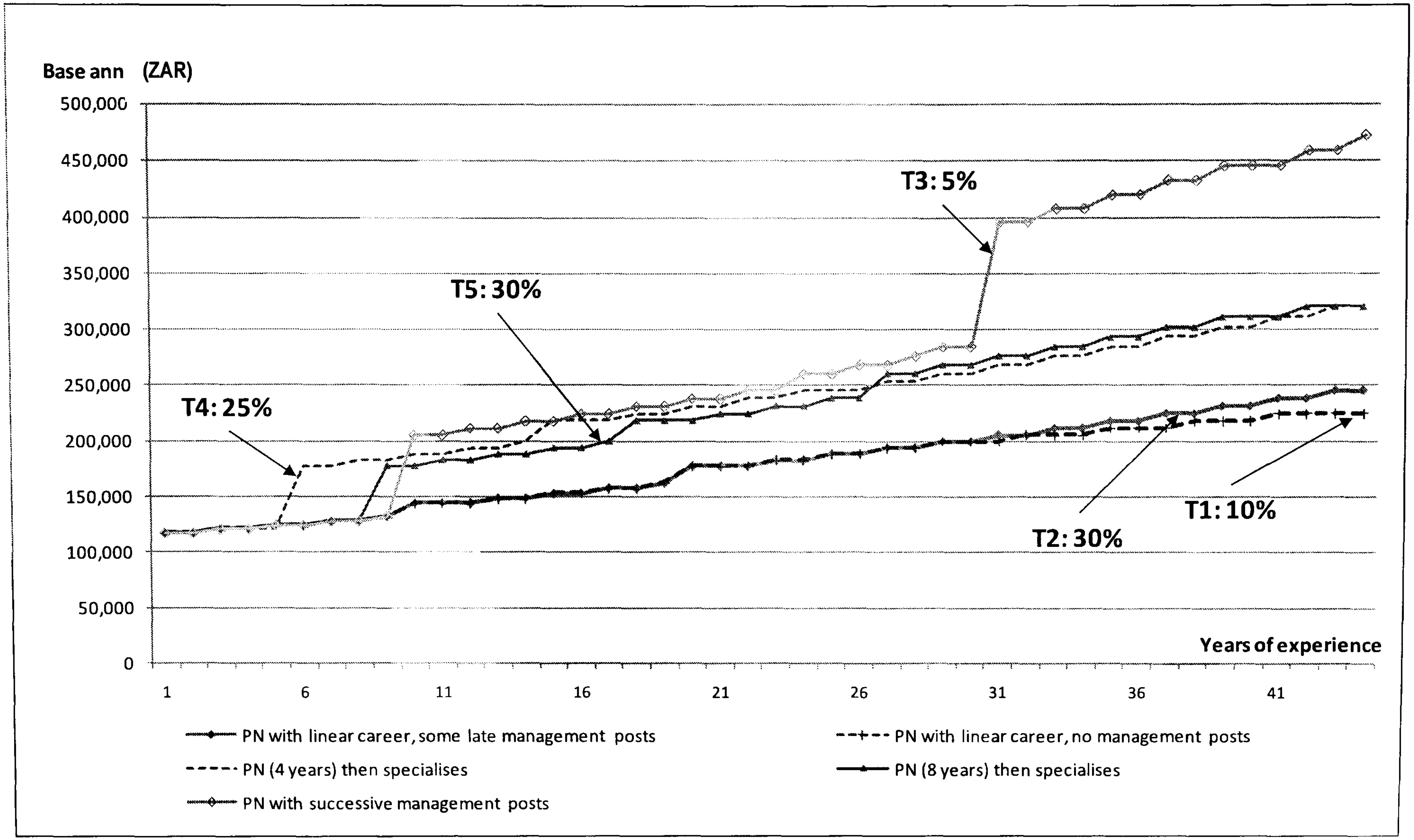
where s_{kt}^b is the cost to the government of a rural nurse on career path *k* in year *t*, and ω_k is the proportion of nurses on this career path (or the 'weight' of the career path in the average constructed career).

Therefore, to compute $\bar{s}_t$ assumptions had to be made regarding:

- The number and shape of hypothetical career paths
- The weight allocated to each typical career path.

The choice of simulated career paths was based on the concern to be able to account for a sufficiently wide range of costs to avoid a systematic under or over-estimation of salary costs. The idea was to avoid modelling only steady career paths to avoid the under-estimation of costs associated with better careers (more costly for the employers). At the same time, the weight allocated to the more rapid career paths had to be carefully chosen, to avoid over-estimation of salaries. In the end, five career paths were generated that are depicted in Figure 9.2: three for general professional nurses who do not decide to specialise (T1, T2 and T3), and two for nurses who would specialise (T4 and T5) – see Appendix 9.1 for greater details on each 'stylised' career path.

Figure 9.2: Structure and distribution of 'typical' career paths for South African nurses



Source: Department of Public Service and Administration, South Africa (Department of Public Service and Administration, 2008).

The following guiding principles were chosen to assume the weights indicated on Figure 9.2 for each career path:

- As indicated in Chapter 8, information collected during an interview suggested that about 50% of a given cohort would specialise. This means that the three non-specialist tracks (T1, T2 and T3) represent at best 50% of the weights;
- The "fast track" path (T3) is unlikely to be frequent, and therefore a weigh of 0.05 was attributed to it;
- Since it is unlikely that many nurses not be promoted at all during their career, T2 is assumed to represent 30% of the cases, and T1 only 10%;
- Finally the last two specialist tracks, T4 and T5 are split into almost equal weights, although a greater influence is given to T5 since the majority of nurses, from interview data, appear to specialise five to 10 years into their career.

Personnel costs include not only salary, but also fringe benefits and other employment costs that are paid by the employer. In the public sector in South Africa, this includes the employers' contribution to medical insurance and a pension contribution. The actual costs of these benefits are complex to estimate, as they depend partly on choices made by the employees and partly on the experience and age of the employee. These additional costs to the employer are assumed proportional to the salary level. Therefore the actual cost to the employer is:

$$\bar{S}_t^b = \sum_{k=1}^{5} \omega_k (1+\rho)\, s_{kt}^b$$

where ρ is the "fringe benefit" rate. Based on some official documentation (Department of Public Service and Administration, 2006), the fringe benefit rate was approximated at ρ=0.25.

Unit costs under the different policy incentives

The policy incentives can alter the calculations of the salary costs of a rural nurse-year in three different ways.

A first change occurs whenever a policy intervention involves an increase δ_i (expressed in % change) in the salary offered to nurses in rural posts. The unit costs are then adjusted in the following way:

$$\bar{S}_t^i = \sum_{k} \omega_k (1+\rho) s_{kt}^i$$

with $s_{kt}^i = (1+\delta_i) s_{kt}$ and $\delta_1 = 0.1$; $\delta_2 = 0.2$; $\delta_3 = 0.3$.

It is assumed that the career path weights remain unaffected by the change in salary levels.

A second modification occurs when a policy proposes a quicker promotion. This means that instead of staying for two years in the first salary grade, rural nurses achieve the first salary increment after just one year. It means that instead of using the vector of salary levels $\langle S_0, S_1, \dots S_{39}\rangle$, over the span of a 40-year career, the simulations are made using a slightly modified vector: $\langle S_0^p, S_1^p \dots S_{39}^p\rangle$ where $S_t^p = S_{t+1}^b \; \forall\, t$. For example: $S_0^p = S_1^b$; $S_1^p = S_2^b$, etc. This is as if the career paths presented in Figure 9.2 are shifted to the left by one period.

A third modification changes the salary costs when nurses are offered guaranteed study leave sooner (after two years in post instead of six). As indicated before, this incentive increases the number of nurses who choose to specialise. Consequently, there should be an increase in the proportion of nurses who specialise at an early stage of their career. This change is simply modelled through a new set of weights (ω_k^e), where the weight corresponding to the specialist paths is greater:

$$\bar{S}_t^e = \sum_{k=1}^{5} \omega_k^e (1+\rho) s_{kt}$$

With $\omega_k^e > \omega_k$ for $k \in \{4,5\}$ which corresponds to the two simulated "specialised nurse" career paths. More details on how these weights are calculated are provided in section E.

C. Housing allowance

Some rural incentives offer a housing allowance, either for "a single room in a shared flat" or for a self-contained "two-bedroom house". The cost of this subsidy to the government was valued with estimates of the monthly rent paid for similar properties on the South African real estate market obtained from seven cities (see Appendix 9.2).

In the absence of further data on the sample used to produce the average costs reported for each city, a simple unweighted average was calculated. Estimates of the annual cost of a shared flat are given by the bachelor accommodation average cost (H^f=R1,872) and that for a two-bed house is provided by the same average estimates from (H^h=R2,871).

Although the conditions of the housing allowance were not precisely mentioned in the choice experiment, it was decided to calculate this additional benefit on top of the monthly housing allowance currently received by all South African nurses (amounting to R500). Therefore the cost of housing takes into account the difference between the current allowance and the amount needed to provide the accommodation proposed in the DCE:

$$H = \varphi(\mathbf{1}_f \times 12(H^f - 500) + \mathbf{1}_h \times 12(H^h - 500))$$

where $\mathbf{1}_\mathrm{f}$ is an indicator function that takes the value 1 when the housing option offered is a flat and zero otherwise. Accordingly, $\mathbf{1}_\mathrm{h}$ is the indicator function for the two-bedroom house option. The parameter φ represents the subsidy paid by the employer – although the DCE mentioned a "subsidised" housing option, it remained silent on the proportion of the housing cost to be subsidised by the employer. It was decided that a subsidy φ=50% would be a reasonable proportion of the rent.

D. Car allowance

The rural jobs sometimes offered a car allowance whose value was clearly stated in the choice experiment: c = R500 per month. It was hypothesised that this would remain constant over the years, and this monthly value was simply recalculated over the year, representing a R6,000 additional benefit to the salary.

E. Costs of training

It was explained in Chapter 8 that all nurses specialising obtain study leave from the government. Therefore, training always generates some costs for the MOH which depend on the number of nurses obtaining study leave[101]. Those costs are the direct costs of training involved in the provision of the actual course during one year, and the payment of nurses' salaries on study leave. But there are also indirect costs triggered by education policies. Indeed, guaranteeing rural nurses the possibility to go on study leave changes the relative weights of the different nursing career paths.

Direct education costs

The first direct cost of providing training benefits to rural nurses is the salary paid to nurses who receive study leave. The unit cost of this salary is calculated as follows:

$$\overline{L}_t^D = \sum_{k<4} \omega_k s_{kt}$$

where $k < 4$ ensures that one only takes into account the average annual salary cost of a nurse who will not have specialised yet (one only takes the non-specialist paths into account). The monthly rents are multiplied by 12 months in order to compute consistent annual costs.

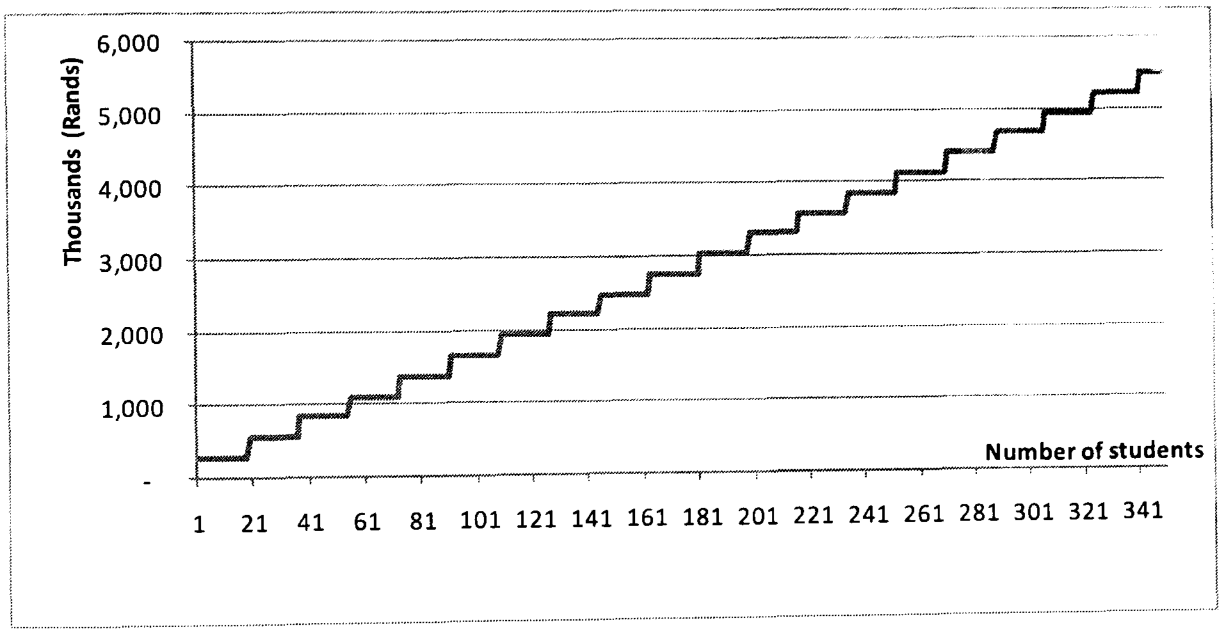
The second direct cost involved in providing study leave is incurred through the provision of the one-year training to the nurses. Broadly speaking, these expenditures involve essentially teachers' time and support costs encompassing administrative and infrastructure costs.

101 Under "normal" conditions, some nurses obtain study leave as well, and therefore some costs are already incurred.

To ascertain this, data on budgets obtained from the South African Nursing Council and some nursing colleges were used. Appendix 9.3 provides some detailed explanation about how costs were computed. In brief, it was found that the salary of lecturers represent the main cost of nursing training institutions. All other costs can therefore be reduced to overheads paid on top of lecturers' salaries. A lecturer's annual salary was approximated to about R220,000 and overheads were estimated to an additional 25%. With an average estimated ratio of 18 students per lecturer in specialty courses (see Appendix 9.3 for a full justification), a unit cost per student can be estimated as a function of the total number of students taking the course on a given year N_t^{all} (see Figure 9.3 below). Therefore the annual indirect unit cost of study leave on a given year (L_t^l) can be expressed as follows:

$$L_t^l = \frac{275{,}000 \times \|N_t^{all}/18\|}{N_t^{all}} \quad \text{where } f(x) = \|x\| \text{ returns the nearest integer of } x.$$

Figure 9.3: Indirect cost of providing specialist as a function of the number of students



Indirect education costs

As explained before, because the education policies guarantee access to study leave for rural nurses, it is likely that these interventions will change the relative weights of the suggested career paths (in Figure 9.2). Indeed, as explained in the previous chapter, many nurses will come to rural areas with the objective of specialising. Therefore the proportion of specialist career paths should increase accordingly. This is an indirect effect that needs to be accounted for, since it increases the costs to the government (as higher salaries need to be paid).

To compute this effect in a relatively simple manner, the difference in the number of nurses who specialise in a given cohort is computed, between the baseline scenario and each of the different education packages. The increase in the proportion of specialist nurses in a given cohort (π) can thereby be calculated for a given scenario:

$$\pi = \frac{\sum_t \mathrm{N}^{\mathrm{all}}(S)}{\sum_t \mathrm{N}^{\mathrm{all}}(B)}$$

Where $\mathrm{N}^{\mathrm{all}}(S)$ is the total number of nurses from a cohort specialising over the 40-year horizon under conditions set by scenario S, while $\mathrm{N}^{\mathrm{all}}(B)$ is the corresponding number under conditions defined in the base scenario.

This increase is applied to the proportion of nurses who follow a specialist track (T4 and T5), and it is assumed that this proportion is taken from career path T2, where there is the biggest reservoir of nurses susceptible to specialise:

$\omega'_k = \pi\omega_k$ for k=4 and k=5

$\omega'_2 = \omega_2 - (\omega'_4 - \omega_4) - (\omega'_5 - \omega_5)$

To obtain the *total cost* of rural nurses to the government, the sum of all direct and indirect costs in each scenario (see Appendix 9.4) is computed.

9.2.4. Modelling the cost-effectiveness of interventions

A. <u>Discounting outcomes</u>

For each given year over a *n*-year period, the costing model and the Markov model generate raw numbers of nurse-years in rural areas and their corresponding cost for the government. To be able to make comparisons between different streams of future costs and benefits, and account for time preference, the costs incurred over *n* future periods are usually discounted to present values, with the following calculation:

$$P = \sum_{t=0}^{n} \frac{C_n}{(1+r)^t}$$

where r is the discount rate. The choice of the discount rate r, also called the social discount rate in the analysis of public programmes, has been a widely debated issue (Drummond et al., 2005). It is usually advised to choose a central social rate of time preference that is consistent with the current practice in the field and/or has been a government recommended rate. This study therefore adopted as social discount rate $r = 0.03$, which is the standard rate in public health interventions, also adopted in South Africa (Russell et al., 1996). This figure corresponds to the *real* discount rate, which does already account for future anticipated inflation.

Another area of debate regarding discounting relates to whether or not the outcomes should be discounted and if so, whether they should be discounted at the same rate as costs are. To simplify to be able to compare costs and effects adequately, it was decided to discount both costs and effects. Indeed, it makes perfect sense for a government to value the presence of rural nurses in the short term more than that in the long term, as it can obtain direct electoral benefits from addressing rural shortages while in power.

Applying the social discount rate r to the total cost incurred in any given year *t*, the present value of future outcomes X_t^T (this can be future annual costs or future effects) is given by:

$$X^T = \sum_{t=0}^{40} \frac{X_t^T}{(1+r)^t}$$

B. <u>Incremental cost-effectiveness ratios</u>

In the case of mutually exclusive options presented here, identifying the policy that is expected to provide the highest level of benefits for a given level of cost can be done by calculating the incremental cost-effectiveness ratio (ICER) of each policy relative to the next best strategy (Drummond et al., 2005). Before calculating the ICER, it is important to identify and exclude any dominated strategy, which is more expensive and less effective than another option. Options subject to extended dominance should also be discarded; those options are identified by the fact that a combination of other options can provide a higher benefits for the same cost (Barton et al., 2008). For any two scenarios S1 and S2, an ICER can then be calculated as follows:

$$\text{ICER} = \frac{C_{S1} - C_{S2}}{N_{S1} - N_{S2}}$$

where N_{S1} is the total number of rural nurse-years under scenario S1 and N_{S2} is the number of nursing years in scenario S2, while C_{s1} and C_{s2} are the related costs of each policy.

The optimal strategy is the one with the highest ICER below the cost-effectiveness threshold, usually noted λ (Drummond et al., 2005). This threshold represents the maximum amount that the decision-maker is willing to pay for a particular outcome (maximum acceptable ceiling ratio). Only if the intervention falls below this threshold, is it deemed cost-effective. In the present context, there is no obvious threshold. Yet, knowing that the salary of a beginning nurse in a rural area is currently R132,000, and because it is hypothesised that the marginal value of a nurse is greater than this current cost, the monetary threshold of the government is necessarily greater than that level. In fact, it is possible to assume that the government would be ready to pay much more to attract nurses to rural areas, considering that the average cost of a nurse over her career is the discounted value of all her salary flows, and is necessarily higher than the starting salary.

C. Probabilistic sensitivity analysis

As in the previous chapter for the Markov model, a lot of assumptions have been made throughout the costing of rural nurse-years. Therefore, in addition to the model parameters involved in the computation of effect outcomes (described at great length in the previous chapter), it is important to account for uncertainty introduced by assumptions on costs. Table 9.1 below summarises the main cost parameters of the model to be used in the Probabilistic Sensitivity Analysis.

Table 9.1: Parameter distributions

Name	Description	Min	Parameter mean	Max	Distribution	α	β
Salary costs							
ω_1	Weight associated (career path P1)	-	$\omega_1 = 0.10$	-	Dirichlet distribution	-	-
ω_2	Weight associated (career path P2)	-	$\omega_2 = 0.30$	-		-	-
ω_3	Weight associated (career path P3)	-	$\omega_3 = 0.05$	-		-	-
ω_4	Weight associated (career path P4)	-	$\omega_4 = 0.30$	-		-	-
ω_5	Weight associated (career path P5)	-	$\omega_5 = 0.25$	-		-	-
Housing allowance							
φ	Subsidy level	0	$\varphi = 0.50$	1	Beta distribution	50	50
H^f	Average cost of a flat	-	H^f=R1,872 (sd=474)	-	Gamma distribution	16	120
H^h	Average cost of a 2-bedroom house	-	H^h=R2,871 (sd=588)	-	Gamma distribution	24	121
Car allowance							
C	Monthly car allowance		C = R500 (sd= 25)		Gamma distribution	500	1

Note: the distributions are chosen according to the standard practices used in economic analysis (Briggs et al. 2006).

Note that this list excludes the following parameters:

- The "fringe benefit" rate (ρ) remains unchanged (25%). Indeed, although this is based on some approximation, it is probably not too far from the real rate (Department of Public Service and Administration, 2008);
- The discount rate (r), as it is unusual to put the discount rate directly in the PSA;

- The non-standard weights (those used in the training interventions) because they are indirectly affected by the random draws of the standard career path weights, and therefore are influenced by these latter parameters;

The probabilistic analysis is undertaken by randomly sampling from each of the parameter distributions and calculating the expected costs and expected number of rural-nurse years. This is done for 2,000 replications.

Cost-Effectiveness Acceptability Curves

Cost-effectiveness acceptability curves (CEAC) were developed in order to illustrate the uncertainty surrounding the estimate of cost-effectiveness (Briggs and Gray, 1999, Fenwick et al., 2001, O'Brien and Briggs, 2002), as an alternative to producing confidence intervals around ICERs (Van Hout et al., 1994, Briggs and Fenn, 1998).The use of these curves to summarise information uncertainty in cost-effectiveness analysis has now become widespread (Barton et al., 2008). In the case of multiple options, a separate CEAC can be plotted for each option and each curve shows the probability of each option being cost-effective at different levels of money decision-makers are ready to spend to improve the outcome of interest (Briggs et al., 2006). Following the method suggested by Briggs et al. (2006), this probability was estimated by identifying, for each of the 2,000 replications, the option with the highest net monetary benefit (NMB), defined as:

$$NMB = \lambda E - C$$

where C is the total expected cost and E is the total expected effect, and of λ is a particular cost-effectiveness threshold.

For a given λ, one can then equate the probability that a strategy is cost-effective as the proportion of the 2,000 iterations for which that particular option had the highest net benefit. This calculation is replicated for various values of λ comprised between R0 and R500,000 (by intervals of R1,000). One can then plot the cost-effectiveness acceptability curves for each intervention providing the probability of an intervention to be cost-effective (y-axis) for different values of λ (x-axis).

Cost-Effectiveness Acceptability Frontier

If the objective is to maximise the benefits of an intervention, researchers have argued that relying on the probability of an option to be cost-effective, as CEACs do, can be misleading

(Fenwick et al., 2001). Instead, decisions should be taken on the basis of expected net benefits, regardless of the uncertainty associated with the decision.
It is therefore possible to find a situation where the strategy with the highest probability of being cost-effective (highest CEAC) is not the optimal option (Fenwick et al., 2001). To address this issue, it is recommended to use Cost-Effectiveness Acceptability Frontiers (CEAF). At different levels of λ, a CEAF only plots the probability that the optimal option is cost-effective, ignoring all other strategies.

To produce the CEAF, the mean cost and mean effect for each option is calculated over the 2,000 replications and one identifies which option has the highest net monetary benefit over a range of values of λ. Once the optimal option is identified (for each value of λ), one reports the probability of this option being cost-effective, as determined by the CEAC.
From the CEAF one can deduce:

- The range of values of cost-effectiveness thresholds over which a given strategy is cost-effective;
- The ICER between different options[102], which correspond to the "switch points" on the CEAF, when there is a change in the identity of the optimal option;
- The probability of making a wrong decision (error probability) at any value of the threshold λ, which is equal to one minus the probability given by the CEAF.

D. Investigating heterogeneity in cost-effectiveness

In Chapter 7 it was found that nurses from rural areas were less sensitive to policy interventions than their urban counterparts. In this chapter, the consequences of these results for the relative cost-effectiveness of interventions are investigated. More precisely, results for nurses from urban backgrounds are compared to those from rural backgrounds.

[102] The lower value of λ for which each option was optimal denotes the ICER for that particular option, and the upper value denotes the ICER for the next most costly option.

9.3. Results

9.3.1. Cost analysis

Table 9.2 provides details of the costs incurred by the government to fund the presence of nurses from a given cohort in rural areas over a 40-year period. This clearly demonstrates that salaries are the main cost, as they systematically represent at least 90% of all costs. The second biggest cost is housing, representing 2.5 to 5.5% of all costs. The cost of providing education is quite minimal, although the figures do not provide a detailed account of the additional salary costs incurred indirectly as a result of education strategies (through the change in nurses' salary structure). Similar figures can be found in Appendix 9.5 for 40 simulated cohorts.

Table 9.2: Structure of costs by strategies (calculated over one cohort)

	Salary	Car	Education direct cost	Housing cost
Base scenario	95.20%	0.00%	1.63%	3.17%
10% rural allowance	95.50%	0.00%	1.60%	2.91%
20% rural allowance	95.73%	0.00%	1.59%	2.68%
30% rural allowance	95.95%	0.00%	1.57%	2.49%
2-bedroom house	93.03%	0.00%	1.58%	5.38%
Car allowance	92.98%	2.29%	1.58%	3.15%
Promoted faster	95.30%	0.00%	1.61%	3.09%
Study leave soon	94.58%	0.00%	2.23%	3.19%
Quick promotion + car	93.12%	2.24%	1.57%	3.07%
Quick promotion + 10% salary increase	95.57%	0.00%	1.60%	2.83%
Quick promotion + 20% salary increase	95.81%	0.00%	1.58%	2.62%
10% salary increase + car allowance	93.44%	2.10%	1.58%	2.88%
20% salary increase + car allowance	93.82%	1.93%	1.59%	2.65%
Better housing + car	90.83%	2.26%	1.57%	5.35%
Better housing + car + 10% increase	91.47%	2.06%	1.58%	4.89%
Better housing + car + 20% increase	92.06%	1.90%	1.55%	4.50%
Study leave soon + car	92.13%	2.27%	2.48%	3.12%
Study leave soon + 10% increase	94.63%	0.00%	2.52%	2.85%
Study leave soon + 20% increase	95.00%	0.00%	2.43%	2.56%
Study leave soon + 10% increase + car	92.72%	2.02%	2.49%	2.77%

9.3.2. Economic analysis of downstream measures

A. Expected costs and effects

For each policy intervention, Monte-Carlo simulations drawing parameters of the model generated 2,000 pairs of expected incremental costs and number of rural-nurse years (compared to baseline). The results from these replications for four education-related scenarios are presented in Figure 9.4, together with the deterministic estimates for each scenario.

The wide dispersion of points in the figure illustrates the uncertainty surrounding the estimates of expected costs and expected effects associated with the different interventions. The dispersion of points above the x-axis and to the right of the y-axis indicates that in general all these interventions are more effective than the current situation, but that they are also more expensive.

Since the gains in outcomes are achieved at a higher cost, then the critical issue is to understand how much (if any) the decision-maker is prepared to pay for an additional rural nurse-year. Using these 2,000 replications, average expected costs and effects can be calculated for each intervention (see Table 9.3). First, the dominated strategies were identified (these are the ones in highlighted rows). Once strategies are ordered from the least to the most costly, dominated strategies are the ones for which it is possible to identify a cheaper strategy that produces better outcomes. It is interesting to note that most of the strategies relying almost entirely on direct financial incentives are dominated. Second, the various HR options subject to extended dominance were identified. This left only four possible cost-effective options, which were the interventions offering study leave to rural nurses within two years, sometimes accompanied by salary increases. This is not entirely surprising considering the sensitivity of nurses to these incentives underlined in the previous two chapters, as well as the fact that the associated costs of training are not very high (see Table 9.2). The relevant incremental cost effectiveness ratios were calculated for these four options, for one and 40 cohorts. Results are presented in Table 9.4.

Figure 9.4: Scatter plot showing the incremental costs and effects between policy interventions and baseline using 2,000 bootstrap replicates (for 1 cohort)

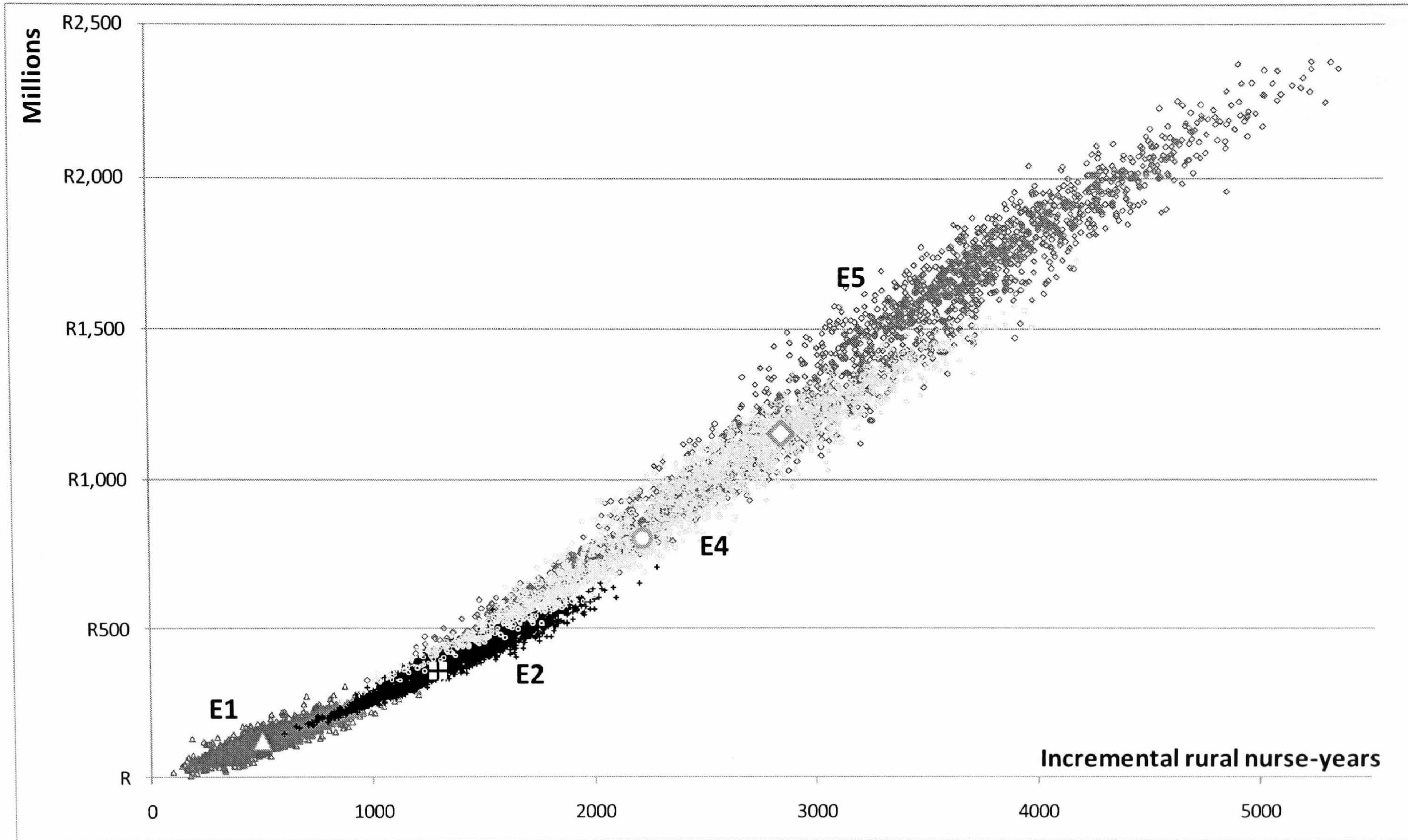


Table 9.3: Expected costs and effects of downstream policy interventions ranked by costs (over 2,000 simulations)

Scenario	Analysis for one unique cohort		Scenario	Analysis for 40 cumulated cohorts	
	Expected costs	Expected effects		Expected costs	Expected effects
Base scenario	R 1,326,214,432	4,738	Base scenario	R 23,078,084,747	89,595
Promoted faster	R 1,372,338,929	4,802	Promoted faster	R 24,017,154,750	91,142
2-bedroom house	R 1,384,951,431	4,874	2-bedroom house	R 24,325,723,137	92,843
Car allowance	R 1,447,248,864	5,153	Car allowance	R 25,726,095,201	99,186
Study leave soon (E1)	**R 1,455,099,614**	**5,253**	**Study leave soon (E1)**	**R 25,943,261,881**	**101,480**
Quick promotion + car	R 1,492,668,724	5,199	Quick promotion + car	R 26,639,296,643	100,272
Better housing + car	R 1,528,185,694	5,363	Better housing + car	R 27,421,466,688	103,895
10% rural allowance	R 1,634,305,738	5,367	10% rural allowance	R 29,188,199,496	103,867
Quick promotion + 10% salary increase	R 1,691,435,081	5,431	Quick promotion + 10% salary increase	R 30,340,853,899	105,345
Study leave soon + car (E2)	**R 1,720,202,762**	**6,100**	**Study leave soon + car (E2)**	**R 31,216,476,662**	**119,315**
10% salary increase + car allowance	R 1,873,210,394	6,128	20% rural allowance	R 34,135,286,171	112,215
20% rural allowance	R 1,883,615,891	5,723	10% salary increase + car allowance	R 34,166,953,297	120,426
Quick promotion + 20% salary increase	R 1,955,340,586	5,805	Quick promotion + 20% salary increase	R 35,453,295,562	113,597
Better housing + car + 10% increase	R 2,018,287,438	6,496	Study leave soon + 10% increase	R 37,005,442,590	129,201
Study leave soon + 10% increase	R 2,042,458,931	6,607	Better housing + car + 10% increase	R 37,070,510,507	128,181
30% rural allowance	R 2,127,752,057	5,997	30% rural allowance	R 38,737,984,811	117,964
20% salary increase + car allowance	R 2,192,576,910	6,612	20% salary increase + car allowance	R 40,271,339,908	130,671
Study leave soon + 10% increase + car (E4)	**R 2,280,913,118**	**7,183**	**Study leave soon + 10% increase + car (E4)**	**R 41,180,078,966**	**139,831**
Better housing + car + 20% increase	R 2,362,769,901	7,011	Better housing + car + 20% increase	R 43,624,123,843	138,889
Study leave soon + 20% increase (E5)	**R 2,746,664,183**	**7,971**	**Study leave soon + 20% increase (E5)**	**R 48,856,995,580**	**153,481**

Compared to the current situation, the cost of an additional rural nurse-year is slightly more than R241,073 if the government decides to offer study leave to rural nurses after two years in post, and R250,065 if one considers only one cohort. With an additional car allowance offered, the cost per additional rural nurse-year goes up to about R295,666 (or R313,096 in one cohort), while it increases to more than R485,655/R517,831 and R562,395/R590,988 when direct financial incentives are added (see Table 9.4). It is interesting to note that the ICERs for the 40 cumulated cohorts are lower than the ones computed on one unique cohort. This is probably due to the fact that in the cumulative model, the last cohorts that are aggregated in the model are effective at bringing many rural nurses years (it had been highlighted before that the number of nurses in rural areas are the highest at the beginning of the cohorts), who are less costly since they are only at the start of their career.

Table 9.4: ICER of the cost-effective downstream interventions

Strategy	ID	ICER for 1 cohort	ICER for 40 cohorts
Study leave soon	E1	R 250,065	R 241,073
Study leave soon + car	E2	R 313,096	R 295,666
Study leave soon + 10% increase + car	E4	R 517,831	R 485,655
Study leave soon + 20% increase	E5	R 590,988	R 562,395

Ignoring the interventions including study leave, the more cost-effective strategy would then be to provide a car allowance (an additional cost of R 291,541 per additional rural nurse year, based on figures for one cohort). The ranking of all possible downstream interventions by ascending ICER (calculated against the current situation) underline that although financial incentives seemed very attractive for their effects (see results in Chapter 7), they are much less so when costs are factored in (see Table 9.5).

Table 9.5: ICER of all downstream measures except those that include study leave (one cohort)

Policy measures	ICER of each intervention compared to current (baseline) situation
Single interventions	
Car allowance	R 291,541
2-bedroom house	R 431,326
10% rural allowance	R 489,868
20% rural allowance	R 566,016
30% rural allowance	R 636,437
Promoted faster	R 716,515
Policy packages	
Better housing + car	R 323,419

Quick promotion + car	R 360,908
10% salary increase + car allowance	R 393,565
Better housing + car + 10% increase	R 393,628
Better housing + car + 20% increase	R 456,119
20% salary increase + car allowance	R 462,324
Quick promotion + 10% salary increase	R 527,181
Quick promotion + 20% salary increase	R 589,423

Although they are based on the average expected costs and effects obtained through 2,000 simulations, these results do not reflect well the uncertainty associated with the estimated cost-effectiveness of an option. This is the reason why cost-effectiveness acceptability curves are needed.

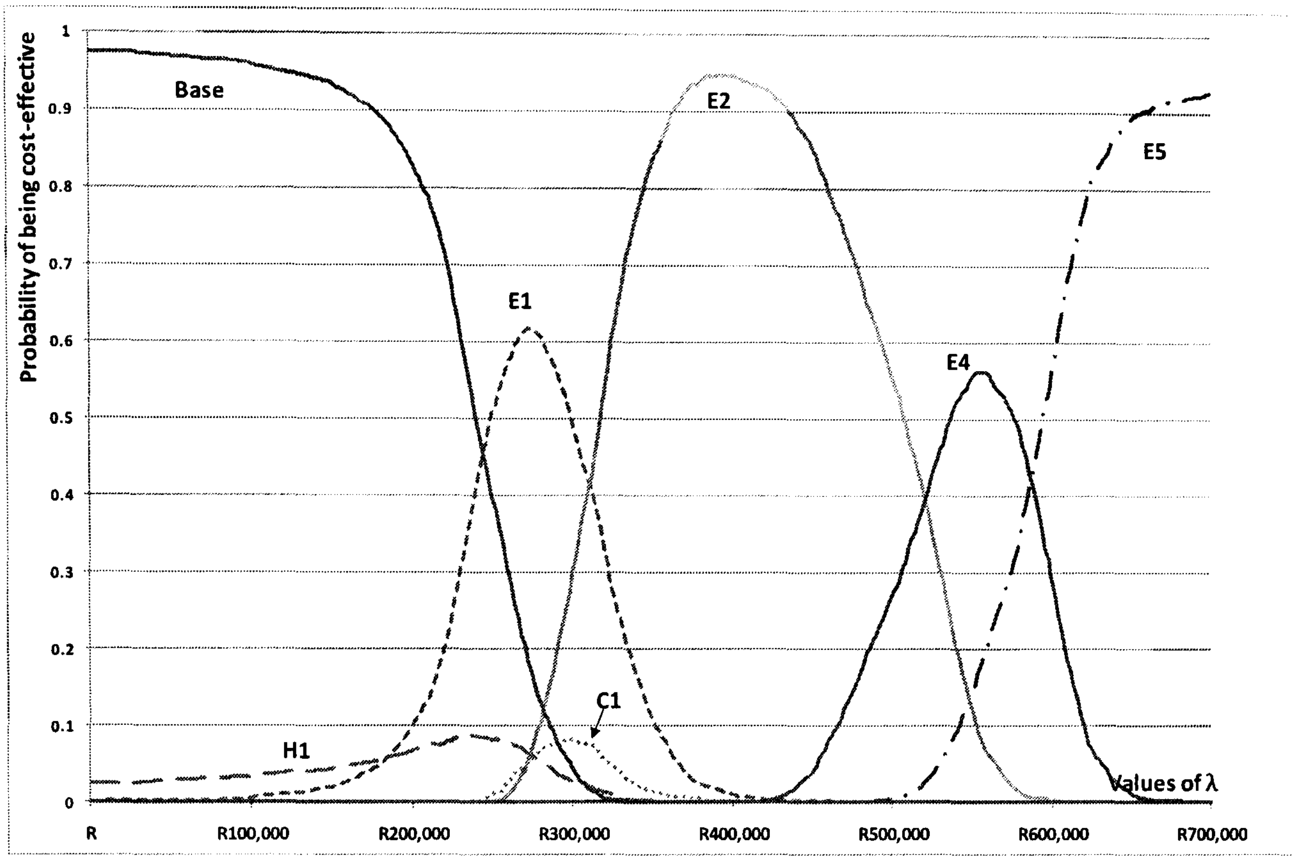
B. Cost-Effectiveness Acceptability Curves and Frontier

Figure 9.5 presents the cost-effectiveness acceptability curve of all listed interventions for one cohort. The curves indicate the probability of the different policies being more cost-effective than the current situation for a range of possible amounts that the government is willing to pay for an additional rural nurse-year. Figure 9.5 demonstrates that if the government is willing to pay approximately R250,000 per rural nurse-year, there is a 50% chance that the education strategy is more cost-effective than the current situation. At a figure of about R265,000 per rural nurse-year, this probability rises to nearly 60%.

To present simultaneously the optimal option and the level of uncertainty associated with that option, the associated CEAF was plotted (Figure 9.6), vertical lines representing the ICERs. Prior to the first vertical line (λ<R250,000), the current situation is optimal, i.e. more cost-effective than offering study leave to rural nurses who have been in post two years. The next strategy (study leave after two years and a car allowance) only becomes optimal (more cost-effective than just offering a study leave) if the government is ready to spend between R315,000 and R517,000 (for one-cohort simulation).

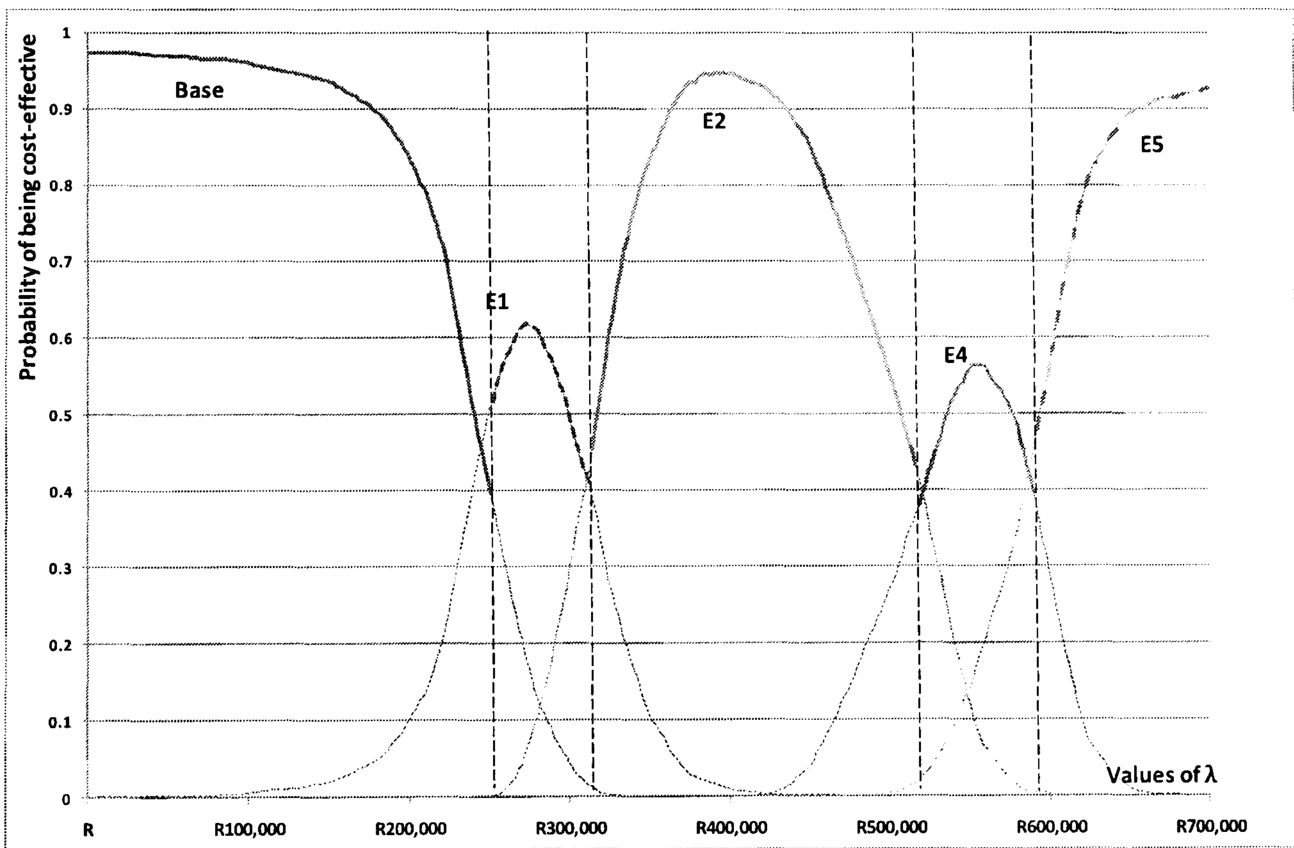
Furthermore, the CEAF is disjointed around some of the threshold values. For example, at the third vertical line of the top graph (λ= R 517,831) the probability of option E2 being cost-effective is 43%, whereas the corresponding probability for option E4 is 38%. Moreover, at this point, not only does the optimal option (E4) not have the highest probability of being cost-effective, but there is a 62% probability that it is not the most cost-effective option. This arises because the CEAF determines the optimal option by the highest expected net benefit, whereas the CEAC simply represents the proportion of iterations over which each option had the highest net benefit.

Figure 9.5: Cost-Effectiveness Acceptability Curves of HR scenarios for one cohort



Note: the graph shows the probability that the HR scenarios are cost-effective in comparison with the current situation (y-axis), as a function of decision-makers' ceiling cost-effectiveness ratio (x-axis)

Figure 9.6: Cost-Effectiveness Acceptability Frontiers of HR scenarios for one cohort



9.3.3. Economic analysis of upstream measures

Since the effects of interventions vary between nurses from rural and urban backgrounds, this section estimates the cost-effectiveness of some upstream measures, whereby a greater proportion of individuals from rural background would be selected into nursing training and enter the labour market. Simulations were carried out in which the selection process was hypothesised to have successfully enrolled 75% and 100% of individuals from rural backgrounds. In addition to this recruitment strategy, the different interventions presented previously were also simulated with these new populations.

The (mean) expected costs and effects of the different interventions can be found in Appendix 9.6. For each sub-population, an analysis similar to the one presented above was carried out, and incremental cost-effectiveness ratios were calculated for the non-dominated options. Two findings emerge from the results presented in Table 9.6. First, 'simple' upstream measures consisting in the selection of more individuals from rural backgrounds are more cost-effective than any of the downstream measures presented so far. Indeed the ICERs of these simple interventions are smaller than the ICER relating to a "study leave" policy with the current population. Selecting 75% of rural nursing students (instead of about 50% at the moment) would be cost-effective if the government was willing to pay at most R213,000 per rural nurse-year (taking the conservative estimate of one cohort), while it would cost R250,000 per additional rural nurse-year if the government offered study leave sooner to the current population of nurses.

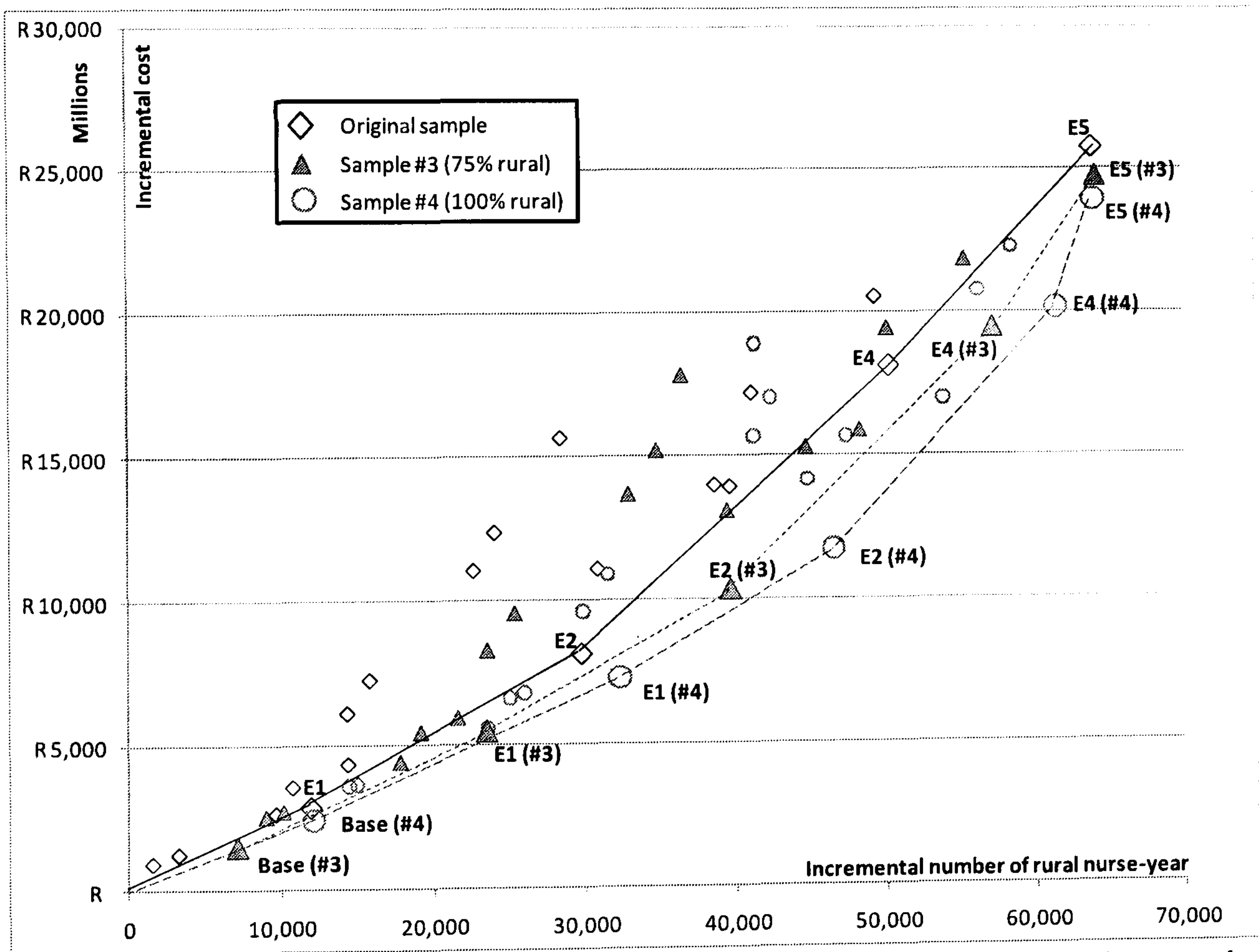
Table 9.6: ICER of cost-effective upstream strategies with more rural nursing populations (obtained over 2,000 simulations)

Strategy	ID	ICER for 1 cohort	ICER for 40 cohorts
Results for sample #3 (75% rural nurses, 25% urban nurses)			
Recruiting 75% of rural nurses	B3	R 213,170	R 210,875
Recruiting 75% of rural nurses + study leave soon	E1	R 252,608	R 327,324
Recruiting 75% of rural nurses + Study leave soon + car	E2	R 318,519	R 239,019
Recruiting 75% of rural nurses + study leave soon + 10% increase + car	E4	R 558,983	R 522,584
Recruiting 75% of rural nurses + Study leave soon + 20% increase	E5	R 800,428	R 758,942
Results for sample #4 (100% rural nurses, 0% urban nurses)			
Recruiting 100% of rural nurses	B4	R 211,270	R 200,215
Recruiting 100% of rural nurses + study leave soon	E1	R 252,994	R 242,089
Recruiting 100% of rural nurses + study leave soon + car	E2	R 327,968	R 310,331
Recruiting 100% of rural nurses + study leave soon + 10% increase + car	E4	R 607,832	R 565,197
Recruiting 75% of rural nurses + study leave soon + 20% increase	E5	R 1,574,226	R 1,471,745

In addition, the selection of more rural area-friendly individuals coupled with additional incentives would also remain more cost-effective than equivalent measures undertaken with the current population. In fact, as clearly demonstrated by Figure 9.7, there seems to be an almost linear relationship between the cost-effectiveness of options and the proportion of rural students.

The cost-effectiveness frontier of the entirely rural population completely dominates all the policy options that can be undertaken with a population of only 75% of rural individuals, which in turn offers policy-makers options that are all more cost-effective than those currently available. Interestingly, the interventions deemed cost-effective with the new nursing population structure are the same as those found cost-effective for the entire nursing population. This tends to reiterate the interest of using attractive incentives that may not be based entirely on financial rewards.

Figure 9.7: Cost-effectiveness plane showing the average expected incremental costs and effects of interventions with different populations (for 40 cohorts)



Note: the incremental costs and effects are all calculated in reference to the current situation (in terms of job conditions and population structure)

To put these results in context, some additional simulations were undertaken to understand what the effect would be if an *undesired* change in the structure of the nursing population, where fewer people from rural background would become nurses (0% or 25% only of the nursing population was simulated to be from rural backgrounds). The results, presented in Appendix 9.7, show that this change in population would decrease the number of rural nurses-years[103], and that increasing the number of rural nurse-years from its present level would be very costly (about R350,000 per additional rural nurse-year if the population was entirely urban).

9.4. Discussion

9.4.1. Summary of key findings

This chapter presented an economic analysis of HR policy interventions, based on outcomes generated by stated preference techniques and embedded in a Markov model, and costs estimated with secondary data. The analysis assessed a variety of policies that tried to alter the working conditions of nurses currently working (downstream measures), as well as interventions based on the selection of more individuals likely to take up rural posts (upstream measures). Several clear messages arise from the findings.

First, most of the strategies relying almost entirely on direct financial incentives are strictly dominated by other interventions, meaning that better outcomes can be achieved at a lower price. Second, amongst all the simulated downstream measures, the ones that were most cost-effective offered the possibility of study leave to rural nurses after two years in post. This result confirms the importance of this incentive, and the small additional cost it represents (compared to salary costs) makes it the most financially attractive option. Finally, the analysis clearly showed that upstream measures, based entirely on the selection of more nursing students who are more likely to accept positions in rural areas (people with rural backgrounds), are more cost-effective than downstream ones. Furthermore the analysis showed that all of the interventions would be most cost-effective if the proportion of rural nurses was higher.

9.4.2. Discussion of results

This study is the first to try and evaluate the cost-effectiveness of different policy interventions to attract nurses to rural areas. The economic analysis presented here represents a significant improvement from a situation where none of these policy decisions was informed by a transparent attempt to estimate costs and effects. Due to the lack of similar existing studies, it is difficult to compare the ICER obtained to equivalent studies. However, it is possible to calculate the average discounted cost of a rural-nurse year (see details on the calculation in Appendix 9.8). Assuming that the cost of a nurse relates only to salary (excluding the cost of specialist training

[103] In the absence of intervention or even with study leave offered to nurses in rural posts if the population were entirely urban.

for example), then the present value of an average rural nurse-year is R238,324. This means that the willingness to pay for a rural nurse year is currently at least equal to that value. Assuming that the government is not ready to pay more than that threshold (therefore λ_{min}=R238,324) the cost-effective interventions are the simple upstream interventions[104] ($ICER_u<\lambda_{min}$). However this threshold is certainly under-estimated because it does not incorporate training costs paid to some of the nurses who are already currently offered study leave to specialise. Besides, if the South African government is willing to increase access to health services in rural areas, it implies the value of a rural nurse-year (to the government) is higher than this. Given that the cost per additional rural nurse year under the most effective downstream policy is just slightly higher than an under-estimated willingness-to-pay threshold of the government ($ICER_{E1}$= R 241,073> λ_{min}= R238,324) it is reasonable to believe that offering study leave to rural nurses is probably a cost-effective downstream measure.

The particular findings for South Africa suggest that guaranteeing to nurses the possibility to specialise later is the most cost-effective "downstream" measure. Such policies have been used in different settings, but mostly for doctors, who had to work in a rural area before being able to specialise. Yet such experiences have been closer to coercive measures than actual incentives. In some developing countries, efforts have been made to promote education opportunities for staff in rural areas (Mauritius Ministry of Health and Quality of Life, 2003, Wibulpolprasert and Pengpaiboon, 2003, Dräger et al., 2006), but guaranteeing some (paid) study leave to specialise remains to be introduced. In addition, despite this range of experiences, neither the cost nor the effect of these policies have ever been calculated. Yet the modelling presented here suggests that despite possible adverse effects (specialist nurses not returning to rural areas or the public sector generally), such interventions are more cost-effective than any alternative.

Furthermore, the work presented here indicates that financial incentives are only relatively cost-ineffective options to attract health workers to rural areas. Direct financial incentives were found to be dominated options in all configurations, even when one excluded the possibility of offering study leave to nurses. This is a critical finding which contrasts with most attempts in developed and developing countries to attract health workers to under-served areas (see the literature review in Chapter 2). Although the findings presented here are specific to a particular sample of the nursing workforce in South Africa, it is likely that similar results could hold for other cadres and other settings. All it takes is the identification of some intervention that would be much less costly than salary increases and whose effects would be quite important. The case of the car

[104] Selecting more nurses from rural backgrounds, without any form of incentive.

allowance here is quite interesting. Although it is a financial incentive, its effect is certainly greater than an equivalent amount of money because it encompasses some "status" effect.

In addition, the results presented here have underlined the importance of understanding the heterogeneity of job preferences amongst health workers, as they can have important consequences for policy planning. In the case of South Africa, the differences in job preferences between individuals from rural and urban backgrounds directly translate into the possibility of addressing an acute policy issue (staff shortages in rural areas) with more cost-effective policies. There is enough evidence in the literature to suggest that selecting individuals from rural areas is probably an effective way to address rural shortages (Brooks et al., 2002, Lehmann et al., 2008). Here it was demonstrated that it was also the most cost-effective policy. More in-depth information about the heterogeneity of preferences might be able to reveal other (cost-effective) policy levers for policy-makers.

Finally, this work provides some insight into the complexity underlying the costing of national policies where resources are individuals, whose costs are driven by complex dynamics. There has been very little done to cost the financial resources needed to employ health professionals under different situations and positions. Some recent efforts in several low- and middle-income countries to cost HR policies have highlighted the difficulties in accessing good quality data (McCoy et al., 2008, Vujicic et al., 2009). These studies highlight the challenges involved if researchers want to undertake more refined cost estimates, which could help develop more refined, individual-based, cost-effectiveness models.

9.4.3. Limitations

As the first study undertaken to assess the relative cost-effectiveness of various policy interventions to attract more health workers to rural areas, it is important to highlight potential limitations with the analysis.

First, the costs may have been under-estimated.

For downstream measures, all cost-effective interventions comprised the possibility to obtain study leave earlier. Whilst particular efforts were made to estimate the cost of providing that year of education to nurses, these estimations assumed that no infrastructure or equipment cost would be incurred as a result of the interventions (i.e. there would not be a need to build new buildings or classrooms). However, if the policies are successful, large numbers of students cannot probably be accommodated within existing infrastructures, and there could be an additional cost. However, this cost would be shared by other government interventions (e.g.

regular nursing training). Another aspect that was not costed in the economic analysis is the expenditures that would be incurred if the health authorities decided to replace rural nurses while they are on study leave. In the present circumstances, the South African government does not hire additional nurses when some leave their post to undertake a one-year specialist training. This is partly explained by the fact that during their one-year training, nurses continue to work in some facilities during rotations. At present, due to the limited number of nurses from rural areas who are offered study leave, the provision of care in under-served areas is not disturbed much. However, if a systematic effort was made to guarantee study leave to rural nurses, this situation could change. In that case, it is possible that the government could wish to employ 'replacement' nurses to cover for those would be on study leave. On the other hand, if such nurses were to be hired, their costs would be mitigated by the benefit of having them in rural areas. Although the model did not take the replacement cost into account, it did account for the loss in rural nurse-years resulting from the study leave. It is possible that these two could have balanced each other out, and that the absence of replacement nurses does not invalidate the results of the model.

Similarly, the cost of upstream measures also systematically hypothesised that the selection of more individuals from rural areas would not create additional costs. This assumed that achieving a proportion of 75% rural graduates would just require a particular effort in the selection of students already applying to nursing studies. However, barriers might exist that prevent individuals with rural backgrounds from applying to higher education (information barrier, financial costs, etc.). These barriers could be overcome by additional bursaries, or information campaigns, but those would have a cost, which has not been accounted for here. Another way to attract more rural graduates, adopted by many countries, has been to decentralise training institutions to rural areas (Wibulpolprasert and Pengpaiboon, 2003, Grobler et al., 2009). This would also be a way to ensure a higher proportion of rural nursing graduates, which would incur non-negligible costs.

Second, the perspective taken for the cost-effectiveness analysis might have overlooked some detrimental effects. It is usually recommended to adopt a societal perspective, because it can detect cost shifting between sectors if they occur. For example, it is reasonable to assume that public policies offering higher salaries for nurses in rural areas could introduce distortions on the labour market, and increase the marginal cost of a nurse overall. Consequently, this could lead to a reduction of the nursing workforce in the labour market as fewer nurses could be hired (if budgets were held constant), which would lead to a reduction in the well-being of patients. Such adverse effects suggest that the overall effect might not necessarily be positive, unlike that seen when taking a limited government's perspective. Furthermore, adverse effects on urban nurses were not accounted for, despite the structure of the Markov model whereby initial increases in the number of rural nurses automatically decrease urban nurses. Despite these issues, there are reasons to reject a societal perspective, and consider a government perspective only. First, in practice, it would be difficult to evaluate all the relevant costs and benefits to be included in an economic evaluation taking a societal perspective. For example, to evaluate the financial loss incurred by the private sector of a nurse, further assumptions would have to be made on the monetary value of a private nurse compared to a public nurse. Second, the potential effects that are excluded from a government perspective are likely to have little impact on the overall results. Possible negative effects in the private sector could only lead to minor costs to patients (e.g. increase in premiums to pay for higher salaries to nurses), which would be negligible compared to the ones modelled here. Regarding negative effects for the patients consulting public facilities in urban areas, it is possible to assume that the benefits gained by patients in remote under-served areas would have been greater than the loss to patients in urban areas, which are neither short of facilities nor of staff. Of course, such an argument can only be held on the condition that the policies do not create shortages in urban areas, by draining all the public staff there. The results of the Markov model described in detail in the previous chapter provide some reassurance about that, as they showed that the proportion of staff in urban areas was never smaller than that in rural areas.

A third series of limitations in this economic analysis relates to the lack of data to model the costs of interventions. As a result, many assumptions had to be made to gauge the costs of the interventions simulated. Some assumptions were made relative to the cost of housing (for example, no detailed data could be found on the weighted average costs of housing). Others were made on the cost of providing education for nurses. For this intervention, it is likely that the costs used might have under-estimated the actual costs of providing education, in particular when many more students take-up post training courses as in education strategies. Indeed, having more students is likely to increase fixed costs such as the cost of building bigger facilities or the administrative costs induced by the management of more students. But the most important hypothesis concerned the salaries paid to nurses, by simplifying the possible career paths to five possible options. As expected, the results showed that salaries are the most important costs, representing more than 90% of all costs in these interventions. Therefore, under-estimating the costs of paying the nursing salaries would directly under-estimate the cost of the interventions. But the major problem is that it is difficult to ascertain whether the salary costs were over- or under-estimated. Although three of the five career paths were specifically chosen to try and represent some of the more costly nursing careers in the public sector, the absence of data on that topic prevents definitive conclusions. Besides, even if the probabilistic sensitivity analysis has avoided some of these pitfalls by drawing various estimates of the weights given to each one of the five career paths, the actual salary structure of these paths was never changed. These caveats suggest that the cost estimates might have been inaccurate. However, the relative cost of one policy to another was systematically based on the same assumptions. Even if they were inaccurate, the relative change in costs would only have been caused by the change in effects (the number of nurses to be paid), but the structure of the underlying costs would have remained the same. Therefore, providing the change in effects between one option and another was relatively well modelled, the relative cost-effectiveness of one option compared to another should have be well estimated as incremental costs would not have been biased by inaccurate cost estimates.

A fourth caveat in this analysis pertains to the way the model values the outcomes of the policies. In terms of effects, the model assumes an equal benefit whether the nurse staying in the rural area is young and inexperienced, or older and experienced. Both are equivalent to one rural-nurse year. This hypothesis may therefore reduce the benefits provided by the presence of experienced and productive nurses. Taking into account their productivity and knowledge, it could be argued that the value of a nurse is an increasing function of time, up a certain point. This limitation is particularly critical as the costs in the model do reflect the differences in the productivity and role of nurses. Because they are mostly based on salaries, which increase with experience, the costs of a nurse towards the end of a cohort is higher than that of a beginning nurse. It would be desirable to address this issue, given that the results of the model prove that policies that are cost-effective are the ones that are particularly good at attracting young and inexperienced nurses (e.g. education policies attracting nurses before they specialise). It is also an important issue considering the underlying structure of the model, where the high turnover rates at the beginning of the work life suggest that the majority of rural (young) nurses leave for urban areas and private facilities. A related issue concerns the assumption made about upstream measures, where it is implicitly assumed that more rural individuals can be recruited into the nursing profession without decreasing the selection standards (and obtain an equal 'quality' of nurses). Although the high number of applications suggests that this is not an unreasonable assumption, it remains to be confirmed.

A fifth limitation stems from the exclusive reliance on stated preference outputs coupled to numerous assumptions made to set up the Markov model. A detailed discussion on the external validity of DCEs can be found in section 6.5.3, while a broader discussion on the various limitations of outcome measures can be found in the discussion section of the last chapter.

Although they do not fix all the problems, the use of PSA and CEAFs contribute to taking into account the uncertainty of these parameters in the model estimates.

Finally, the model presented here fails to take into account the complexity of the reality in general, and that of policy implementation in developing countries in particular.

First, one of the critical underlying assumptions is that there is a demand for nurses in rural areas, which remains constant over time. Therefore this implies that such demand remains constant and is neither mitigated by the successes of the policies, nor by potential population movements between rural and urban areas which would decrease the demand for nurses in the former areas. Although this might be a restrictive and unrealistic assumption, it is reasonable for the purposes of the modelling to consider only the supply-side decisions of nurses and consider that 'all things remain equal' on the demand side.

Second, the model used is unlikely to help policy-makers understand the heterogeneity in preferences and policy effects that could stem from the diversity of rural areas. For example, it is likely that some results could be applicable to certain rural areas (for example those around the regional capital of Mmabatho, in the North West province), but not in the most remote areas of the Northern Cape Province. This heterogeneity was not captured by the cost-effectiveness model, which assumed homogeneous effect for all rural areas. Therefore the model might have over-estimated the effects of policy interventions, if respondents had in mind an "average" rural area that might be more attractive than more remote ones.

Third, the economic analysis did not incorporate the potential costs and inefficiencies involved in the implementation of such policies. In the real world, failure to implement the proposed policies adequately can lead to increased costs, possible frustrations and adverse effects (Penn-Kekana et al., 2004, Walker and Gilson, 2004). Applied to the simulated policies, it is plausible to imagine that the government's failure to guarantee study leave to rural nurses within two years (as indicated in all the cost-effective policies) could create resentment and frustration amongst the nursing profession, and all projected effects might wane. Similarly, upstream policies based on quotas favouring the recruitment of certain groups of the population could face a lot of political obstacles, and the social and political costs of implementing them might outweigh the expected benefits. Indeed, groups who would be discriminated, or even nursing trade unions, would certainly oppose reforms that would create inequalities of opportunities between individuals. In the particular political context of South Africa, this issue might not be taken lightly.

Overall, despite its simplicity, this cost-effectiveness model provides an invaluable framework to analyse a difficult policy problem. The fact that other problems might derail the effects of policies envisaged here is somehow another issue, which pertains to broader governance problems, requiring separate analyses and answers.

9.4.4. Implications for policy and research

A. Implication for policy

Because this study is the first to use stated preference techniques to inform these policy issues, and because the model presented a number of limitations both for the evaluation of costs and effects, some caution should be taken when considering the policy implications of the findings. Nonetheless, the work presented here has several implications for HR policies to attract health workers to rural areas and leads to considering new ways to improve the planning and design of human resources policies in general.

In principle, in any economic analysis the alternative with the lowest cost per achievement gain would be the most desirable. However, it is important to consider whether differences in cost-effectiveness ratios are large or small. If the differences are small, it is probably wise to weigh more fully other criteria in making the decision such as the ease of implementation or previous experiences. If the differences in cost-effectiveness are large, it is advisable to give greater confidence to the cost-effectiveness criteria while still considering other factors that were not considered in the analysis. In the present case, the results suggest that with an additional cost per rural nurse-year of just R213,170, the South African government should try to increase the proportion of rural nursing students up to 75% to attract staff to rural areas. The more cost-effective option of enrolling into nursing *only* individuals from rural background was used here to illustrate the effect of selecting more "rural-friendly" individuals, but it is certainly not an option that could be politically envisaged.

Failing to adopt upstream interventions, the government should guarantee study leave sooner to rural nurses, as this is cost-effective if the government is ready to spend at least about R250,000 per nurse in rural areas each year. Alternatively[105], the government could decide to offer a car allowance of R500 every month to rural nurses, which would increase rural staff at a cost of about R291,000 per additional nurse-year. The large difference between these two ICERs suggests that it is reasonable for the South African government to use the first option. Yet, further consideration

[105] If providing study leave sooner could not be proposed.

should be given to other aspects, such as the problems that might be encountered by the government, if it was seen as granting an undue advantage to rural nurses.

The results summarised above therefore suggest that in South Africa policy-makers should design policies that give priority access to health workers from rural areas to specialist training and study leave. This seems to be not only one of the most effective incentives to attract them to rural areas, as underlined in the previous chapter, but in fact the most cost-effective. The economic analysis also rules out the use of strong financial incentives. This is a key result for policy-makers, as direct financial incentives have been one of the most widely used policies to address rural shortages both in developed and developing countries (Dussault and Franceschini, 2006, Grobler et al., 2009). Even allowing for more uncertainty due to the various caveats of the model used, this study has clearly demonstrated that salary increases are highly unlikely to be cost-effective. This should be taken into account by policy-makers in contexts where addressing the issue of health personnel in rural areas is critical, while budgetary resources are scarce.

Finally, despite the emphasis given to human resources for health in the past few years in developing countries, the lack of rigorous planning tools and data is regularly brought up as a reason why governments fail to address the HR crisis effectively. Despite its relative complexity, this work demonstrates that it might be feasible to inform the design of policy options, as well as provide information on their financial desirability. This complements recent efforts that have been carried out to improve prospective HR planning (WHO, 2006, Vujicic et al., 2009). Further work should be pursued in closer collaboration with governments to refine the tools developed here and adapt them more precisely to the needs of policy-makers. Such engagement could also provide a valuable opportunity to improve the model features and assumptions.

B. Implication for research

The research presented here suggests at least three different further explorations of the cost-effectiveness of HR policy interventions.

First, further research would be welcome to refine the model presented here. In particular, the costing of policy interventions was not informed using particularly accurate data. Further data on salary costs could be collected to obtain a more reliable estimation of the ICERs. This attempt to improve the model could also benefit from better data to estimate a structural Markov model. In particular, it would be desirable to understand better the movements from one sector to another to improve the reliability of the transition matrix used. It is hoped that this will be achieved by following up over time the group of nurses who took part in this research. Although the sample is small (377 nurses at baseline), it should be sufficient to develop better assumptions for various model parameters.

Second, as noted in the previous chapter, several simplifications were made regarding the effectiveness of the policies. It would be interesting to remove some and test whether the results still hold. Various assumptions could be tested. The effects of policy interventions could be modelled to decrease with time and successive cohorts. This would certainly be a more realistic approach. One could thereby test how the cost-effectiveness of different scenarios varies according to the time horizon chosen. This is particularly relevant to real decision-making processes of government who might prefer options cost-effective in the short-term over those optimal in the long run.

Third, this research provides helpful insight for the future use of DCEs to inform economic analysis of policy options. Initially, the DCE used here to simulate the effects of policy interventions was not designed purposefully to serve as input into a cost-effectiveness analysis. As a result, some attributes and levels introduced in the DCE provided ambiguous or incomplete information for the costing of interventions. For example, the housing attribute was not clearly defined. The wording in the DCE mentioned "subsidised" housing, but it was never clear the amount that would be subsidised, neither whether the cost of housing was expected to be different from one place to another. As a result, various assumptions were made to cost that policy. It is also unclear what respondents might have had in mind when they read that element. Future research using the results of DCEs to measure the effects of policy intervention should have this objective from the beginning and make sure that attributes are clearly defined, not only for the purpose of respondents' understanding of the DCE, but also for costing purposes.

9.5. Conclusion

Although choice experiments have been recently used to predict the uptake of jobs or specific health programmes (Gerard et al., 2008, Hanson and Jack, 2008, Kolstad, 2010), those studies never used such outputs from DCE studies to further investigate the cost-effectiveness of interventions modelled. This chapter therefore proposed an innovative use for choice experiment results, as inputs to a cost-effectiveness model, measuring the effects of possible policy options. It is likely that this application could open new possibilities for researchers and policy-makers alike to design effective interventions. Indeed, carrying out impact evaluation studies to obtain precise and rigorous measures of effects is not always feasible or desirable, due to cost, ethical or practical constraints (Ranson et al., 2006). This is particularly true in the case of complex interventions, where various incentives are combined. In this context, DCEs can play a crucial role as an alternative cheap and quick means to develop the evidence base, and help governments make informed decisions.

Chapter 10 - Discussion and Conclusion

10.1. Key findings

This thesis set out to explore the determinants of job choices in the context of the nursing labour market, with a view to discuss the design of efficient policies to address the shortage in rural areas. Results were based on data from the middle-income country setting of South Africa. This section brings together the main findings from the results chapters, presenting them according to the overall objectives of the thesis.

10.1.1. Exploring nurses' altruism (Objective 1)

According to the conceptual framework, altruistic individuals were hypothesised to self-select into the nursing profession (H1). The first objective of the thesis was therefore to test this hypothesis before embarking on an empirical analysis of the determinants of nurses' job choices. The aim was to measure, compare and contrast South African nurses' altruism to that of other individuals and other groups of nurses.

Altruism was measured quantitatively by playing the dictator game, a behavioural economic game. Nurses had to decide whether they wanted to allocate part of a sum of money (corresponding to the daily salary of an early career nurse) between themselves and an anonymous recipient.

The results suggest that altruistic individuals probably self-select into the nursing profession. Indeed, nursing students are always systematically more generous than economic students (in South Africa), and, from the literature, other participants who have played the dictator game. The similarity of results obtained from nurses in South Africa, Kenya and Thailand strengthen the hypothesis of a common altruistic nursing culture.

However, when altruism towards patients specifically is measured, the decisions made by nursing and economic students in South Africa are virtually identical. The results also suggest that, unlike other survey participants in other settings, South African nurses do not see patients as more "deserving" (Branas-Garza, 2006, Carpenter et al., 2008) than their peers.

Finally, findings show that some socio-demographic characteristics (gender, age) and societal values affect the generosity displayed in experimental games, in a way that is in agreement with other empirical findings and the expected effect of moral and social motivations.

10.1.2. Studying the determinants of nurses' career preferences (Objective 2)

The conceptual framework was built upon the hypothesis that preferences for jobs differ across individuals. In particular, altruistic nurses were hypothesised to be more attracted by public jobs than other jobs, and within public jobs to favour rural jobs. This was derived from the assumption that more altruistic nurses increase their utility through the increase in the marginal benefits to patients derived from their presence. It was also hypothesised that individuals from rural areas would be more likely than others to choose rural posts.

These hypotheses were tested empirically through the use a labelled discrete choice experiment specifically constructed to replicate the four main job opportunities of South African nurses when they enter the labour market (private job, overseas job, rural and urban jobs in the public sector). The choice of a stated preference technique was justified by the lack of appropriate data on actual choices, and a desire to understand the trade-offs made between the different options.

As expected, good job characteristics were found to be associated with an increase in the utility of a job, conversely for bad working conditions or job characteristics. The results also showed that individuals valued money differently across the different job opportunities. This suggests that they expect employers to apply the theory of compensating wage differentials and compensate them for the various unpleasant non-financial aspects of the jobs. In particular, South African nurses expect higher salaries overseas, probably to be compensated for the cost of leaving one's family and country, and to cope with the higher cost of living. A higher compensation was also expected in rural areas, possibly to compensate for the lack of amenities and difficult working conditions.

The analysis confirmed the hypothesis (H6) that individuals with rural backgrounds or having a positive attitude towards rural areas were more likely to choose positions in rural areas than in urban areas. Having trained in a rural province instead of an urban one was also found to be significantly associated with rejecting a job in urban areas. This confirms the hypothesis that enjoying life in rural areas (through childhood, training or other channel) increases the utility derived from a job located there.

The role of altruism in job choices was less clearly demonstrated. Overall experimental measures of altruism were not significantly correlated with particular job preferences. However, greater altruism in the dictator game towards poor recipients was associated with a preference for public jobs, and rural ones in particular. To some extent, this confirms, albeit tentatively, hypotheses H2 and H3. In addition, survey measures showed that more selfless and pro-poor values are correlated with a preference for public sector jobs, while more conservative and individualistic views are associated with a greater preference for private jobs. Other individual characteristics that mattered included the type of training institution, age, gender and race.

Finally, the choice experiment predicted that under prevailing labour market conditions, 12% of nurses would choose a job overseas, and the rest of the nursing population would split evenly between the three other career opportunities. Although lack of data prevented the comparison of most of these predictions with actual data, available figures on emigration flows suggest that the model substantially over-estimates emigration decisions made by South African nurses.

10.1.3. Assessing the effects of policies to attract nurses to rural areas (Objective 3)

The third objective of the thesis was to investigate the differing effects of HR interventions to attract more nurses to rural areas. The empirical approach taken to address this objective was to use another choice experiment, which was restricted to rural and urban jobs in the public sector. The choice experiment was purposefully designed to propose more attractive features in rural jobs than in urban ones.

The analysis of the heterogeneity of job preferences amongst individuals carried out here partly concurred with the one performed on the whole set of job opportunities. In particular, individuals with rural backgrounds, those who had trained in a more rural province or who had positive attitudes towards rural areas were found to be more likely to prefer rural jobs than others. Yet, unlike what had been found in the analysis of preferences for all labour market opportunities, neither altruism nor any other measure of pro-social attitude was found to be associated with a preference for rural jobs. The final analysis only showed an association between pro-poor attitude (measured through a survey) and a preference for rural posts, which was significant at $p<0.13$.

The analysis confirmed the presence of heterogeneous tastes within the population regarding the different policy levers. A further analysis showed that the origin of nursing students (whether they came from rural backgrounds or not) was a key factor explaining that heterogeneity. In effect, people from rural areas are significantly less sensitive to most of the incentives used to attract nurses to rural areas.

The estimated model was then used to predict different uptake of rural vs. urban posts. Under baseline (current) conditions, 70% of nurses choose a position in an urban area, while 30% would choose one in rural areas. These figures could not be compared to actual choices, as the scarce data available do not provide refined information about rural and urban posts.

As expected from the regression results, a different management system or quicker promotion would not affect this distribution much. In contrast, financial incentives (salary increases and car allowance) have strong effects, and the guarantee to obtain study leave four years sooner than is usual provides the third most powerful policy lever (after the salary increases of 20% or 30%). The simulations also showed that a combination of different incentives could achieve a high uptake of rural posts.

Finally, different policy simulations were undertaken with synthetic populations which varied in their proportion of rural nurses (0%, 25%, 75% or 100%). This analysis clearly demonstrated the potential positive effect of upstream policy measures that would seek to recruit more rural graduates. Indeed, the analysis showed that the more rural nurses in the population the higher the proportion of nurses who will choose to work in rural areas.

10.1.4. Measuring the relative cost-effectiveness of HR interventions (Objective 4)

The final objective of the thesis was to determine the relative cost-effectiveness of different policies that could be employed by the South African government to attract nurses to rural areas. The analysis estimated the cost-effectiveness of policies that tried to alter the working conditions of nurses currently working (downstream measures), as well as interventions based on the selection of individuals more likely to take up rural posts (upstream measures). This economic analysis was based on outcomes generated by stated preference techniques and embedded in a Markov model that was constructed to simulate the movements of staff in the long run within the public sector (between rural and urban posts), and also between the public and private sectors.

The results determined that direct financial incentives are not cost-effective strategies to attract nurses to rural areas. Among all the downstream measures simulated, the ones found to be cost-effective all guarantee rural nurses the possibility of study leave after two years in post. Finally, the analysis clearly demonstrated that increasing the number of nurses who are more likely to accept positions in rural areas (those with rural backgrounds) is the most cost-effective approach. The results also suggested that cost-effective downstream measures would bring even better results if they were offered to a nursing population that would include a greater proportion of rural nurses than the current one.

10.2. Strengths and limitations of the thesis

In each of the five empirical chapters, the contribution of this work to the existing literature was discussed. The specific limitations of some of the methodological approaches and tools or analyses were also presented. This section brings together the main elements discussed earlier and reflects on the overall contribution and limitations of the thesis.

10.2.1. Reflections on the overall empirical approach

The strengths and limitations of the empirical approach were mainly shaped by the use of particular methods, as discussed below. However, some comments can be made about the overall empirical study design. As explained in Chapter 3, this work was embedded in a cross-country project and constructed upon the South African component of that study. This general framework has determined various decisions and constraints that had to be taken into account.

First, the CREHS project was conceived as a cohort study that would examine issues of nurse attraction and retention in rural areas. To avoid some of the biases that would have arisen with the sampling of nurses already in post (see Chapter 3), the cohort study was designed around nurses about to graduate and enter the labour market. This meant that the study population was imposed on this thesis. Similar research could have been undertaken with working nurses permitting the investigation of other sources of heterogeneity of job preferences (e.g. past job experiences). This is potentially relevant as the economic literature has recurrently underlined the importance of reference-dependent preferences. After they spend some time in a work environment, individuals' preferences are certainly influenced and framed by their own experience and that of their friends and colleagues. For example, it is unlikely that any study participant had previously worked overseas or in the private sector, although all would have had some experience of the public sector (through rotations during their training). However, surveying graduate nurses gave the opportunity to provide a baseline on work preferences at the beginning of a nurse's career, free from the multiple biases and influences described above. The continuation of the cohort study will provide a rich dataset to study these factors in the future. In the meantime, this study provides valuable information about the preferences of a population whose decisions are probably easier to change or shape than those of nurses more settled in their lives and perceptions.

Second, sampling graduating nursing students made it impossible to investigate nurses' actual career choices. Consequently, the investigation of career preferences (Chapter 6) had to rely on a choice experiment. On the one hand, this approach is limited by the reliability of participants' stated preferences, which may differ from their actual decisions (see previous discussions on that point). On the other hand, the DCE used gave the opportunity to measure the preferences of individuals in a market with perfect information. It is also relevant for policies to understand the preferences of nurses about to enter the labour market, as it may be easier to shape and alter their behaviours.

Third, building upon an existing study meant that the scope to influence the content of the tools was somewhat limited. For example, the discrete choice experiment assessing the impact of different policy interventions was the product of collaborative work between researchers from three countries. Compromises had to be made about which attributes to include, and it is likely that the tools would have been different had they been developed solely for the purpose of this PhD. For instance, an alternative option in the policy DCE would have been to include a third job (in the private sector) or an opt-out option. This would probably have made the simultaneous use of the two choice experiments easier. However, extra questions were inserted in the data collection tools in South Africa. For example, several questions were added to the self-administered questionnaire, not to mention the addition of the choice experiment presented in Chapter 6 to the rest of the data collection tools.

Finally, despite these constraints, the opportunity to carry out this work within the CREHS cohort study has also opened several research opportunities. First, it provided unique comparisons for the experimental economic games that were played in the three countries, with the same procedures and populations. The data collection on the cohort study continues, and upcoming follow-up surveys will present two special opportunities: some tools will be repeated (dictator games and the policy choice experiment), and data on revealed job preferences will be collected for each cohort member. Although this goes beyond this thesis (and its timeline), these new data will help investigate further some questions that remained unanswered by this work and under-researched (see below).

10.2.2. Generalizability of results

The sampling of the study population was never designed to be representative of the South African nursing population. Somewhat unexpectedly, the population study can seem broadly representative of the nursing population of South Africa (based on the few socio-demographic elements available on the latter). However, sampling was only done in two provinces, and it is likely that use of alternative socio-demographic indicators would have resulted in different conclusions. In fact, failing to include individuals from other rural and urban parts of the country probably precludes a robust generalisation of the results, as one of the core concepts of this work

– "rural jobs" or "rural areas" – is likely to be interpreted differently across the provinces of South Africa. In addition, as mentioned before, study respondents were exclusively nurses about to enter the nursing labour market as Professional Nurses. Therefore their preferences are probably not representative of those of more experienced nurses, who would have worked in the public and private sectors.

It would be even more ill-advised to attempt to generalise some of the findings of this empirical work beyond the South African context. Preliminary results from the two other countries involved in the CREHS cohort study underline the danger of "one size fits all" recommendations when it comes to designing human resources policies. For example, these analyses show that the influence of salary increases, better education opportunities or even types of facilities differ in size and sometimes in direction from one country to another (Blaauw et al., 2010).

Nevertheless, the focus of the analysis of this particular group of South African nurses and the limitations of the quantitative methods used are unlikely to change the core insights of the thesis on the importance of heterogeneity of preferences in job choices, and their relevance for policy design. Most health care workers are unlikely to be monolithic *homo economicus*, and their labour supply decisions will be influenced by different motives, with important implications for the policies public authorities might develop to address some of the failures in the health care labour market. In fact, there is already a broad literature outside economics showing that exposure to rural areas or rural origins are important for understanding health workers' locational preferences (Brooks et al., 2002, Lehmann et al., 2008). Preliminary results from Thailand and Kenya also underline the heterogeneity of individual preferences between rural and urban jobs (Blaauw and Lagarde, 2009).

10.2.3. Reflections on the use of discrete choice experiments

This thesis has made extensive use of discrete choice experiments, partly so in a very novel way. At the same time, some of the results raise questions regarding the limits of that method.

The work presented here made an innovative use of discrete choice experiments. First, a "representative" labelled choice experiment was constructed to replicate the main decisions nurses would face in the labour market. This is the first application of DCEs to labour market decisions where the objective is to simulate the actual choices made by workers, and not specifically to understand the trade-offs made by workers between different job characteristics. Here what mattered more were the trade-offs made between different types of jobs. Second, the combination of the outcomes of two choice experiments in a Markov model is an original way to simulate movements and choices of workers in the labour markets. Albeit imperfect, it also constitutes an alternative to the creation of a complex unique discrete choice experiment that would have been the combination of the two DCEs shown here[106]. Third, the use of the predictive capability of choice experiments to create the outcome (the number of rural nurse-years) in a cost-effectiveness model also opens new possible applications for DCEs to inform policy-making.

In this work, there were discrepancies between respondents' answers in the two DCEs. While the "representative" DCE with private and overseas jobs predicted that about 30% of respondents would choose rural jobs and 30% urban ones (an equal split between rural and urban amongst all those who would choose public jobs), the "policy" DCE predicted that 70% of respondents would choose urban jobs. Although they may simply stem from the differences in the choice sets proposed to respondents, these discrepancies raise a number of questions about the interpretation of DCE results, and their external validity in general.

As presented in Chapter 6, the analysis of DCEs relies upon the assumptions of classical consumer behaviour theory, and in particular assumes that people have complete rational preferences, use all available information to make their choices, and engage in compensatory decision-making. If these assumptions hold, then there are two alternative reasons for observing such differences. The first comes from the absence of opt-out option in the policy DCE, which will have forced people who would have otherwise opted for non-public jobs to make some trade-off. Since these people are likely to have preferred urban to rural jobs, they probably contributed to increasing the uptake of urban jobs. A second explanation behind this difference is the inclusion of different attributes for public jobs in the two choice experiments. It is well known that the valuation of a DCE attribute is directly dependent on the valuation of other included attributes, as the analysis assumes that trade-offs are made. Therefore different estimates (and predictions) from two DCEs with different attributes are to be expected.

Alternative explanations can be found in behavioural economics, a discipline that has incorporated insights from psychology to explore the various obstacles that can compromise what is seen as "rational" decision-making in the standard economic framework. A first lesson from behavioural economics is that context (in a broad sense) matters (Kahneman, 2003). In DCEs, researchers have showed that the position of the cost attribute could influence responses (Kjær et al., 2006). Here, as the ordering of the two choice experiments was never changed (the rural/urban DCE was always administered before the "representative" one) respondents may

[106] Such hybrid DCE would have required many choice sets, and therefore a very large sample.

have felt encouraged to choose rural jobs, which could have increased their propensity to choose them in the second DCE (hence increasing the uptake of rural jobs). Similarly, individuals' preferences during the second DCE may have been anchored onto the choices proposed in the first one. Through some form of "endowment effect", the framing of rural posts in the first DCE (with favourable working conditions such as housing and car allowances) may have continued to influence the decision in the second choice experiment.

All these various explanations are equally plausible, and to some extent probably all played a role. These unresolved questions call for further research into the validity of DCEs.

10.2.4. Reflections on the use of experimental economics

The empirical approach adopted in this thesis takes forward the empirical economic literature using experimental measures of social preferences to predict individual choices or behaviours.

Two features distinguish this study from the few that have used experimental measures to evaluate the impact of values and norms on individual decisions or behaviour (Barr and Serneels, 2004, Karlan, 2005, Carpenter and Seki, 2006). First, none of these studies has explored the relationship between experimental measures and stated preferences. Second, they have not used measures of altruism (obtained from dictator games), but have utilised measures of trust or reciprocity obtained through the trust game (Berg et al., 1995). Most of the experimental literature has found that experimental measures of social preferences were good predictors of actual behaviours or other measures. For example Karlan (2005) showed that behaviour in trust games predicted repayment of loans to a Peruvian group lending micro-finance programme. Other experiments have shown a relationship between political participation and dictator game giving (Fowler, 2006, Fowler and Kam, 2007), suggesting that the latter may be an externally valid indicator of concern for the well-being of others. The erratic correlation (and statistical significance) here between experimental measures of altruism and job choices assumed to be more attractive to altruistic individuals (public choices and rural ones) raises three questions.

The first concerns the trust one can have in stated preference techniques and their capacity to reflect actual preferences. This issue is discussed at length elsewhere. Until further research tests the correspondence between revealed and stated preferences, at least two arguments can provide some support to the argument that stated job preferences might be a reasonably good proxy for revealed ones. First, there has been some work in other fields showing a high correlation between stated and revealed preferences (Louviere, 1988). Second, the application of

DCEs to job preferences is likely to pose fewer credibility problems to respondents, who are typically used to consider job descriptions.

The second question concerns the capacity of the dictator game to actually measure respondents' altruism. Failure to measure altruism could have stemmed from the caveats regarding the experimental procedures used here (see the discussion in Chapter 5). However, more generally, it could be a misinterpretation of behaviours in dictator games. This has been a recurring debate in the experimental economic literature (Frohlich et al., 2001, Bradsley, 2005, Koch and Normann, 2008), and to some extent there is no simple answer. While some posit that the anonymity and privacy of behavioural games allow the free expression of self-interest (Hoffman et al., 1994), others have argued that these two artificial conditions create doubts about the veracity of the experiments in the dictators' mind, who then choose to keep most for themselves (Frohlich et al., 2001). Yet, in the present study, the correlation between decisions in dictator games and societal values tends to corroborate the theoretical validity of dictator games as a way to measure underlying values, in the form of generosity and concern for others. Furthermore, the irregularities in the association between altruism and job preferences may also reflect the "instability" in behaviours observed in the labs. The latter has led researchers to question the link between laboratory experiments and real life decisions (Levitt and List, 2007). In a study where he observed the behaviours of individuals in the lab and in real situations (List, 2005), concluded that social preferences observed in the lab were over-estimated compared to those observed in real situations.

Finally, the absence of a link between experimental measures of altruism and job preferences questions the hypothesis formulated initially, and supported by some literature (Le Grand, 1997, Delfgaauw, 2007a, Buurman et al., 2009, Perry et al., 2009), that altruism is a determining factor for public jobs or jobs where health workers' action will have a greater impact on others (e.g. rural jobs). However, in dealing with nurses and their motivation, this study might tackle a more subtle distinction in individual motivations. It has been shown that altruism and concerns for others are likely to play a role in the choice of nursing as a profession. To some extent, the experimental results in the Chapter 5 have shown that nurses tended to be more altruistic than the traditional subjects of dictator games. Working as a nurse, be it in the private or public sector, means that they already "serve" or "help" others, their patients. Having a preference for the public or private sector is likely to relate to the idea that some patients are more "deserving" or "needy" than others. To some extent, this is better captured in the "poor" framing of the dictator game, and in fact a more generous attitude in that game is indeed correlated with preferences for rural jobs

($p<0.08$). To summarise, this empirical investigation underlines the complexity of the nature and role of intrinsic motivation, and the attendant measurement difficulties.

10.3. Policy implications

Because many of the policy implications that could be inferred from each results chapter have already been detailed in the relevant chapter sections, only the broader policy implications of the thesis are presented here.

10.3.1. Money is not all that matters

The economic analysis of behaviours is mainly concerned with the impact of financial incentives. One of the underlying objectives of this thesis was to try and demonstrate empirically that such "*Econs*" presented a too simplistic representation of human decisions. Several findings reinforce that assumption. First, altruistic individuals were found to be more attracted by public jobs, everything else being equal (i.e. with no particular financial incentive). Similarly, an exposure to rural areas (through training or childhood) or a positive attitude towards rural areas was associated with a greater willingness to work in rural areas, controlling for all other job characteristics. This means that despite recognising the difficult working and living conditions, nurses may have intrinsic motives to derive a greater utility from a job with no particular financial appeal. Finally, the strong impact of some incentives suggests that money is not the only motive driving individuals. For example, the effect of introducing a R500 car allowance was found to be more effective to attract nurses to rural areas than an equivalent monthly increase in salary would have been (under the assumption of linear salary effect). This is probably due to the status effect it may confer to nurses.

A corollary is that although financial incentives might seem to produce the largest effects, to infer their superiority (and lobby for their implementation) fails to account for two facts. The first is the heterogeneity of individual preferences for jobs, which means that some individuals actually do not need (such large) financial incentives to accept jobs in under-served areas, or might be less sensitive to financial incentives, and more to other ones. The second shortcoming of financial interventions is that they constitute sub-optimal options from an economic point of view. Indeed, as shown in this study, decision-makers can probably always identify alternative incentives, or packages of incentives that are effective policy levers, but much less expensive.

10.3.2. Attracting an appropriate "mix" of individuals into nursing

To a large extent the policy debate in low and middle income countries is focused on the types of incentives that should be offered to health workers to entice them to work in under-serviced areas (Sempowski, 2004, Henderson and Tulloch, 2008, Barnighausen and Bloom, 2009). What has been termed here "upstream" measures, which consist in deliberate interventions aiming to attract particular groups of individuals into the profession, have been almost entirely absent from this debate. As mentioned in the literature review, these interventions have only ever been implemented in developed countries. In the context of South Africa, this thesis suggests that a more appropriate selection of students with rural backgrounds, and the nurturing of altruistic concerns through nursing education, might help improve the distribution of nurses between sectors and regions.

The clearest policy message emerging from the thesis is that South Africa would benefit from increasing the selection of individuals from rural areas, or those having a positive attitude towards rural areas. This has been realised in some developed countries through the introduction of scholarships or quotas for people from specific under-served areas. An indirect way to increase the number of students from rural areas is to set up training programmes or build training institutions in under-served areas, in order to favour the enrolment of individuals from these areas, as well as provide exposure to rural areas to trainee health professionals. Indeed, positive attitude towards rural areas was also found to be strongly associated with a greater willingness to take up rural jobs. The development of such a favourable mindset is likely to be encouraged by a greater exposure to life and work in rural areas, while exclusive experience in urban areas is likely to fuel existing prejudices against rural areas.

Furthermore, whilst altruism was found to be associated with a greater propensity to choose public jobs, South African nurses were found to be less generous towards patients than their Kenyan and Thai peers in the dictator game. This would suggest that the enrolment of more altruistic individuals into nursing could help mitigate the unequal distribution of nurses between the public and the private sector. In practical terms, it is not clear how the selection of altruistic individuals could be enhanced, as it is unlikely that dictator games would be played, or even could be helpful at all as a screening mechanism (candidates could easily see through the objective, and would "cheat" the tool). Yet there are two potential areas for indirect policy interventions.

First, less generous behaviours raise some concerns about some social norms or lack of moral motivation that could exist in the nursing community in this country. This finding suggests that greater importance be given in the curriculum to nursing ethics and attitudes towards patients. Other studies have highlighted the importance of training in the creation of a shared pool of values amongst the nursing profession, and emphasised the role of educators on the formation of nurses' values (Haigh and Johnson, 2007). Others have underlined the importance of better integrating altruism and other professional values into the nursing curriculum (Shaw and Degazon, 2008).

Second, having chosen nursing reluctantly (i.e. not as one's first choice) was found to have a negative impact on the decision to allocate money to the students. It means that those students are probably less intrinsically motivated or, if one adheres to the moral interpretation, less sensitive to the moral norm that should prevail in the profession. Taking intrinsic motivation into account in the selection of nursing students, by favouring those for whom nursing was a first choice, could help establish a greater concern for patients in the nursing community. Several studies have already underlined the necessity to improve the recruitment of nurses in order to screen and "identify appropriate candidates" (Zysberg and Berry, 2005).

10.3.3. Using research to inform policy

This thesis was partly developed against the backdrop of a lack of evidence on the effects of different interventions to address rural shortages (Grobler et al., 2009, Wilson et al., 2009). The health systems literature recommends the implementation of more experimental or quasi-experimental research to help policy-makers design the most adequate policies: "*Rigorous studies are needed to evaluate the true effect of these strategies to increase the number of health care professionals working in underserved areas*" (Grobler et al., 2009). Yet such study designs can be complex, costly, or infeasible to undertake, in particular in the case of HR interventions which might be difficult to randomise. The present work suggests that quicker, easier and cheaper alternative studies could be commissioned by governments to obtain useful information and inform their decisions, in particular in contexts where policies are designed more by policy-makers' intuitions or agendas rather than by evidence.

With a minimal amount of primary data collection (a cross-sectional survey) and some secondary data collected on costs, this thesis showed how it was possible to evaluate the relative cost-effectiveness of different incentives or combinations of incentives. It also proved the value of evaluating the differences in job preferences across population groups to identify policies that appear highly cost-effective.

10.4. Areas for future research

10.4.1. The role of altruism

With the development of behavioural and experimental economics, altruism has been hypothesised to play a fundamental role in explaining individual behaviours. However, empirical evidence on altruism remains scarce. This work attempted to show the role of altruism in individual decisions by proving an association between experimental measures of altruism and stated preferences. This approach could be extended in several directions.

First, it remains unclear how best to measure or capture altruism. In particular, the use of the dictator game to measure altruism has often been debated. In the study of health professionals' altruism and its role in their work decisions and attitudes, it is unclear whether experimental measures are the best way to quantify altruism, and if they are, whether the dictator game should be framed or not. These results showed a correlation between survey and experimental measures of altruism. Although experimental games have been promoted as useful measurement tools of social preferences (Glaeser et al., 2000, Ensminger, 2001, Carpenter, 2002, Karlan, 2005), their sensitivity (that is their capacity to capture meaningful and significant differences in behaviours) remains unexplored.

Second, health professionals may be relevant for the study of altruism (as explained in Chapter 2), however, labour market choices may not have been the ideal choice for studying a link between altruistic motives and health workers' behaviours. A natural extension of this work could look at the role of altruism in a more interactive setting between health providers and patients. Outcomes of interest could include health workers' attitudes and effort in the treatment of patients.

Finally questions that remain under-researched are the extent to which altruism is shaped by external factors, and how it evolves over time. Altruism is often presented, to some extent, as an intrinsic characteristic of individuals. However the simple fact that age has been repeatedly found to be associated with greater altruism suggests that pro-social concerns vary over time, shaped by changing situations and circumstances (older people might be more generous because they have accumulated more capital). In the study of the influence of altruism on health workers' decisions and behaviours, another dimension concerns the study of external working conditions on individual altruism. More precisely, two series of factors could play an important role. First, collective norms and behaviours of peers could influence individual behaviours. Second, altruism may be crowded out by job dissatisfaction and poor working conditions. The cohort study upon which this thesis was built presents the opportunity to study some of these factors, as cohort participants are still being followed and dictator games can be repeated over time.

10.4.2. Using choice experiments to study labour market decisions

As highlighted before, this work has drawn attention to the interest and relevance of choice experiments for informing HR policy design. But more generally, this work highlighted the use of discrete choice experiments to study labour market decisions and behaviours. This could be developed in two directions.

First, although the theoretical validity of DCEs is supported by the fact that the results obtained in most choice experiments (including this one) confirmed some *a priori* expectations (Ryan and Gerard, 2002), further research is needed to test their external validity. The comparison of stated and revealed preferences that has been made in disciplines other than health economics has generally supported the external validity of DCEs (Louviere, 1988, Louviere et al., 2000). Yet, similar research has still to be done in health economics, in particular for DCEs applied to labour supply decisions, where it could be relatively easy to collect data on actual choices. However, beyond it is probably important for researchers using DCEs to go beyond simple tests of external validity of DCEs. More precisely, if differences are found between revealed and stated preferences, it is important to identify their origin in order to improve stated preference tools. Comparing decisions made in experimental laboratories and in the real world, Levitt and List (2007) identified a large number of factors that could explain differences in decisions, including scrutiny, stakes, selection of subjects, different time horizons and different choice sets. The last two issues identified by Levitt and List seem particularly worthy of further investigation. In DCEs respondents make decisions in a few minutes at best, while equivalent real decisions are typically made over days or weeks (for example the decision to take up one job rather than another). One way of testing (or controlling for) that effect would be to use "time-to-think" protocols where fieldworkers distribute the questionnaire on a day and come back the next to collect it (Cook et al., 2007). The other limitation of DCEs is that respondents are encouraged to focus exclusively on the attributes and issue at hand in the survey situation. While in some situations this is desirable (e.g. to have a controllable experimental environment), the contingent valuation literature has shown the issues arising from situations where the budget constraint was not well taken into account by respondents. There are other such constraints that may be overlooked by respondents in a job DCEs, such as regulatory (obtaining visas to emigrate), family (child care) or logistical (costs incurred by a move) constraints. Survey participants could be encouraged more systematically to take those constraints into account.

Second, further questions relevant to labour supply could be tested with the use of DCEs. Although labour economists have developed many sophisticated approaches to model and understand labour supply decisions better, it has mainly relied on information about jobs taken by individuals, but has usually failed to include information on the alternatives considered. Building on the possibilities offered by DCEs to include a wide range of job characteristics, the influence of working conditions on labour supply decisions could be tested more systematically. Health professionals' willingness to be compensated for bad working conditions (as the theory of compensating wage differential suggests) could be tested with the interaction between a salary attribute and working condition attribute. Furthermore, as indicated in Chapter 6, DCEs could help understand how well labour markets work, and the extent to which individuals make decisions based on complete information or restrict themselves to easily accessible job offers.

10.4.3. Refining the economic evaluation of HR interventions

The lack of evidence on the effectiveness of HR interventions has already been underlined many times in the literature (Lehmann et al., 2008, Grobler et al., 2009, Wilson et al., 2009), but researchers in health systems have been surprisingly silent on the absence of evidence on the cost-effectiveness of these interventions. Given the importance of the policy issue that shortages in rural areas represents, this should be a priority area for research. Similar modelling to that presented here could be conducted in other settings. The model would gain in robustness and reliability if more data could inform the choice of parameters. A more refined costing of policy interventions could also be undertaken – for South Africa and other potential settings. More sophisticated modelling could also allow for more heterogeneity in the model parameters and flexibility, in order to address some of the limitations of the model highlighted before. A systematic effort should also be made to add an economic analysis component to all projects that will, in the future, determine the effects of HR interventions to attract staff to under-served areas.

10.5. Conclusion

In low and middle-income countries, the vast majority of poor and disadvantaged patients live in rural areas where health services are least developed. A major constraint to improving the availability and quality of health care services in rural areas is often the lack of skilled health workers in rural health facilities. So far, most developing countries have employed compulsory service or financial incentives to address these challenges. Despite growing attention focused on human resource strategies to address this maldistribution, several studies have underscored the lack of evidence on the effectiveness of policy interventions. At the same time, the literature has been silent on the absence of economic analysis of such policies.

This thesis developed a theoretical framework that showed how the heterogeneity of preferences amongst health care workers can directly affect the choices made between different jobs in the labour market, in particular when these jobs are clearly differentiated from one another by intrinsic characteristics – for example public vs. private, rural vs. urban. The empirical work carried out with nurses in South Africa confirmed the assumption that altruistic individuals are more likely to choose public jobs, and people from rural backgrounds more willing to take up positions in rural areas.

A subsequent economic evaluation of potential policy interventions demonstrated that adopting financial incentives, albeit effective to increase the number of staff in rural areas, is never an economically optimal option. In contrast, the most cost-effective interventions involve upstream measures attracting more people who naturally prefer rural jobs into the nursing professions.

This work confirmed empirically the impact of individual characteristics on labour supply choices, and it demonstrated the importance for policy-making of better understanding the driving factors behind health professionals' job choices.

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APPENDICES

Appendix 2.1: Literature review search terms and strategy

The health literature on job satisfaction and policy interventions was identified using the following search terms: *staff retention, retention in rural areas, retention in low-income countries, turnover, medically underserved area, rural area, motivation, intention to quit, intention to leave, job satisfaction* (see below)

These terms were searched in combination with professional classifications (*health workers, nurses, doctors, health workers*). No geographical limitation was used, but the search in PubMed was limited to studies published after the 1st January 2007.

The search was made on the 6th January 2010.

Search	Queries
#5	"attracting" OR "retaining" OR "attraction" OR "incentivise" OR "attract" OR "retain" OR "encourage"
#4	Search "policy" OR "policies" OR "intervention" OR "interventions" OR "measure" OR "strategies" OR "strategy" OR "incentive"
#3	Search "rural" OR "rural area" OR "rural areas" OR "underserved areas" OR "underserved area" OR "remote area" OR "remote areas"
#2	Search "job satisfaction" OR "motivation" OR "job preference" OR "job preferences" OR "intention to quit" OR "intentions to quit" OR "intention to leave" OR "intentions to leave" OR "retaining" OR "retention" OR "turnover"
#1	Search nurse OR nurses OR physician OR physicians OR doctor OR doctors OR "mid-level worker" OR "health worker" OR "health workers" OR "health practitioner"

Two combinations of terms were used:

- To update the literature on job satisfaction: searches #1 was combine with #2 – this led to 3,397 references.
- To update the literature on policy interventions to attract health workers to rural areas, the following combination was used: #1 AND #3 AND #4 AND #5 – this led to 51 references

Combined in a unique database, 18 redundant studies were discarded, leaving a total of 3,430 references.

In addition to this systematic search, relevant journals were consulted, including *Health economics, the Journal of Health Economics, Health Policy and Planning, Health Services Research, Human Resources for Health,* the *Journal of Rural Health,* and *Rural Remote Health.* No additional reference was identified.

Appendices to Chapter 3

Appendix 3.1: London School of Hygiene and Tropical Medicine ethical approval

LONDON SCHOOL OF HYGIENE
& TROPICAL MEDICINE

ETHICS COMMITTEE

APPROVAL FORM
Application number: 5252

Name of Principal Investigator: **Natasha Palmer**

Department: **Public Health and Policy**

Head of Department: **Professor Anne Mills**

Title: **Health workers' preferences and policy interventions to improve retention in rural areas in Kenya, South Africa and Thailand**

This application has been approved by the Committee.

Chair .... T. W. Meade ....
Professor Tom Meade

Date ....12 February 2008.......................................

Approval is dependent on local ethical approval having been received.

Any subsequent changes to the consent form must be re-submitted to the Committee.

Appendix 3.2: University of Witwatersrand ethical approval

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Blaauw/Erasmus

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M080221**
PROJECT	Health workers' preferences and policy interventions to improve retention in rural areas in Kenya, South Africa and Thailand
INVESTIGATORS	Dr/Mr D/E Blaauw/Erasmus
DEPARTMENT	School of Public Health
DATE CONSIDERED	08.02.29
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 08.04.02 **CHAIRPERSON** ....
(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor :

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 3.3: Information sheet

The CREHS Cohort Study
Information sheet for nursing students

Good day,

We represent the Centre for Health Policy, Wits University. We would like to give you some information about our research project and to invite you to participate. Let's begin by telling you a bit about the research.

This research will be conducted in Thailand, Kenya and South Africa. Here in South Africa, our study will investigate the attitudes, values, preferences and early career choices of a cohort of nursing graduates. Having a cohort of nursing graduates means that we will, over a certain time period, be doing research with exactly the same group of people.

From this group of nursing graduates, we hope to learn more about their attitudes to and preferences for certain aspects of a nursing career. We would also like to understand better the career choices they make at an early stage of their professional life, with a particular emphasis on the factors – individual and job-related– affecting these choices. We are particularly interested in the things that would encourage nurses to choose jobs in rural areas and to continue working in those areas.

The research will be conducted in a number of nursing colleges. The selection of the nursing colleges was to some extent based on geographic criteria. We wanted to make sure, for example, that we worked with nursing colleges in both urban and rural areas. In all cases, the plan is to work with students who are about to graduate. This is to enable us to follow them up once they start working.

It is important to note that this research will be conducted in a number of phases. A big part of the research will be done at this point in time. However, because this is a cohort study (as explained above) some of the activities involving the research participants will carry on over the next year or so.

The following research phases are envisaged:

Phase 1: Initial data collection (this part of the research will happen now)
This phase will take about half a day of participants' time to complete and includes:

- A questionnaire that participants will fill in on their own. It will consist of a series of questions about participants themselves, their educational backgrounds and their opinions on the nursing profession and aspects of the work environment.
- A second set of questions, which will present a series of job descriptions/environments. Participants will be asked to choose their favorite job descriptions/environments.
- Two decision-making activities. In the first, you will be asked to divide certain benefits between yourself and other people. In the second, you will be presented with five scenarios. Again, within the context of these scenarios, you will be asked to divide certain benefits between different parties.
- Small/focus group discussions, in which participants will discuss in more depth their views on some of the issues and questions covered in the abovementioned questionnaires and activities.

Phase 2: Keeping in touch
As explained above, we would like to gather information on participants' early career choices, as they move from the nursing colleges to their places of work. After graduation, participants will therefore be contacted every three months or so to provide some information about their employment situation and to update their contact details. This contact will be as brief as possible and it is anticipated that it won't take more than a few minutes of participants' time.

To be able to contact participants like this we will keep records of their contact details and also ask them to provide the contact details of family members and friends. This is so that we have alternative points of contact, in case participants change cell phone numbers, emigrate etc. without informing the researchers.

Phase 3: Follow-up data collection
Approximately 1 year from now, participants will be contacted again and asked to complete a questionnaire(s). The objective is to better understand how participants' choices and career concerns change over time. The questions asked will be about job satisfaction, participants' opinions on future career choices etc. It is possible that the research might continue after phase 3 if further funding can be sourced. If this happens, participants will be asked again at that time if they want to stay involved in the study.

This, in a nutshell, is the research that we invite you to participate in. In essence, we are inviting you to become a member of this cohort of nursing graduates.

Please note that your participation in the research is entirely voluntary, i.e. you do not have to take part if you do not want to. If you do not want to participate or if you agree to participate and you change your mind, you are free to tell the researchers and they will end your participation immediately, without any penalty to you. We don't anticipate that any harm will come to people through their participation in the research.

As a participant in the research you can expect that all the information you provide will be treated in confidence. This means, for example, that your name will not be used when we write our reports about the research. It also means that no one outside the research team – lecturers, colleagues in the college etc. - will know how you as an individual answered the questions. However, we are not able to guarantee confidentiality when it comes to small/focus group discussions because participants might tell others outside the group what was said. Having said this, the researchers will ask all participants to respect the confidentiality of the small/focus group discussions. No quotes or other results arising from your participation in this study will be included in any reports, even anonymously, without your agreement.

Lastly, please note that the group discussions will be tape-recorded to give the researchers an accurate record of the discussions. These tapes will be transcribed and kept for 2 years if no publications are made or 6 years after publication.

For more information on the research please contact:

Dr Duane Blaauw
Tel: (011) 242 9903
Cell: 082 295 7377
duane.blaauw@nhls.ac.za

Mr Ermin Erasmus
Tel: (011) 242 9911
Cell: 083 324 7507
ermin.erasmus@nhls.ac.za

Appendix 3.4: Consent form

1. General ethical issues

- I have read the study information sheet [or have understood the verbal explanation] and I understand what will be required of me.
- I understand that the study involves a number of phases and that I am being asked to consent to participate in Phases 1, 2 and 3 (as outlined in the information sheet)
- I know that I do not have to participate in this study if I do not want to, and that I will not be affected negatively in any way if I do not want to participate.
- I have the right not to answer questions if I do not want to and the right to end my participation in the research at any time.
- I understand that the information I will give will be treated in the strictest confidence.

2. Activity-specific ethical issues

- Phase 1, small/focus group discussions:
  - ✓ I understand that these discussions will be tape-recorded. I understand that the tapes will be transcribed and kept for some time before being destroyed.
  - ✓ I understand that the researchers cannot guarantee the anonymity and confidentiality of these discussions, for the reasons stated in the information sheet.
  - ✓ I agree to quotes or other results arising from my participation in the study being included anonymously in any reports about the study
- Phase 2:
  - ✓ I understand that the research team will contact me periodically
  - ✓ I agree to provide the necessary contact details to enable the research team to get in touch with me

Participant's name (please print): ____________________ **Date:**____________

Participant's signature: ____________________

Researcher's name (please print): ____________________ **Date:**____________

Researcher's signature: ____________________

Appendix 4.1: Number of community service Professional Nurses in 2008, by province

EC	FS	GP	KZN	LP	MP	NC	NW	WC	South Africa
237	72	591	226	206	86	11	184	272	1,950

Notes: **EC:** Eastern Cape **FS:** Free State **GP:** Gauteng **KZN:** KwaZulu-Natal **LP:** Limpopo **MP:** Mpumalanga **NC:** Northern Cape **NW:** North West **WC:** Western Cape
Source: http://www.hst.org.za/healthstats/272/data

Appendix 4.2: Evolution of the number of registered Professional Nurses

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
PN registered with SANC	91,011	92,390	93,303	94,552	94,948	96,715	98,490	99,534	101,295	103,792
Annual growth		1.5%	1.0%	1.3%	0.4%	1.9%	1.8%	1.1%	1.8%	2.5%

Source: http://www.hst.org.za/healthstats/101/data from PERSAL and SANC data

Appendix 4.3: Evolution of the national density of Professional Nurses (per 100,000 population)

	EC	FS	GP	KZN	LP	MP	NC	NW	WC	South Africa
2000	106.1	128.9	172.5	119.8	104.6	90.5	122.3	94.3	139.9	120.3
2001	91.2	125.2	138.7	114.4	101.7	89	119.7	95.7	137.5	111.9
2002	74.9	124.1	136.3	109	110.5	89.6	107.1	94.1	130	106.8
2003	98.5	130.7	115.1	107.3	119.3	93.7	127.1	88.9	113.9	107.1
2005	109.1	149.7	106.9	108.8	110	93.2	144.6	90	111.2	109.2
2006	102.3	139.4	113.1	111.4	110.3	96.4	126.9	88.9	114.7	109.5
2007	106.3	131.6	107.3	120.9	115.3	92.5	147.1	81	114	110.4
2008	114.2	94.5	111.7	136.3	127.5	102.9	155	81.1	123.4	116.6
% change over the period	**7.6%**	**-26.7%**	**-35.2%**	**13.8%**	**21.9%**	**13.7%**	**26.7%**	**-14.0%**	**-11.8%**	**-3.1%**

Notes: **EC:** Eastern Cape **FS:** Free State **GP:** Gauteng **KZN:** KwaZulu-Natal **LP:** Limpopo **MP:** Mpumalanga **NC:** Northern Cape **NW:** North West **WC:** Western Cape
Source: http://www.hst.org.za/healthstats/72/data from SANC data

Appendix 4.4: Geographical distribution and characteristics of the nursing population, 2008

Province		Population Estimates (2008)	Nursing Manpower as at 2008/12/31				In Training as at 2008/12/31
			RNs	ENs	ENAs	Total	Students
Limpopo							
	Females	2 768 100	7537	2836	6823	17196	1277
	Males	2 506 700	835	363	853	2051	476
	Total	5 274 800	8372	3199	7676	19247	1753
North West							
	Females	1 756 200	6342	1996	4048	12386	1094
	Males	1 668 800	705	191	538	1434	335
	Total	3 425 000	7047	2187	4586	13820	1429
Mpumalanga							
	Females	1 859 100	4903	1630	3063	9596	286
	Males	1 730 900	400	144	292	836	140
	Total	3 590 000	5303	1774	3355	10432	426
Gauteng							
	Females	5 248 600	26874	10379	15042	52295	3299
	Males	5 198 500	1312	682	1068	3062	701
	Total	10 447 100	28186	11061	16110	55357	4000
Free State							
	- Females	1 506 800	6506	1278	2674	10458	751
	- Males	1 370 900	783	228	339	1350	245
	- Total	2 877 700	7289	1506	3013	11808	996
KwaZulu Natal							
	Females	5 321 100	21188	14307	10305	45800	2187
	Males	4 784 400	1280	1517	1075	3872	614
	Total	10 105 500	22468	15824	11380	49672	2801
Northern Cape							
	Females	580 500	1915	405	1195	3515	232
	Males	545 400	156	30	119	305	58
	Total	1 125 900	2071	435	1314	3820	290
Western Cape							
	Females	2 760 400	13421	4710	7527	25658	1437
	Males	2 501 600	594	244	512	1350	321
	Total	5 262 000	14015	4954	8039	27008	1758
Eastern Cape							
	Females	3 441 500	12400	2575	4998	19973	2296
	Males	3 137 800	827	171	671	1669	708
	Total	6 579 300	13227	2746	5669	21642	3004
TOTAL							
	Females	25 242 300	101086	40116	55675	196877	12859
	Males	23 445 000	6892	3570	5467	15929	3598
	Total	48 687 300	107978	43686	61142	212806	16457

Source: http://www.sanc.co.za/stats/stat2008/Distribution%202008xls.htm

Appendices to Chapter 5

Appendix 5.1: Economic game introduction and instructions

WELCOME ANNOUNCEMENT AND INTRODUCTION TO THE SESSION

Good morning, welcome and thank you for agreeing to participate in this study.

You will participate here in two tasks on decision making. These tasks are not designed to test you. In these tasks you will be presented with various options or choices. What we want to know is what choices you would make. There is no right or wrong answer, the only right answer is what you really want to choose.

Your choices will remain anonymous. This means that nobody will be told what choices you have made. Not even the persons sitting around you will know which choices you make now or even later.

We think you will find these 1st 2 tasks interesting, because you will be using real money. Believe it or not for this type of methods this is a requirement to use real money ! The use of real money ensures that you take this activity seriously.

How much you take home will depend partly on the choices you make and partly on chance (like the luck of the draw in a lottery). Whatever money you win in the session will be yours to keep and take home. I will explain later how Ermin will calculate the payment for each of you while you finish the other 3 tasks.

Before we begin I want to make some general comments about what we are doing here today and explain the rules that we must follow.
There will be two small tasks on decision-making. It is important that you listen as carefully as possible. The instructions are simple, and it will help you if you follow them carefully.
You cannot talk to each other while here in the group. This is very important. Please be sure that you obey this rule.
If one person talks about the game while sitting in the group, we would not be able to continue today. Do not worry if you do not completely understand the rules: each of you will have a chance to ask questions in private to be sure that you understand how to play: raise your hand and someone will come near you to explain whatever aspect you may not have understood.

The session will proceed in 2 parts.
The first task should last less than 15 minutes.
The second task should last less than 30 minutes.

DECISION TASK 1

We will now begin the first activity. You can now open the first envelope that is on your desk and where it says "__task 1__".

With this first task, you have to decide how to divide R 100 between yourself and another person.
You will never be told who exactly that person is, either during or after the session, and he or she will not be told who you are.
We do not reveal the **identity of that person, the recipient**, on purpose, because it is part of the principles of these methods to understand how you make decisions with very limited information.

What you must understand is that we are going to give you at the end of the morning the money corresponding to your decisions and we will give the money you will have decided to send to that other person.

We are going to ask you 3 times to divide R 100. Each time you are going to be *paired, or joined* with a different person:

- The first time (QA) you are going to decide how you want to divide the money between yourself and another nursing student, not necessarily here in that college. This person will be different for each of you.
- The second choice is how to divide the R 100 between yourself and a patient. This patient will be different for each of you.
- The third choice is how to divide the R 100 between yourself and a person who is poor. This poor person will be different for each of you.

Again, as I said before, this game is played for real. The figures that you see on these sheets are real, for you and for the person who will receive it. We are really going to give you in the end whatever you earn, and will also give whatever money you allocated to the recipients.

To divide the money, you have to choose 1 out of 11 possible divisions shown on your answer sheet (*Show answer sheet on the projector*).

HOW DO YOU MAKE YOUR CHOICE?
You can see the three different options referred to as A, B and C (*Show sheet on the projector*):

- the first question A refers to the division where you have to decide how to divide the money between yourself and another nursing student;
- The second one B refers to the division where you have to decide how to divide the money between yourself and a patient;
- The third one C refers to the division where you have to decide how to divide the money between yourself and a person who is poor.

For the three divisions, you have to indicate how you want to divide R 100, by circling the corresponding number <u>at the bottom.</u>

CONCERNING THE PAYMENT
How much money you will earn depends directly on the choices you make but also partly on chance. To simplify the payment and because we had some budget constraints, we will not be able to pay you the 3 decisions altogether, but just one.

Instead, we will randomly choose one of the three options A, B or C. Someone will come at the end and draw a paper from this box, and the paper chosen will decide which question we pay.
Ermin will take all the sheets and calculate for each corresponding id number how much you take home.

To make sure everything is clear, I will give you some examples [*show with a response sheet at the same time*]:

Examples:

1. A person can decide to make the following choices: to keep nothing 0% for her and allocate 100% to another student; to keep 50% for her and allocate 50% to the patient; to keep 100% for her and allocate 0% to the poor person. Overall, that person will hand in an answer sheet that looks like that [*show at the same time on a response sheet*].

At the end, someone will draw a token randomly; if it is PAPER B then for this person with id number 000 Ermin will put R50 in the envelope with ID number 000. And at the end of the morning we will distribute the envelopes. The corresponding R50 for the patient will also be paid later this month, but we cannot tell you to whom.

2. A person can decide to make the following choices: to keep 50% for her and allocate 50% to the other student; to keep 90% for her and allocate 10% to the patient; to keep 10% for her and allocate 90% to the poor person [*show at the same time on a response sheet*];

At the end, if we draw paper B then Ermin will put R10 in the envelope with number and we will give R90 to someone who is poor.

These are 2 separate examples. We will only draw a paper once and this will define what is the winning question for the whole group.

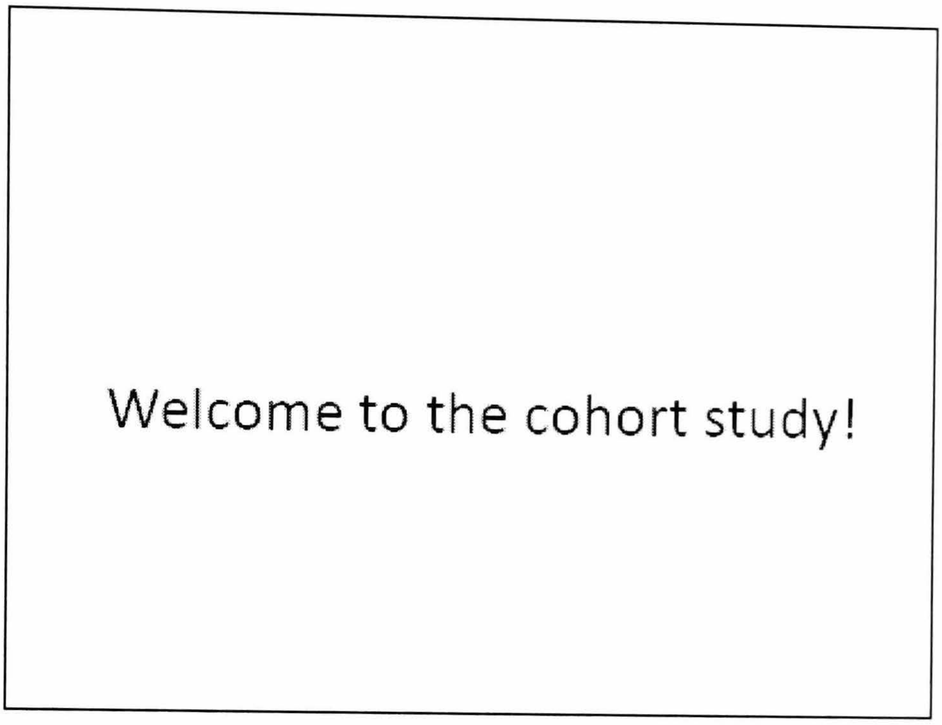
Therefore it is very important that you give the same level of care to each choice, because any of the three could determine the money allocated to you and to someone else. Again, there is no right or wrong answer, the only right answer is what you really want to choose.

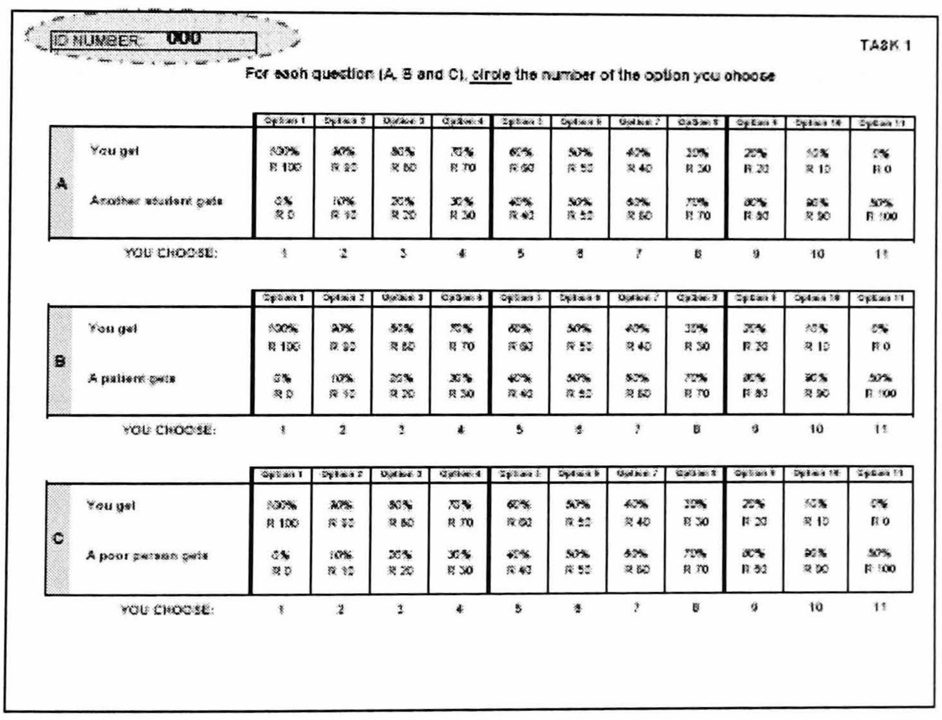
If you have any question, please raise your hand. You will then be able to ask your question privately.

If you are all ready, you can complete the problem. When you are finished please put your sheet face down on the right of your desk and someone will collect them.

Appendix 5.2: Visual support used to explain the economic games

This appendix shows the visual support that was used to present the economic experimental game. The PowerPoint presentation used included some animations to highlight the different components and steps of the game. For obvious reasons, this cannot be reflected here.





ID NUMBER: 000

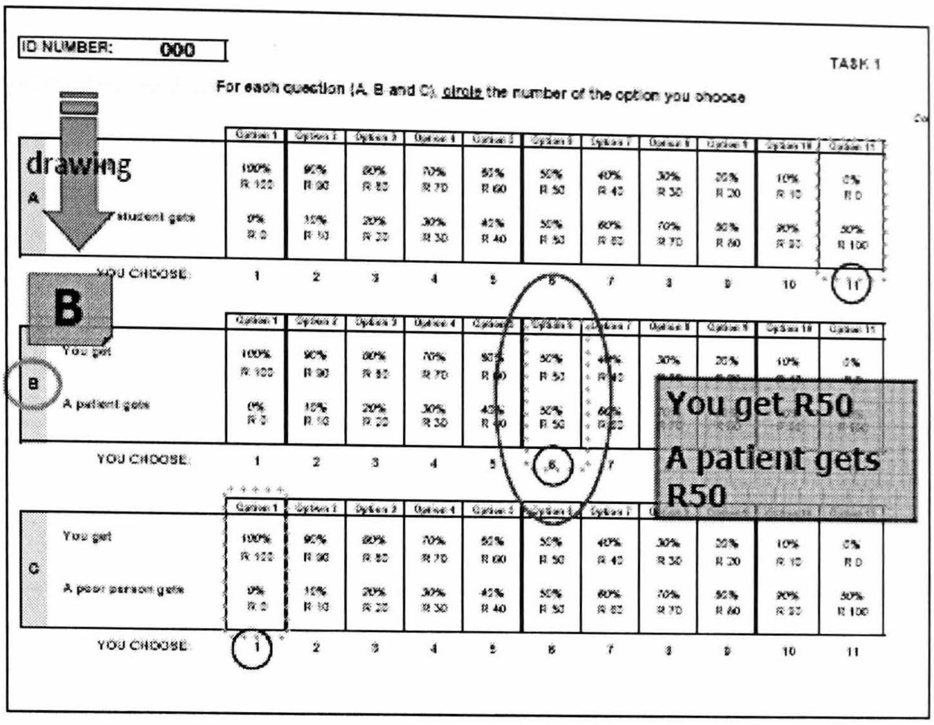
TASK 1

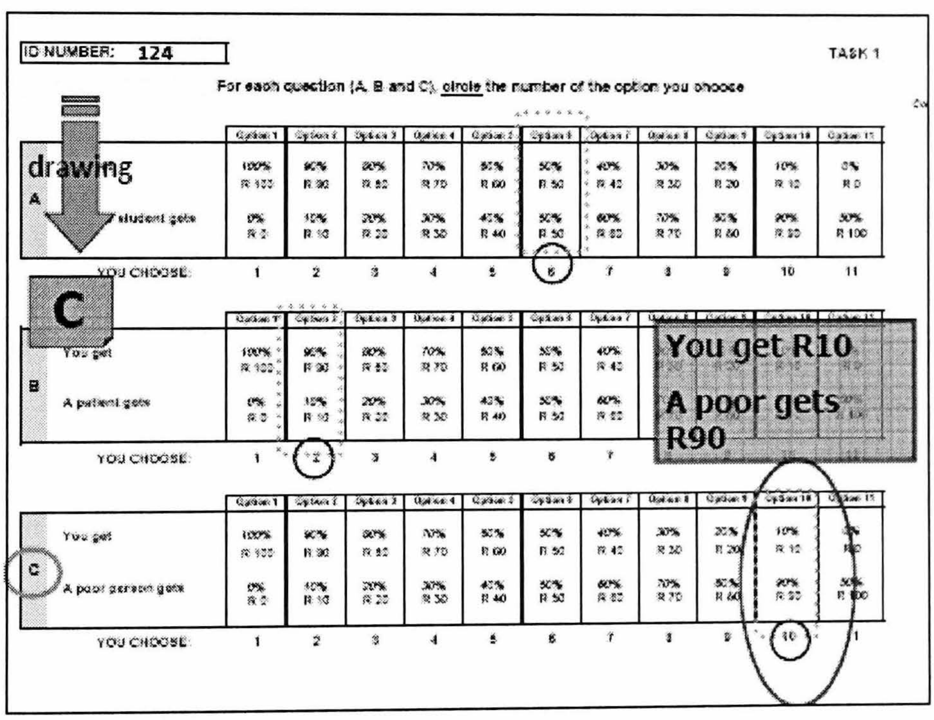
For each question (A, B and C), circle the number of the option you choose

		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11
A	You get	100% R 100	90% R 90	80% R 80	70% R 70	60% R 60	50% R 50	40% R 40	30% R 30	20% R 20	10% R 10	0% R 0
	Another student gets	0% R 0	10% R 10	20% R 20	30% R 30	40% R 40	50% R 50	60% R 60	70% R 70	80% R 80	90% R 90	100% R 100
	YOU CHOOSE:	1	2	3	4	5	6	7	8	9	10	11

		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11
B	You get	100% R 100	90% R 90	80% R 80	70% R 70	60% R 60	50% R 50	40% R 40	30% R 30	20% R 20	10% R 10	0% R 0
	A patient gets	0% R 0	10% R 10	20% R 20	30% R 30	40% R 40	50% R 50	60% R 60	70% R 70	80% R 80	90% R 90	100% R 100
	YOU CHOOSE:	1	2	3	4	5	6	7	8	9	10	11

		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11
C	You get	100% R 100	90% R 90	80% R 80	70% R 70	60% R 60	50% R 50	40% R 40	30% R 30	20% R 20	10% R 10	0% R 0
	A poor person gets	0% R 0	10% R 10	20% R 20	30% R 30	40% R 40	50% R 50	60% R 60	70% R 70	80% R 80	90% R 90	100% R 100
	YOU CHOOSE:	1	2	3	4	5	6	7	8	9	10	11


ID NUMBER: 000
TASK 1
For each question (A, B and C), circle the number of the option you choose
drawing
A
student gets
YOU CHOOSE:
B
You get
A patient gets
YOU CHOOSE:
You get R50
A patient gets R50
C
You get
A poor person gets
YOU CHOOSE:


ID NUMBER: 124
TASK 1
For each question (A, B and C), circle the number of the option you choose
drawing
A
student gets
YOU CHOOSE:
C
You get
B
A patient gets
YOU CHOOSE:
You get R10
A poor gets R90
You get
C
A poor person gets
YOU CHOOSE:

Appendix 5.3: Self-Administered Questionnaire

TASK 5 - BASELINE SURVEY

STUDY NUMBER:

Please answer the following questions, and for each of them <u>circle</u> the appropriate answer or fill in the space provided.

Q 1 Your gender
1. Male
2. Female

Q 2 How old are you? ________ years

Q 3 Are you ......?
1. Single
2. Married (or with long-term partner) → **If Married:**
3. Divorced/separated
4. Widowed

Q 4 What does your spouse/partner do?
1. s-he studies
2. s-he works
3. s-he does not work (unemployed)

Q 5 How many children do you have?

________ child(ren) → **If Any:**

Q 6 How old are they?

1) ______ years old
2) ______ years old
3) ______ years old
4) ______ years old
5) ______ years old

Q 7 How would you describe yourself in relation to population group? (This question is for statistical purposes only)
1. Black
2. Coloured
3. Indian
4. Other: ____________________
5. Do not want to answer

Q 8 Where were you born?
1. Name of the Town or City or Area ________________________
2. Name of the Province________________________

Q 9 How would you describe the area where you were born?
1. Very rural
2. Relatively rural
3. Urban (town)
4. Urban (city)

Q 10 Where did you spend most of your childhood?

1. Name of the Town or City or Area ______________________________
2. Name of the Province________________________________

Q 11 Where do your parents live?
1. Name of the Town or City or Area ______________________________
2. Name of the Province________________________________

Q 12 Where is your spouse/partner from (if applicable)?

Name of the Town or City or Area ______________________________

Name of the Province________________________________

Q 13 For each of the following organisations, please circle the corresponding number if you are an **active member (2)**, an **inactive member (1)** or **not a member (0)** of that type of organisation?

	Active member	Inactive member	Not a member
Church or religious organization	2	1	0
Sport or recreational organization	2	1	0
Art, music or educational organization	2	1	0
Labour Union	2	1	0
Political party	2	1	0
Environmental organization	2	1	0
Professional association	2	1	0
Humanitarian or charitable organization	2	1	0
Any other (write in): ____________________	2	1	0

Q 14 What is your father's level of education?

1. Between Grade 1 and Grade 6 (or Grade 1 and Standard 4)
2. Between Grade 7 and Grade 9 (or Standard 5 and Standard 7)
3. Between Grade 10 and Grade 11 (or Standard 8 and Standard 9)
4. Matric Certificate (Grade 12 or Standard 10)
5. Technicon, Other college education or University

Q 15 Is your father currently working?

1. Yes → **If Yes:**
2. No
3. N/A

Q 16 What is his profession?

____

Q 17 Does he currently work in the public sector?

1. Yes
2. No

Q 18 What is your mother's level of education

1. Between Grade 1 and Grade 6 (or Grade 1 and Standard 4)
2. Between Grade 7 and Grade 9 (or Standard 5 and Standard 7)
3. Between Grade 10 and Grade 11 (or Standard 8 and Standard 9)
4. Matric Certificate
5. Technicon, Other college education or University

Q 19 Is your mother currently working?

1. Yes → **If Yes:**
2. No
3. N/A

Q 20 What is her profession?

____

Q 21 Does she currently work in the public sector?

1. Yes
2. No

Q 22 Was nursing your first choice as a career?

1. Yes
2. No → **If No:**

Q 23 What was your first choice?

____

Q 24 During the course of your studies, did you complete a course on "community health" or "public health"?

1. Yes
2. No

Q 25 Did you spend any time in a RURAL hospital or a RURAL community health centre or a RURAL clinic during your training?

1. Yes → **If Yes: Q 26** Provide the details below for each visit:
2. No

Type of Facility (hospital or clinic)	*Name of the Area*	*How long in total did you spend there?*

Q 27 How did you pay for your nursing training (**<u>there may be more than one answer, in which case, circle all relevant answers</u>**)

My parents or other members of my family supported me

1. I received a salary
2. I took a loan
3. I was on study leave from the public sector
4. I obtained a scholarship/bursary from the government
5. I received a scholarship/bursary from the private sector
6. Other, specify: ____________________

If you got a loan:

Q 28 What is the current outstanding amount on your loan?

____

Q 29 Where have you requested / will you request to do your community service next year?

	Name for the facility	*Closest village/ Town or city?*	*Type of facility?*	*Is it in an urban or rural area?*
1st choice			1. Clinic 2. Hospital	1. Rural 2. Urban
2nd choice			1. Clinic 2. Hospital	1. Rural 2. Urban
3rd choice			1. Clinic 2. Hospital	1. Rural 2. Urban

Q 30 How long is your contractual obligation after community service?

1. 6 months
2. 1 year
3. 1.5 years
4. 2 years
5. Other: ____________________

Where would you most like to work after the end of your contract?

Q 31 *Location:*

Name of the Town or City or Area____________________

Name of the Province____________________

Q 32 *Type of health facility?*

1. Clinic
2. Hospital
3. GP practice
4. Other

Specify:____________________

Q 33 *Sector*

1. Public sector
2. Private for-profit sector
3. Private not-for-profit sector / NGO

Area of specialty____________________

Q 34 *Type of work*

1. General nursing
2. Community nursing
3. Specialised nursing

Q 35 Here are some of the things many people take into account in relation to their work. Which one would <u>you, personally, place first</u> if you were looking for a job (**<u>circle ONE only</u>**):

1. A good income so that you do not have any worries about money

2. A safe job with no risk of closing down or unemployment
3. Working with people you like
4. Doing an important job that gives you a feeling of accomplishment

Q 36 And what would be your <u>second choice?</u> **<u>circle ONE only</u>**

1. A good income so that you do not have any worries about money
2. A safe job with no risk of closing down or unemployment
3. Working with people you like
4. Doing an important job that gives you a feeling of accomplishment

Q 37 On a scale from 1 (strongly disagree) to 6 (strongly agree), indicate how you feel for each of the following statements, by **<u>circling the corresponding number</u>**

	Strongly Disagree ←					**Strongly Agree** →
I chose my profession to help others	1	2	3	4	5	6
I chose my profession because I can earn money	1	2	3	4	5	6
I chose my profession because other people value it	1	2	3	4	5	6
I chose my profession because I can always find a job	1	2	3	4	5	6

Q 38 On a scale from 1 (strongly disagree) to 6 (strongly agree), indicate how you feel for each of the following statements, by **<u>circling the corresponding number</u>**

	Strongly Disagree ←					**Strongly Agree** →
Working in rural areas means you are without support from colleagues/supervisors	1	2	3	4	5	6
You can earn more money when you work in a rural area	1	2	3	4	5	6
You can obtain advancement in your career quickly if you choose a rural position	1	2	3	4	5	6
Working in rural areas is not stressful at all.	1	2	3	4	5	6
Quality of life in rural areas is very good.	1	2	3	4	5	6
The lifestyle you have in rural areas appeals to me	1	2	3	4	5	6
The social life in rural areas is enjoyable.	1	2	3	4	5	6
Living in a city is stressful.	1	2	3	4	5	6
Bringing up children in rural areas is difficult.	1	2	3	4	5	6

Q 39 On a scale from 1 (strongly disagree) to 6 (strongly agree), indicate how you feel for each of the following statements by **circling the corresponding number**

	Strongly Disagree ←					Strongly Agree →
The government should spend more money for the poor, even if it leads to higher taxes	1	2	3	4	5	6
Around here, most unemployed people could find a job if they really wanted one	1	2	3	4	5	6
Many people who get social grants don't really deserve them	1	2	3	4	5	6
If social grants and other benefits weren't so generous, people would learn to stand on their own feet	1	2	3	4	5	6
Cutting welfare grants would damage too many people's lives	1	2	3	4	5	6

Q 40 What is the government's responsibility?
On a scale from 1 (strongly disagree) to 6 (strongly agree), indicate if you feel for each of the following statements, by **circling the corresponding number**

	Strongly Disagree ←					Strongly Agree →
Ensure that everyone is provided for	1	2	3	4	5	6
Redistribute income from the better off to those who are less well-off	1	2	3	4	5	6
Provide a job for everyone who wants one	1	2	3	4	5	6
Provide health care for the sick	1	2	3	4	5	6
Provide a decent standard of living for the old	1	2	3	4	5	6
Provide a decent standard of living for the unemployed	1	2	3	4	5	6
Give financial help to university students from low-income families	1	2	3	4	5	6

Q 41 Which is it more important for governments to do? (**circle one only**)

1 To get people to claim social grants and other benefits to which they are entitled

2 To stop people from claiming social grants and other benefits to which they are not entitled

Q 42 Why do you think there are people who live in need?
On a scale from 1 (strongly disagree) to 6 (strongly agree), indicate how you feel about the following statements, by **circling the corresponding number**

	Strongly Disagree ←					Strongly Agree →
Because they have been unlucky	1	2	3	4	5	6

Because of laziness or lack of will power	1	2	3	4	5	6
Because of injustice in our society	1	2	3	4	5	6
It's an inevitable part of modern life	1	2	3	4	5	6

Q 43 On a scale from 1 (strongly disagree) to 6 (strongly agree), indicate how you feel for each of the following statements, by **circling the corresponding number**

	Strongly Disagree ←					**Strongly Agree** →
Criminals should receive help rather than punishment.	1	2	3	4	5	6
The government should help the poorest.	1	2	3	4	5	6
Helping others with my time or money is very important to me	1	2	3	4	5	6
Those in need have to learn to take care of themselves and not depend on others	1	2	3	4	5	6
These days, people need to look after themselves and not overly worry about others	1	2	3	4	5	6
Personally assisting people in trouble is very important to me	1	2	3	4	5	6

Q 44 On a scale from 1 (strongly disagree) to 6 (strongly agree), indicate how you feel for each of the following statements, by **circling the corresponding number**

	Strongly Disagree ←					**Strongly Agree →**
Compulsory community service is a good thing.	**1**	**2**	**3**	**4**	**5**	**6**
I can see myself working overseas in the future	**1**	**2**	**3**	**4**	**5**	**6**
Paying more to nurses who work in disadvantaged or very remote areas is fine	**1**	**2**	**3**	**4**	**5**	**6**
Giving more responsibilities to nurses is a good way to motivate them.	**1**	**2**	**3**	**4**	**5**	**6**
If I have to work in a rural area it is important to me to be able to choose which rural area.	**1**	**2**	**3**	**4**	**5**	**6**
I always wanted to be a nurse	**1**	**2**	**3**	**4**	**5**	**6**
For your career advancement, each year spent as a nurse in a remote or disadvantaged area should count twice as much as anywhere else.	**1**	**2**	**3**	**4**	**5**	**6**
Community service is a waste of time	**1**	**2**	**3**	**4**	**5**	**6**
I can see myself leaving nursing in the future	**1**	**2**	**3**	**4**	**5**	**6**
If decent housing was provided at posts in rural areas I would be happy to go.	**1**	**2**	**3**	**4**	**5**	**6**
I am proud to tell people that I am a nurse	**1**	**2**	**3**	**4**	**5**	**6**
The idea of working in the private sector appeals to me	**1**	**2**	**3**	**4**	**5**	**6**

Appendix 5.4: Detailed results from the Principal Component Analysis

This appendix reports in detail the analysis that was used to create some of the proxy variables used in the analysis of the data in chapters 5 to 7. In general the criterion proposed by Kaiser (1960)[107] was followed and only factors with eigenvalues greater than 1 were retained. This criterion basically means that unless a factor extracts at least as much information as that contained in one of the original variables, it should be dropped.

1. Nursing ethics

This first group of variables analysed included the following questions:

4. "I chose my profession to help others".
5. "I always wanted to be a nurse".
6. "I am proud to tell people that I am a nurse".

For this group of variables, the first component is highly correlated with all 3 variables, the correlations are of the same sign, and it explains 54% of the variance in the data. This finding lets us

interpret the first principal component as a factor that shifts the whole structure together. The first component was therefore extracted to create the variable "nursethics" which relates to vocational

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.6313	.816502	0.5438	0.5438
Comp2	.814799	.260899	0.2716	0.8154
Comp3	.5539	.	0.1846	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Unexplained
wethics1r	0.5048	0.8109	0.2960	0
att4r	0.5786	-0.5723	0.5812	0
att2r	0.6407	-0.1221	-0.7581	0

2. Extrinsic motivation

This second group of variables included the following questions:

6. "I chose my profession because I can earn money".
7. "I chose my profession because other people value it".
8. "I chose my profession because I can always find a job".

[107] Kaiser, H. F. (1960). The application of electronic computers to factor analysis. Educational and Psychological Measurement, 20, 141-151

9. "You can earn more money when you work in a rural area".
"You can obtain advancement in your career quickly if you choose a rural position".

All variables load in the same direction on the first factor, and the latter explains about 33% of the variance in the data. Although the second component also has an eigenvalue greater than 1, it is more problematic to interpret as some variables are negative and others are positive on it.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.64304	.529108	0.3286	0.3286
Comp2	1.11393	.166407	0.2228	0.5514
Comp3	.947523	.270813	0.1895	0.7409
Comp4	.67671	.0579134	0.1353	0.8762
Comp5	.618797	.	0.1238	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Unexplained
wethics2r	0.4613	0.3292	-0.5261	0.5662	0.2854	0
wethics3r	0.3485	0.2195	0.8266	0.3807	-0.0479	0
wethics4r	0.4480	0.5441	-0.0047	-0.7080	0.0440	0
work2r	0.5391	-0.3876	-0.1662	-0.0009	-0.7290	0
work3r	0.4176	-0.6302	0.1112	-0.1824	0.6188	0

3. Rural lifestyle

This group of variables included the following questions:

6. "Working in rural areas is not stressful at all".
7. "Quality of life in rural areas is very good".
8. "The lifestyle you have in rural areas appeals to me".
9. "The social life in rural areas is enjoyable".
10. "Living in a city is stressful".

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.39005	1.43965	0.4780	0.4780
Comp2	.950397	.261009	0.1901	0.6681
Comp3	.689388	.136265	0.1379	0.8060
Comp4	.553122	.13608	0.1106	0.9166
Comp5	.417042	.	0.0834	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Unexplained
work4r	0.4020	-0.4447	0.7241	0.3411	-0.0025	0
life1r	0.4901	-0.1252	0.0549	-0.8567	0.0847	0
life2r	0.5248	0.0700	-0.3422	0.1937	-0.7517	0
life3r	0.5079	-0.0421	-0.4617	0.3310	0.6461	0
life4r	0.2545	0.8831	0.3775	0.0507	0.1012	0

4. Role of the government (welfare)

This group of variables included the following questions:

8. "Ensure that everyone is provided for".
9. "Provide a job for everyone who wants one".
10. "Provide health care for the sick".
11. "Provide a decent standard of living for the old".
12. "Provide a decent standard of living for the unemployed".
13. "Give financial help to university students from low-income families".
14. "The government should help the poorest"

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.46133	1.40333	0.3516	0.3516
Comp2	1.058	.0629273	0.1511	0.5028
Comp3	.995068	.220815	0.1422	0.6449
Comp4	.774252	.113738	0.1106	0.7555
Comp5	.660514	.0713994	0.0944	0.8499
Comp6	.589115	.127385	0.0842	0.9340
Comp7	.46173	.	0.0660	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7
govt1r	0.3828	0.5192	0.1006	-0.2961	0.0962	-0.6255	-0.2924
govt3r	0.4022	0.1752	-0.3734	-0.3848	0.4858	0.4777	0.2366
govt4r	0.3557	-0.4732	0.4826	-0.2586	0.0024	-0.2295	0.5451
govt5r	0.4316	-0.4558	-0.0493	-0.2141	-0.3148	0.2288	-0.6374
govt6r	0.4074	0.2623	-0.3183	0.2483	-0.6805	0.0195	0.3726
govt7r	0.3629	-0.2942	-0.2709	0.6618	0.4309	-0.2846	-0.0602
value2r	0.2851	0.3357	0.6637	0.3897	0.0831	0.4406	-0.1122

The first component was extracted to create govtprov – attitude towards provision of the government

5. Conservative judgement towards poverty

Attitudes towards the four following statements were included:

5. "Around here, most unemployed people could find a job if they really wanted one"
6. "Many people who get social grants don't really deserve them"
7. "If social grants and other benefits weren't so generous, people would learn to stand on their own feet"
8. (poverty is) "Because of laziness or lack of will power"

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.84483	.967733	0.4612	0.4612
Comp2	.877099	.0967856	0.2193	0.6805
Comp3	.780314	.28256	0.1951	0.8756
Comp4	.497754	.	0.1244	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Comp4	Unexplained
social2r	0.3841	0.8087	-0.4429	0.0479	0
social3r	0.5599	-0.4216	-0.2106	0.6815	0

social4r	0.5811	-0.3232	-0.1651	-0.7284	0
poor2r	0.4487	0.2525	0.8557	0.0520	0

6. Pro-poor attitude

This group of variables included the following questions:

1. "The government should spend more money for the poor, even if it leads to higher taxes"
2. "Cutting welfare grants would damage too many people's lives"
3. "Redistribute income from the better off to those who are less well-off"
4. "Most important thing for government to do "To get people to claim social grants and other benefits to which they are entitled"

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.47841	.433741	0.2957	0.2957
Comp2	1.04467	.0891719	0.2089	0.5046
Comp3	.955496	.148394	0.1911	0.6957
Comp4	.807103	.0927788	0.1614	0.8571
Comp5	.714324	.	0.1429	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Unexplained
social1r	0.3854	-0.7133	-0.1250	-0.0615	0.5686	0
social5r	0.4516	0.1533	-0.5997	0.6172	-0.1788	0
poor1r	0.4112	0.6065	-0.1934	-0.5287	0.3823	0
poor3r	0.5688	-0.2283	0.1862	-0.3730	-0.6713	0
poor4r	0.3935	0.2187	0.7435	0.4434	0.2190	0

7. Altruism

Responses to the following two statements were included:

3. "Helping others with my time or money is very important to me".
4. "Personally assisting people in trouble is very important to me".

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.36909	.73819	0.6845	0.6845
Comp2	.630905	.	0.3155	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Unexplained
value3r	0.7071	0.7071	0
value6r	0.7071	-0.7071	0

Appendix 5.5: Independent variables used in the final analysis of the determinants of altruism

Variable	Description	Expected sign		
		Student framing	Patient framing	Poor framing
Age (categorical)	18 to 20 years old	-	-	-
	25 to 29 years old	-	-	-
	30 to 34 years old	+/-	+/-	+/-
	More than 35 years old	+	+	+
Male	Respondent is a male	-	-	-
White	Respondent is white (as opposed to other racial categories)	?	?	?
Nochild	Respondent does not have children	?	?	?
Gauteng	Respondent studied in Gauteng (urban province), in a big city	?	?	?
Bornrural	Respondent was born in a rural area	?	?	?
Univ	Respondent studied nursing at university	?	?	?
Notnurse	Nursing was not respondent's first choice	?	?	?
Altruism	Proxy of altruism measured with survey questions*	+	+	+
Conservative	Proxy of attitudes towards the poor measured with survey questions*	-	-	-
Pro-poor	Proxy of societal values measured with survey questions*	?	?	+
Extrinsic	Proxy of extrinsic motivation measured with survey questions*	-	-	-
Nursing	Proxy of nursing ethics measured with survey questions*	+	+	+

Appendix 5.6: Additional results from the analysis of the data

1. Testing the framing effect with nursing students

```
Random-effects GLS regression                   Number of obs      =      1131
Group variable: idn                             Number of groups   =       377

R-sq:  within  = 0.0000                         Obs per group: min =         3
       between = 0.0000                                        avg =       3.0
       overall = 0.1287                                        max =         3

Random effects u_i ~ Gaussian                   Wald chi2(2)       =    291.16
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
          dg |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     student |  -.1917772   .0119457   -16.05   0.000    -.2151904    -.168364
     patient |  -.1557029   .0119457   -13.03   0.000    -.1791161   -.1322897
       _cons |   .5342175   .0111686    47.83   0.000     .5123274    .5561076
-------------+----------------------------------------------------------------
     sigma_u |  .14187026
     sigma_e |  .16400914
         rho |  .42799938   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. test student=patient

 ( 1)  student - patient = 0

           chi2(  1) =    9.12
         Prob > chi2 =    0.0025
```

2. Testing the differences between economic and nursing students with a Mann-Whitney test

- **Student framing**

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

         pop |      obs    rank sum    expected
-------------+---------------------------------
     nursing |      377     87152.5     81620.5
        econ |       55      6375.5     11907.5
-------------+---------------------------------
    combined |      432       93528       93528

unadjusted variance   748187.92
adjustment for ties   -50250.74
                     ----------
adjusted variance     697937.18

Ho: dgstu(pop==nursing) = dgstu(pop==econ)
             z =   6.622
    Prob > |z| =   0.0000
```

- **Patient framing**

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

         pop |      obs    rank sum    expected
```

```
-------------+---------------------------------
     nursing |       377        81178     81620.5
        econ |        55        12350     11907.5
-------------+---------------------------------
    combined |       432        93528       93528

unadjusted variance   748187.92
adjustment for ties   -18307.05
                     ----------
adjusted variance     729880.86

Ho: dgpat(pop==nursing) = dgpat(pop==econ)
             z =  -0.518
    Prob > |z| =   0.6045
```

- **Poor framing**

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

         pop |      obs    rank sum    expected
-------------+---------------------------------
     nursing |       377        84124     81620.5
        econ |        55         9404     11907.5
-------------+---------------------------------
    combined |       432        93528       93528

unadjusted variance   748187.92
adjustment for ties   -17724.73
                     ----------
adjusted variance     730463.18

Ho: dgpoor(pop==nursing) = dgpoor(pop==econ)
             z =   2.929
    Prob > |z| =   0.0034
```

Appendix 5.7: Bivariate analysis of the influence of individual characteristics on the amount of money sent to the second player, for each framing

	Proportion of money sent to student			Proportion of money sent to patient			Proportion of money sent to poor		
	Mean	SD	Signif.	Mean	SD	Signif.	Mean	SD	Signif.
All (n=377)	0.342	0.198	-	0.377	0.202	-	0.533	0.244	-
Gender									
Male (n=54)	0.296	0.193		0.319	0.196	*	0.452	0.242	**
Female (n=323)	0.350	0.198		0.387	0.202		0.547	0.242	
Age									
20 to 24 (n=97)	0.294	0.206	***	0.354	0.211	*	0.509	0.257	
25 to 29 (n=86)	0.330	0.189		0.358	0.188		0.519	0.240	
30 to 34 (n=94)	0.319	0.175		0.365	0.159		0.531	0.228	
more than 35 (n=100)	0.422	0.198		0.426	0.235		0.570	0.248	
Province									
Gauteng (n=216)	0.349	0.191		0.391	0.206		0.572	0.236	***
North West (n=161)	0.334	0.207		0.358	0.197		0.481	0.246	
Population groups									
Black (n=335)	0.341	0.198		0.371	0.201		0.521	0.241	*
Coloured (n=11)	0.255	0.211		0.427	0.142		0.673	0.233	
white (n=29)	0.390	0.190		0.439	0.231		0.629	0.251	
Marital status									
Single (n=245)	0.320	0.200	*	0.364	0.191		0.518	0.236	
Married or long-term partner (n=113)	0.382	0.188		0.402	0.217		0.565	0.250	
Divorced / Separated (n=7)	0.443	0.215		0.457	0.310		0.414	0.334	
Widowed (n=7)	0.371	0.198		0.314	0.219		0.614	0.297	
Not answered (n=5)	0.360	0.167		0.400	0.187		0.600	0.274	
Having children									
Has at least 1 child (n=232)	0.359	0.197	*	0.388	0.207		0.547	0.236	
Has no child (n=145)	0.316	0.197		0.360	0.194		0.511	0.256	

Note: Statistical difference across categories tested with a t test for binary variables and a Bonferroni test for variables with more than 2 categories. Asterisks indicate that the differences in the mean offers made across categories are significantly different: *** p<0.001 ** p<0.01 * p<0.05

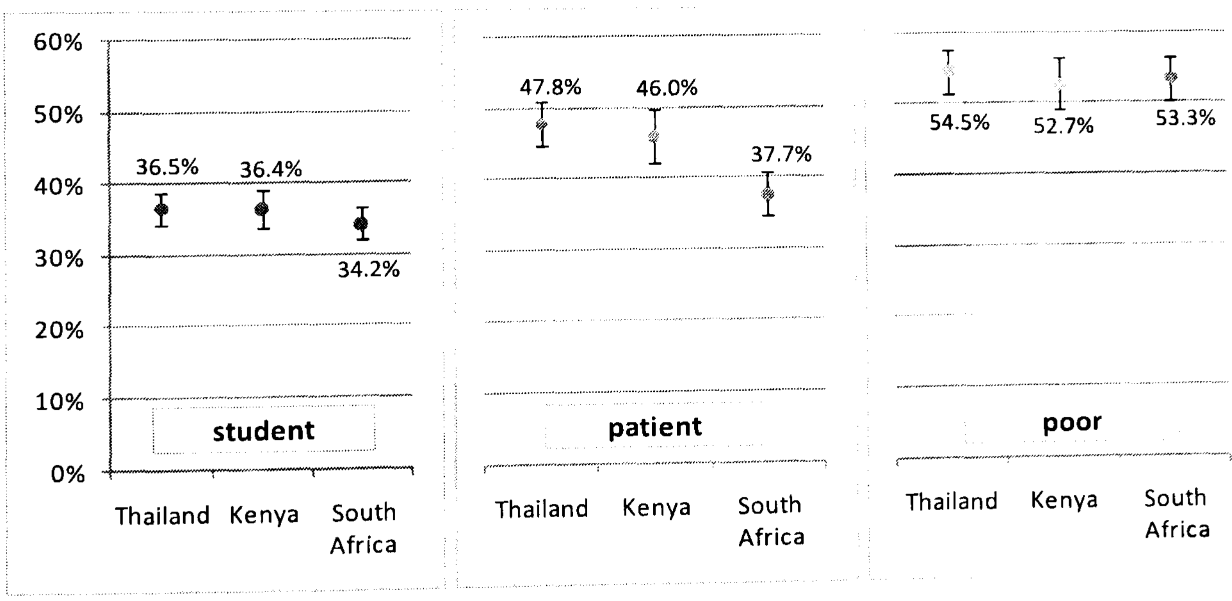
Appendix 5.8: Results from dictator games with nursing students in Kenya and Thailand

This appendix compares the responses given in the dictator game by nursing students from South Africa, Thailand and Kenya.

The same game depicted in Chapter 5 was played with 342 nursing students in Thailand and 346 nursing students from Kenya. This is the reason why particular care was taken to ensure the portability of experiments across locations. In particular, identical game materials (payoff sheets, tokens, etc.). In addition, to control for currency effects (as the subjects were paid in different currencies, systematic variations between countries could appear due to differences in incentives provided), variations due to purchasing power differences were controlled by using a similar incentive in terms of daily salary.

The first striking finding, as displayed by Figure 1, is the surprising similarity of results obtained in the three countries. Except for the patient recipient, to whom South African nurses give less than their Thai and Kenyan colleagues, there is no statistical difference in the three countries in the average amount of money sent to the recipients. In each of the three treatments, the proportions of students who give nothing, half of their endowment and all of it are equally close. For example, in the student frame, 13.5% of the South African nursing students kept all for themselves (8.5% in Thailand and 13% in Kenya), 42.7% split equally (49.1% in Thailand and 49.3% in Kenya) and 0.8% gave away everything (against 0.6% in Thailand and 1.5% in Kenya).

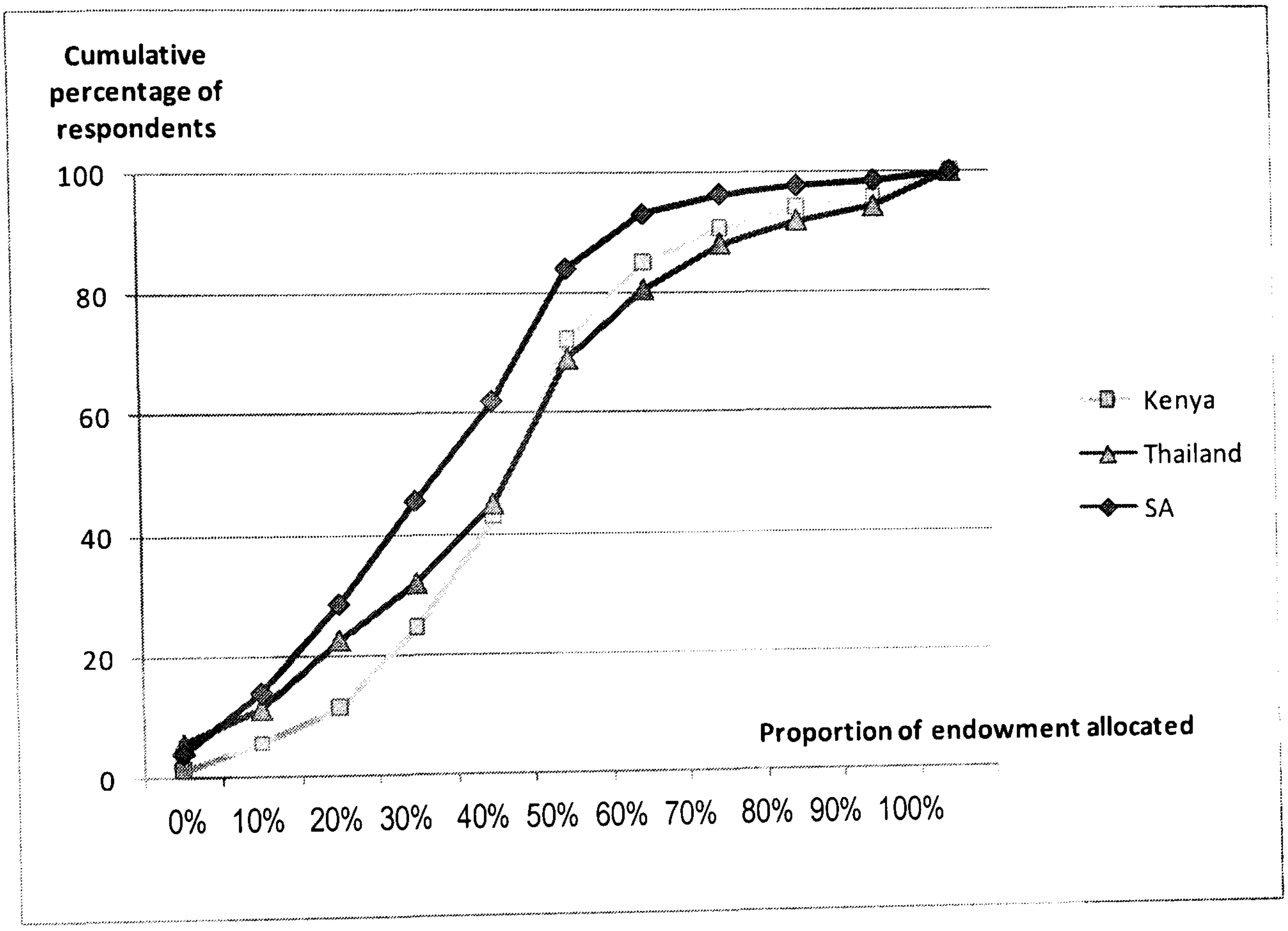
Figure 1: Average share of the initial endowment given by nurses to recipients (with 95% CI), by country, for each type of recipient



Second, the descriptive results presented in the three graphs of Figure indicate that the size of gifts made by dictators to recipients increases with the three different frames used in all three countries. Yet, this increase is almost linear for Kenya and Thailand, whilst South Africa presents a different picture due to a less generous attitude towards patients. This is particularly clear in Figure 2 which depicts the cumulative distribution of choices in the three countries for that particular frame. The difference between the South African distribution and the other two was found significant with a two-sample Mann-Whitney test for South

Africa vs. Kenya ($p < 0.0001$) and for South Africa vs. Kenya ($p < 0.0001$), while there is no difference found between the Kenyan and the Thai ones ($p < 0.39$). The detailed results can be found at the end of this appendix. Interestingly, in all three countries, the student frame is the one that triggers the greatest number of purely selfish decisions (giving nothing to the recipient), and the one that prompted the most equal splits[108].

Figure 2: Cumulative distributions of "patient" dictator games in the three countries



108 An equal split is when the dictator keeps 50% for herself and allocates 50% to the recipient.

Figure 3: Distribution of choices in the dictator games played in Thailand with the three frames

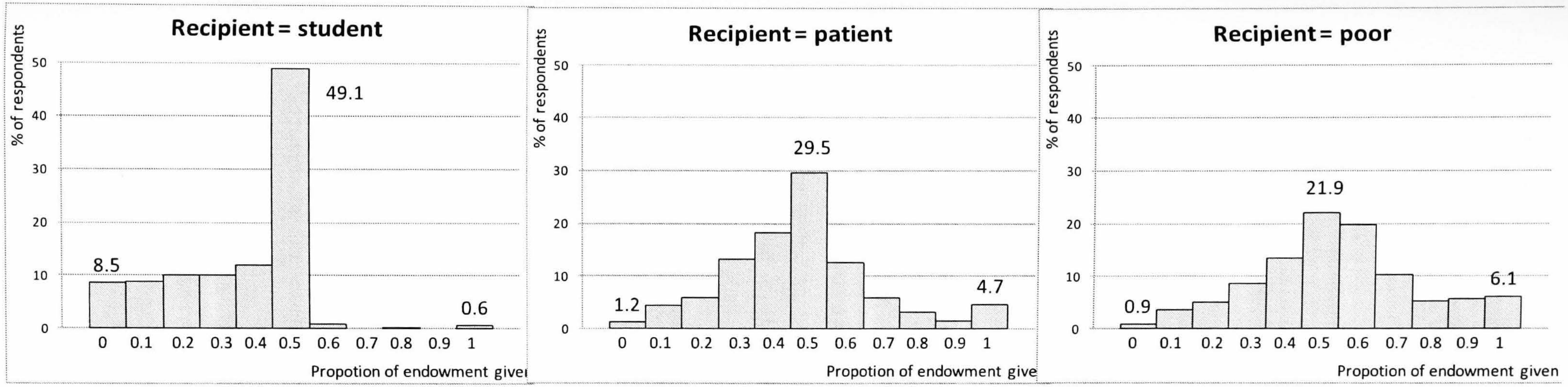
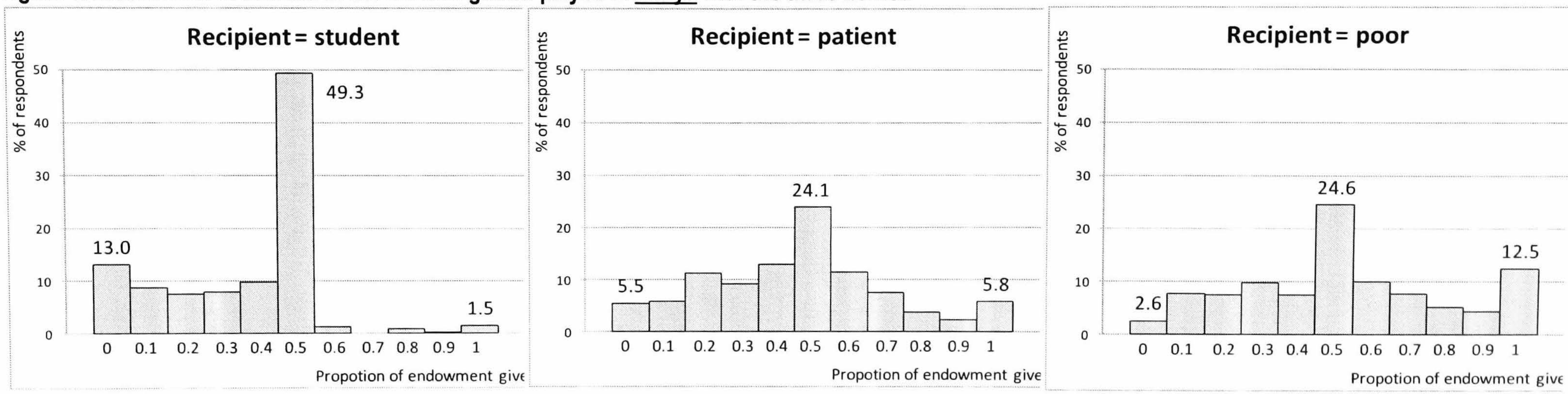


Figure 4: Distribution of choices in the dictator games played in Kenya with the three frames



1. South Africa vs. Kenya (patient framing)

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

     country |      obs    rank sum    expected
-------------+---------------------------------
South Africa |      377    123453.5      136474
       Kenya |      346    138272.5      125252
-------------+---------------------------------
    combined |      723      261726      261726

unadjusted variance   7870000.67
adjustment for ties   -173015.71
                      ----------
adjusted variance     7696984.96

Ho: dgpat(country==South Africa) = dgpat(country==Kenya)
             z =  -4.693
    Prob > |z| =   0.0000
```

2. South Africa vs. Thailand (patient framing)

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

     country |      obs    rank sum    expected
-------------+---------------------------------
    Thailand |      342      140546      123120
South Africa |      377      118294      135720
-------------+---------------------------------
    combined |      719      258840      258840

unadjusted variance   7736040.00
adjustment for ties   -218657.47
                      ----------
adjusted variance     7517382.53

Ho: dgpat(country==Thailand) = dgpat(country==South Africa)
             z =   6.356
    Prob > |z| =   0.0000
```

3. Thailand vs. Kenya (patient framing)

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

     country |      obs    rank sum    expected
-------------+---------------------------------
    Thailand |      342    120027.5      117819
       Kenya |      346    116988.5      119197
-------------+---------------------------------
    combined |      688      237016      237016

unadjusted variance   6794229.00
adjustment for ties   -187865.34
                      ----------
adjusted variance     6606363.66

Ho: dgpat(country==Thailand) = dgpat(country==Kenya)
             z =   0.859
    Prob > |z| =   0.3902
```

Appendix 6.1: Topic guide for Focus Group Discussion preparing the design of the Discrete Choice Experiment

1. Important job characteristics

- As a nurse, what are the important job characteristics to decide which job to apply to/ to take?

Probe specific characteristics:

i. Is the type of facility where the position is an important factor? Why?
Probe: does it tell more what you will do? Is it an indication of the number of staff members?
ii. Location: are there some rural areas more desirable than others? Why?
iii. Is the presence of an adequate level of drugs/equipment an important factor in your choice?
iv. Is career perspectives offered by a job important? How so?/what do you wish?
v. Is the type of tasks you would perform in the position an important criterion? How about clinical only or partly administrative
vi. How do working hours matter? Probe: working on weekends / night shifts
vii. Do you expect to work a lot?

- Are there some aspects that matter most:
- when you are offered a job in the public sector / in the private sector? (does the fact that you help poorer people in public facilities matter?)
- when you are offered a job in rural/urban areas ;

2. Knowledge of job characteristics before applying

- What do you usually know about job offer when you apply?
  i. Probe: What do they know about career prospects - in a public/private facility?
  ii. Probe: do you know something re: level of drugs/equipment? Staffing level? Quality of infrastructure?

- Even when it is not written down, is there some type of information you can guess/infer?
  i. For a job in a rural/remote area – probe: working conditions / work environment?
  ii. For a job in the private sector – probe: working conditions, types of patients?
  iii. Do these unspecified elements matter for your decision?

3. Phrasing of job characteristics/attributes

- What exactly is important in some job characteristics?
  i. How do you judge "career prospects" offered by a job?
  Probe: on-the-job training offered? possibility to upgrade after how many years? Possibility to work in another facility with more responsibility later (when?)?
  ii. How would you describe good/bad working hours? Convenient? Probe: number of night shifts that is acceptable? days working on weekends?

iii. What do you consider as a poor level of equipment/supplies?

iv. How would you describe a high workload (nurse to patient ratio makes sense?)

4. Other job opportunities

- Do you consider working abroad as a possibility in your career? Now? Why?

  Probe other possibilities: working for an NGO/parastatal organisation? Working for a lab? Pharmaceutical company?

Appendix 6.2: Design matrix

In a design, the columns represent the attributes of the design, while the rows represent the choice sets.

x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13	x14	x15
1	1	0	0	1	1	1	1	0	1	0	1	1	0	1
1	1	1	1	0	1	0	0	0	0	1	0	1	0	1
1	0	1	1	1	0	0	1	1	1	1	1	1	0	0
0	0	1	0	0	0	1	0	0	1	1	0	0	0	0
0	1	1	0	1	1	0	0	1	1	0	0	1	1	0
1	1	0	1	0	0	1	0	1	1	1	0	0	0	1
0	1	1	1	1	0	1	1	0	0	1	1	0	1	1
0	1	1	0	1	1	0	0	1	1	1	1	0	0	1
1	0	0	0	1	0	0	0	0	0	1	1	0	1	0
0	1	0	0	0	0	0	1	1	0	1	1	1	0	0
0	1	1	1	1	0	1	1	0	0	0	0	1	0	0
1	1	1	1	0	1	0	0	0	0	0	1	0	1	0
1	0	1	0	0	1	1	1	1	0	0	0	0	0	0
1	0	1	1	1	0	0	1	1	1	0	0	0	1	1
0	0	0	1	1	1	1	0	1	0	0	1	0	0	0
0	1	0	0	0	0	0	1	1	0	0	0	0	1	1
1	1	0	0	1	1	1	1	0	1	1	0	0	1	0
1	0	0	0	1	0	0	0	0	0	0	0	1	0	1
0	0	0	1	0	1	0	1	0	1	1	0	1	1	0
1	0	1	0	0	1	1	1	1	0	1	1	1	1	1
0	0	0	1	1	1	1	0	1	0	1	0	1	1	1
0	0	1	0	0	0	1	0	0	1	0	1	1	1	1
1	1	0	1	0	0	1	0	1	1	0	1	1	1	0
0	0	0	1	0	1	0	1	0	1	0	1	0	0	1

Appendix 6.3: Correlation matrix of main effects and interaction terms

	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13	x14	x15
x1	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x2	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x3	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x4	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x5	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x6	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x7	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00
x10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00
x11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00
x12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00
x13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00
x14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00
x15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**
x1x2	0.00	0.00	0.33	0.33	0.33	-0.33	-0.33	-0.33	-0.33	0.33	0.00	0.00	0.00	0.00	0.00
x1x3	0.25	0.08	0.08	0.42	-0.25	-0.25	0.25	-0.42	-0.25	-0.25	0.08	0.08	0.08	0.08	-0.08
x1x4	-0.42	0.42	0.08	0.08	-0.25	0.42	0.25	0.25	-0.25	-0.25	0.08	0.08	0.08	0.08	-0.08
x1x5	0.25	-0.25	-0.25	0.08	0.08	0.42	-0.42	0.25	0.42	-0.25	0.08	0.08	0.08	0.08	-0.08
x1x6	-0.42	-0.25	-0.25	0.42	0.08	0.08	0.25	0.25	-0.25	-0.25	0.08	0.08	0.08	0.08	-0.08
x1x7	0.42	0.25	-0.42	0.25	0.25	-0.08	0.08	-0.25	-0.42	0.25	-0.08	-0.08	-0.08	-0.08	0.08
x1x8	-0.33	0.33	-0.33	-0.33	-0.33	-0.33	0.00	0.00	-0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x1x9	0.33	0.33	0.33	0.33	-0.33	-0.33	-0.33	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00
x1x10	0.25	-0.25	0.42	-0.25	0.42	-0.25	-0.42	0.25	0.08	0.08	0.08	0.08	0.08	0.08	-0.08
x1x11	-0.08	0.08	0.08	0.08	0.08	0.08	-0.08	-0.08	0.08	0.08	0.08	-0.25	-0.25	-0.25	-0.42
x1x12	-0.08	0.08	-0.25	-0.25	-0.25	0.42	0.25	0.25	0.42	-0.25	0.08	0.08	0.08	0.08	-0.08
x1x13	0.25	0.08	0.08	0.42	-0.25	-0.25	0.25	-0.42	-0.25	-0.25	0.08	0.08	0.08	0.08	-0.08
x1x14	-0.42	0.42	0.08	0.08	-0.25	0.42	0.25	0.25	-0.25	-0.25	0.08	0.08	0.08	0.08	-0.08
x1x15	-0.25	0.25	0.25	-0.08	-0.08	-0.42	0.42	-0.25	-0.42	0.25	-0.08	-0.08	-0.08	-0.08	0.08
x2x3	0.33	0.00	0.00	0.33	-0.33	-0.33	0.33	-0.33	-0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x2x4	0.33	0.00	0.33	0.00	-0.33	-0.33	0.33	0.33	0.33	0.33	0.00	0.00	0.00	0.00	0.00
x2x5	0.33	0.00	-0.33	-0.33	0.00	-0.33	-0.33	0.33	-0.33	0.33	0.00	0.00	0.00	0.00	0.00
x2x6	-0.33	0.00	-0.33	-0.33	-0.33	0.00	0.33	-0.33	-0.33	0.33	0.00	0.00	0.00	0.00	0.00
x2x7	-0.33	0.00	0.33	0.33	-0.33	0.33	0.00	0.33	-0.33	0.33	0.00	0.00	0.00	0.00	0.00
x2x8	-0.33	0.00	-0.33	0.33	0.33	-0.33	0.33	0.00	0.33	0.33	0.00	0.00	0.00	0.00	0.00
x2x9	-0.33	0.00	-0.33	0.33	-0.33	-0.33	-0.33	0.33	0.00	-0.33	0.00	0.00	0.00	0.00	0.00
x2x10	0.33	0.00	-0.33	0.33	0.33	0.33	0.33	0.33	-0.33	0.00	0.00	0.00	-0.33	-0.33	0.33
x2x11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x2x12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.00	0.00	0.33	0.33
x2x13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.00	0.33	0.00	0.33
x2x14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.33	0.33	0.00
x2x15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x3x4	-0.33	0.33	0.00	0.00	-0.33	0.33	0.33	0.33	-0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x3x5	-0.33	-0.33	0.00	-0.33	0.00	-0.33	-0.33	-0.33	-0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x3x6	0.33	-0.33	0.00	0.33	-0.33	0.00	-0.33	0.33	-0.33	0.33	0.00	0.00	0.00	0.00	0.00
x3x7	-0.33	0.33	0.00	0.33	-0.33	-0.33	0.00	-0.33	0.33	0.33	0.00	0.00	0.00	0.00	0.00
x3x8	-0.33	-0.33	0.00	0.33	-0.33	0.33	-0.33	0.00	0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x3x9	-0.33	-0.33	0.00	-0.33	-0.33	-0.33	0.33	0.33	0.00	0.33	0.00	0.00	0.00	0.00	0.00
x3x10	0.33	-0.33	0.00	-0.33	-0.33	0.33	0.33	-0.33	0.33	0.00	0.00	-0.33	0.00	0.33	-0.33
x3x11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.00	0.00	0.33	0.33
x3x12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x3x13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

x3x14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.00	0.00	0.33
x3x15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.33	0.00	0.33	0.00
x4x5	0.33	-0.33	-0.33	0.00	0.00	0.33	-0.33	0.33	0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x4x6	0.33	-0.33	0.33	0.00	0.33	0.00	0.33	-0.33	-0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x4x7	0.33	0.33	0.33	0.00	-0.33	0.33	0.00	-0.33	0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x4x8	-0.33	0.33	0.33	0.00	0.33	-0.33	-0.33	0.00	0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x4x9	0.33	0.33	-0.33	0.00	0.33	-0.33	0.33	0.33	0.00	-0.33	0.00	0.00	0.00	0.00	0.00
x4x10	0.33	0.33	-0.33	0.00	-0.33	-0.33	-0.33	-0.33	-0.33	0.00	0.00	0.00	0.00	0.00	0.00
x4x11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.33	0.00	0.33
x4x12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.00	0.33	0.00	0.33
x4x13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.00	0.00	0.33
x4x14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x4x15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.33	0.00	0.00
x5x6	-0.33	-0.33	-0.33	0.33	0.00	0.00	0.33	0.33	-0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x5x7	-0.33	-0.33	-0.33	-0.33	0.00	0.33	0.00	-0.33	0.33	0.33	0.00	0.00	0.00	0.00	0.00
x5x8	-0.33	0.33	-0.33	0.33	0.00	0.33	-0.33	0.00	-0.33	0.33	0.00	0.00	0.00	0.00	0.00
x5x9	0.33	-0.33	-0.33	0.33	0.00	-0.33	0.33	-0.33	0.00	0.33	0.00	0.00	0.00	0.00	0.00
x5x10	-0.33	0.33	-0.33	-0.33	0.00	-0.33	0.33	0.33	0.33	0.00	0.00	0.00	0.00	0.00	0.00
x5x11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.33	-0.33	0.00
x5x12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.00	-0.33	-0.33	0.00
x5x13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	-0.33	0.00	-0.33	0.00
x5x14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.33	-0.33	0.00	0.00
x5x15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x6x7	0.33	0.33	-0.33	0.33	0.33	0.00	0.00	-0.33	-0.33	0.33	0.00	0.00	0.00	0.00	0.00
x6x8	-0.33	-0.33	0.33	-0.33	0.33	0.00	-0.33	0.00	-0.33	0.33	0.00	0.00	0.00	0.00	0.00
x6x9	0.33	-0.33	-0.33	-0.33	-0.33	0.00	-0.33	-0.33	0.00	-0.33	0.00	0.00	0.00	0.00	0.00
x6x10	0.33	0.33	0.33	-0.33	-0.33	0.00	0.33	0.33	-0.33	0.00	0.00	0.00	0.00	0.00	0.00
x6x11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	-0.33	-0.33	-0.33
x6x12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	-0.33	-0.33	0.33
x6x13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.33	0.00	0.33	0.33
x6x14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.33	0.33	0.00	-0.33
x6x15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.33	0.33	-0.33	0.00
x7x8	-0.33	0.33	-0.33	-0.33	-0.33	-0.33	0.00	0.00	-0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x7x9	-0.33	-0.33	0.33	0.33	0.33	-0.33	0.00	-0.33	0.00	-0.33	0.00	0.00	0.00	0.00	0.00
x7x10	-0.33	0.33	0.33	-0.33	0.33	0.33	0.00	-0.33	-0.33	0.00	0.00	0.00	0.00	0.00	0.00
x7x11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	-0.33	-0.33
x7x12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.33	0.33	0.33
x7x13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.00	0.33	0.33
x7x14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.33	0.33	0.00	0.33
x7x14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.33	0.33	0.33	0.00
x8x9	0.33	0.33	0.33	0.33	-0.33	-0.33	-0.33	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00
x8x10	0.33	0.33	-0.33	-0.33	0.33	0.33	-0.33	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00
x8x12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.33	-0.33
x8x13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	-0.33	0.33	-0.33
x8x14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	-0.33	0.00	0.33	0.33
x8x15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.33	0.00	-0.33
x9x10	0.33	-0.33	0.33	-0.33	0.33	-0.33	-0.33	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
x9x11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	-0.33	0.33
x9x12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	-0.33	0.33	0.33
x9x13`	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	-0.33	0.00	-0.33	0.33
x9x14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.33	-0.33	0.00	-0.33
x9x15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.33	-0.33	0.00
x10x11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.33	-0.33	-0.33
x10x12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.00	-0.33	0.33	-0.33
x10x13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.33	0.00	-0.33	0.33
x10x14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	0.33	-0.33	0.00	0.33

x10x15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.33	-0.33	0.33	0.33	0.00
x11x12	0.00	0.00	-0.33	-0.33	-0.33	0.33	0.33	0.33	0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x11x13	0.00	-0.33	0.00	0.33	0.33	-0.33	0.33	0.33	0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x11x14	0.00	-0.33	0.33	0.00	-0.33	-0.33	-0.33	0.33	-0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x11x15	0.00	0.33	-0.33	0.33	0.00	-0.33	-0.33	-0.33	0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x12x13	0.33	0.00	0.00	0.33	-0.33	-0.33	0.33	-0.33	-0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x12x14	0.33	0.00	0.33	0.00	-0.33	-0.33	0.33	0.33	0.33	0.33	0.00	0.00	0.00	0.00	0.00
x12x15	-0.33	0.00	0.33	0.33	0.00	0.33	0.33	-0.33	0.33	-0.33	0.00	0.00	0.00	0.00	0.00
x13x14	-0.33	0.33	0.00	0.00	-0.33	0.33	0.33	0.33	-0.33	-0.33	0.00	0.00	0.00	0 00	0 00
x13x15	0.33	0.33	0.00	0.33	0.00	0.33	0.33	0.33	0.33	0.33	0.00	0.00	0.00	0.00	0.00
x14x15	-0.33	0.33	0.33	0.00	0.00	-0.33	0.33	-0.33	-0.33	0.33	0.00	0.00	0.00	0.00	0.00

The highlighted rows show that there were three interactions that could be estimated: X3 and X13, X2 and X12, and X5 and X15.

Appendix 6.4: Data collection problems

Following an error in the SAS code exporting the two blocks of the design into excel, a unique questionnaire, built on the same block (block 1), was printed and administered to the first 315 students who participated in the study. This mistake was spotted late into the data collection, so that most of the fieldwork had already been completed and only block 1s had been handed in to participants, instead of a random administration of block 1s and block 2s. To address the problem, and obtain an equal number of blocks, it was decided to administer only the 2nd block to the students from the remaining two training institutions to be surveyed (North West University and Mmabatho University). Therefore, at the end of the "normal" data collection, there was 51 block 2s and 326 block 1s. As this was insufficient to analyse the questionnaire properly, several measures were taken to administer block 2s to study participants. Two strategies were used to get cohort members who had already completed the baseline to complete the other version of the DCE.

- First, students with an email address were sent the 2nd block. Unfortunately very few of them had an email address, so less than a dozen such requests were sent out, and four questionnaires were received back from students.
- A second more successful approach was to contact the training institutions, and arrange for a re-administration of the DCE. This was done in two colleges (Excelsius Nursing college in North-West province and Ann Latsky nursing college in Gauteng province). In the end, a total of 326 students completed block 1, 221 students completed block 2. Table VI.1 below summarises their distribution, per college and administration wave.

Table VI.1: Data collection dates and administration of DCE blocks

Name of Institution	First administration		Second administration		Total Block 1	Total block 2
	Block 1	Block 2	Block 1	Block 2		
North West Province	**110**	**51**	**0**	**59**	**110**	**110**
Mmabatho Nursing College	37	0	-	-	37	0
Excelsius Nursing College (Klerksdorp)	73	0	0	59	73	59
North West University (Potchefstroom campus)	0	9	-	-	0	9
North West University (Mafikeng Campus)	0	42	0	0	0	42
Gauteng Province	**216**	**0**	**0**	**111**	**216**	**111**
S.G. Lourens Nursing College (Pretoria)	71	0	0	2*	71	2
Ann Latsky College of Nursing (Johannesburg)	125	0	0	107	125	107

University of Johannesburg	20	0	0	2*	20	2
Total	**326**	**51**	**0**	**111**	**326**	**221**

* Those questionnaires were obtained via email.

Due to these problems, some individuals had completed two questionnaires, one during each of the two waves of questionnaire administration. Table VI.2 shows that there is a sample of 375 individuals for which at least 1 block of questionnaire is available: 153 individuals have completed the two blocks, 164 individuals have completed block 1s only and 58 individuals have completed block 2 only. Since the original sample size was 377, this means that only two individuals systematically filled incomplete questionnaires over the course of the two administrations. Hence, dropping the 19 incomplete questionnaires resulted in the loss of only two individuals.

Table VI.2: Distribution of completed questionnaires

Description	Block 1	Block 2	Total
Number of questionnaires completed by individual			
Individuals who only completed one block	164	58	222
Individuals who completed 2 blocks	153	153	153
Total	**317**	**211**	**375**
Number of questionnaires completed by nursing college			
Ann Latsky College of Nursing (Johannesburg)	120	100	220
S.G. Lourens Nursing College (Pretoria)	70	2	72
University of Johannesburg	18	4	22
North West University (Mafikeng campus)	0	41	41
Mmabatho Nursing College	37	0	37
Excelsius Nursing College (Klerksdorp)	72	55	127
North West University (Potchefstroom campus)	0	9	9

Reconstructing a sample

It was decided to reconstruct a sample of questionnaires that would somehow recreate what should have been randomly collected had the data collection happened as initially planned. Several issues arise in considering how to draw this "recreated" sample:

- The need to avoid having an individual appearing twice in the final sample
- The need to preserve the integrity of the sample; this means that, provided they filled a complete questionnaires, all cohort members should appear in the final sample.
- The need to obtain a balanced number of block 1s and block 2s. This is required to maintain the analysis properties of the DCE.
- The attempt to obtain a balanced distribution of block 1s and block 2s across the two geographical strata (urban vs. rural colleges).

While the first two requirements cannot be dismissed without altering the study design, the last one is more flexible, and was not specifically accounted for. The selection of the final questionnaires to analyse was made in several steps. First, the 222 individuals for whom only one questionnaire can be used were put aside and kept for the final sample. Then, for each of the 153 remaining individuals, a choice needed to be made between using either block 1 or block 2. Two constraints presided over this choice. First, the final sample needed to consist of an equal number of block 1s and 2s. With a total sample size of 375, the final sample of questionnaires must comprise 187 block 1s and 187 block 2s (and another one of the 2 blocks randomly selected). Since there are already 164 block 1s and 58 block 2s (from the individuals who have completed only these questionnaires), 23 additional block 1s and 129 block 2s must be selected. To complete the sample, it was decided to add one more block 1, because they were administered in the original conditions. The second constraint was to ensure that an individual wouldn't appear twice or that all 153 individuals who completed the two blocks would be represented in the final sample. To follow these constraints, 24 block 1s were randomly selected. This automatically identified the 24 block 2s (filled by those individuals who had completed the 24 selected block 1s) that needed be discarded from the final sample. The final sample used is described in Table VI.3 below.

Table VI.3: Description of final sample

Nursing college	**Overall distribution of original sample**	**Overall distribution of reconstructed sample**	**Block 1**	**Block 2**
Ann Latsky College of Nursing (Johannesburg)	125	125	41	84
S.G. Lourens Nursing College (Pretoria)	71	70	68	2
University of Johannesburg	20	20	17	3
North West University (Mafikeng campus)	42	41	0	41
Mmabatho Nursing College	37	37	37	0
Excelsius Nursing College (Klerksdorp)	73	73	25	48
North West University (Potchefstroom campus)	9	9	0	9
TOTAL	377	375	188	187

Appendix 6.5: Basic presentation of the Multinomial Logit (MNL) model

The most widely used discrete choice model is McFadden's conditional or multinomial[109] logit model (McFadden, 1974). This model is derived from the assumption that the random components for each alternative ε_{ik} follow a particular distribution. They are assumed to be independent and identically distributed (IID) extreme value type I (Gumbel) with mode zero and variance $\sigma^2 = \pi^2/\lambda^2 6$ where λ is a positive scale factor. The scale parameter λ essentially describes the profile of the variance of the unobserved effects associated with an alternative (Henscher book).

This assumption generates a combined logistic distribution for the set of disturbances ε_{ik} (for k=1,...,K) which explains the popularity of the model, as it gives simple expressions of the probability $Pr(y_i = k| X_i)$ for individual *i* to choose alternative *k* (where X_{ik} is a vector of alternative and individual characteristics):

$$P_{ik} = \frac{e^{(\lambda\beta X_{ik})}}{\sum_{j=1}^{J} e^{(\lambda\beta X_{ij})}} \qquad (1)$$

The popularity of the MNL is due to the simplicity of its specification which leads to an easy estimation, thanks to Maximum Likelihood estimation techniques.

If it is lauded and used for its easy estimation, the MNL model has conversely long been criticised for the restrictive and sometimes unrealistic assumptions it makes.

The most frequent criticism addressed to the MNL is its reliance on the Independence of Irrelevant Alternatives (IIA) assumption, which comes directly from the IID property of the distribution of error terms assumed. In practical terms, this means that if one introduces or suppresses an alternative, the choice probabilities of the remaining alternatives should all change in the same proportion, thereby assuming that one alternative is never more a substitute to an existing one than any other alternative[110]. In the present labour market example, it means that if international agreements were to suppress the possibility for newly trained South African nurses to choose a job overseas, the model would assume that these nurses would all increase the remaining three main job categories in the same proportion, and not choose one alternative (e.g. the private sector) as a preferred substitute for a position overseas. This assumption of equal

[109] In its original article, McFadden called this model the "conditional logit model" as it is in effect the conditional distribution of demand given the feasible set of choice alternatives. Today, however, this model is more commonly called the multinomial or MNL model, and the name "conditional logit model" is usually given to choice models modelling how alternative characteristics affect individuals likelihood of choosing in them (as opposed to studying only how individual characteristics affect the likelihood of choosing an option).

[110] One shows easily formally that the ratio of choice probabilities of any two alternatives is unaffected by other alternatives.

competition and proportional substitution patterns between alternatives can be judged unrealistic in the present case. If this is the case, it has been shown that the MNL performs poorly (Brownstone and Train, 1999). Henscher et al. (Hensher et al., 2005) highlight the importance of five issues to minimise the impact of the violations of IIA in the model estimation[111]. However, the assumption of IIA can only be avoided by using more complex models that are presented below. Due to increased computer capacity, these new are being increasingly used, but the MNL remains a popular choice modelling framework in the DCE literature (Fiebig et al., 2005, Guttman et al., 2009).

A second limitation of the MNL pertains to the presence of the scale parameter λ in the choice probability. As shown in equation (1) it is not possible to separately identify the impact of the scale parameter λ on the choice probability, from that of tastes. In fact, we identify only the product $\lambda\beta_i$ (Louviere et al., 2000, Swait and Louviere, 1993). Usually, a simplification is assumed about the scale parameter ($\lambda \equiv 1$) to allow identification of the individual preference vector β_i. Heterogeneity in individual tastes can be incorporated in the model through interaction terms between socio-economic variables and alternative attributes (or alternative-specific constants). But some differences in tastes remain random, in the sense that they will be related to unobserved characteristics.

The last restriction of the MNL model relates to the absence of adjustment for serial correlation across individual observations. Because each respondent is asked to answer a sequence of choices one choice, discrete choice experiment data should be analysed with panel data estimators to account for the fact that the within-individual variation across choices may not be random. To adjust for that, a random parameter that is correlated *within* an individual's choices but not *across* individuals has to be added. For individual *i* this means that the utility from a particular choice is given by

$$U_{ni} = V_{ni} + \varepsilon_{ni} + \mu_i$$

where ε_{ni} is the random error term that includes random variation *across discrete choices*, while μ_i is the random error term *across respondents* and is constant for each individual.

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FIEBIG, D., LOUVIERE, J. & WALDMAN, D. 2005. Contemporary issues in modelling discrete choice experimental data in health economics. University of New South Wales.

[111] These issues are: 1/ selecting important attribute that influence individuals' choices, 2/ providing a realistic and meaningful range of levels, 3/using socio-economic variables to explore heterogeneity in utility levels and 4/ the functional form of the attribute parameters and 5/the functional form of the parameters.

GUTTMAN, R., CASTLE, R. & FIEBIG, D. G. 2009. Use of discrete choice experiments in health economics: An update of the literature. *working paper.* Sydney: School of Economics, University of New South Wales.

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Appendix 6.6: Kendall's tau coefficients

Kendall's tau coefficient tests the strength of association of the cross tabulations when both variables are measured at the ordinal level. It is based on the number of discordant and concordant pairs in the datasets, and makes adjustments for ties. Values range from −1 (perfect inversion) to +1 (perfect agreement), and a value of zero indicates the absence of association. Kendall's tau is computed as follows:

$$\tau = \frac{n_c - n_d}{\frac{1}{2}n(n-1)}$$

where n_c is the number of corresponding pairs and $n_d$is the number of discordant pairs in the dataset.

Appendix 6.7: Testing the robustness of alternative-specific salary variables

Alternative	Variable	Coeff.	St. Error	p-value
Salary	Salary (in R1,000)	0.010	0.001	0.000
Private job	Alternative-specific constant	-0.801	0.073	0.000
	Supportive staff [demanding patients]	0.254	0.044	0.000
	Support for external training [on-the-job training]	0.067	0.044	0.131
Overseas job	Alternative-specific constant	-3.560	0.126	0.000
	Status recognised overseas [not fully recognised]	0.826	0.057	0.000
Rural job	Alternative-specific constant	0.253	0.090	0.005
	Clinic [hospital]	0.211	0.046	0.000
	No shortage of supply/drugs [regular shortages]	0.453	0.046	0.000
	Waiting time (per year) to get study leave	-0.120	0.012	0.000
	Service for underserved [services for all]	-0.035	0.046	0.455
Urban job	Clinic [hospital]	0.233	0.045	0.000
	No shortage of supply/drugs [regular shortages]	0.352	0.045	0.000
	Waiting time (per year) to get study leave	-0.102	0.011	0.000
	Service for underserved [services for all]	-0.004	0.045	0.921

Note: N=18,000; Log-L: -12040; restricted Log-L: -14291; $\chi^2(15)$= 4501.59 (p<0.000)
Proportion of 1st choices correctly predicted: = 47.50%; proportion of first 2 choices correctly predicted=32.64%; proportion of full ranking correctly predicted: 22.5%. Kendall's tau: τ =0.41 (p<0.0001).

A likelihood-ratio test was performed to compare the model with a single salary coefficient presented above, to the model reported in Table 6.9, with alternative-specific salary coefficients. The test demonstrates that the hypothesis of a single salary coefficient should be rejected.

```
Likelihood-ratio test                          LR chi2(3)  =    189.96
(Assumption: model0 nested in model1)          Prob > chi2 =    0.0000
```

Appendix 6.8: Description of base scenarios for simulations

The expected deployment of nurses in the labour market was simulated by taking as levels for each job attribute those reflecting the current conditions in the South African labour market, and overseas. Practically, for public positions this means:

- Relatively bad working conditions in rural areas (regular shortages of drugs and medical supplies), but better in urban areas;
- Waiting about 4 years to obtain study leave in urban areas and 6 years in rural areas;
- The salaries reflecting the public service offers as made in 2008 (R120,000/year in urban areas and R132,000/year in rural areas thanks to the rural allowance);
- The provision of health services to underserved populations in rural areas who would otherwise have no alternative, while in urban areas this "social impact" is less strong;
- Jobs are more likely to be located in clinics in rural areas; however for urban posts, they are more likely to be in hospitals.

In private positions, the working conditions are usually relatively stressful with the clients' interests placed at the heart of the management concerns; the salary of beginning nurses are about R10,000/month (R120,000/year), and there is usually no support for further training. Finally in positions overseas, the base scenario was chosen to reflect the literature suggesting that foreign nurses are likely to be less recognised as local nurses. The salary offered was chosen to reflect a generous offer for beginning nurses (R250,000).

Appendix 6.9: Testing the reliability of rank-data

Table VI.4 below shows the coefficient estimates and their standard errors for four models that use different dependent variables: the first one uses only the preferred choice provided by the respondents; the second one uses only information about the first two ranks; the third one uses information about the full ranking; and the final one using the two extreme choices.

As expected the results show that a higher number of alternatives used decreases the standard errors around the parameter estimates. This reflects the increased statistical efficiency obtained by the use of more information to estimate the parameters. However the drop in log-likelihood of associated with the use of less information[112] suggests that there are increasing amounts of unexplained variance corresponding to lower rankings. In turn, this advocates for more caution in the use of rank-order data and rank-ordered logit models. One way to look at the problem is to scrutinise the results obtained with the different specifications in a more qualitative manner, to gauge the extent to which the results are affected by the change in the dependent variable used.

Table VI.4: Goodness-of-fit of the models

	Model I (1st choice only)	**Model II (1st and 2nd choices)**	**Model III (Full ranking)**	**Model IV (1st and 4th chocies)**
Log-likelihood	-4636	-8459	-10559	-10342
Log-likelihood (null)	-5776	-10343	-13224	-7884
Chi2	2280 (p<0.000)	3769 (p<0.000)	5329 (p<0.000)	4914 (p<0.000)
% of 1st choice predicted	51.52	51.74	51.50	51.09
% of first 2 ranks predicted	18.64	28.13	30.93	30.71
% of full ranking predicted	12.55	19.20	21.31	21.11
Kendall's τ_a	0.3033	0.3469	0.3483	0.3456
Kendall's τ_b	0.4044	0.4625	0.4644	0.4608

[112] In this context less information means using only some of the choices made; for example using the first choice only (which only provides information on what is the favourite option, with the last three considered as equal) as opposed to the complete ranking of the four alternatives.

Table VI.5: Estimated parameters for different model specifications using different number of ranks

Alternative	Variables in utility functions	Model I (1st choice)			Model II (1st and 2nd choices)			Model III (Full ranking)			Model IV (Best/worst)		
		Coeff.	Sig.	St. Err.	Coeff.	Sig.	St. Err.	Coeff.	Sig.	St. Err.	Coeff.	Sig.	St. Err.
Private job	Alternative-specific constant	-3.119	***	0.664	-1.957	***	0.409	-0.905	**	0.351	-0.872	*	0.391
	Salary (in R 1,000)	0.039	***	0.004	0.029	***	0.002	0.023	***	0.002	0.024	***	0.002
	Supportive staff [demanding patients]	0.308	**	0.098	0.409	***	0.059	0.292	***	0.048	0.218	***	0.053
	Support for external training [on-the-job training]	0.099		0.098	0.053		0.059	0.027		0.048	0.018		0.054
	Male	0.409	*	0.167	0.087		0.104	0.073		0.085	0.059		0.094
	White	0.497	*	0.243	0.329	*	0.155	0.210		0.131	0.221		0.142
	Young (<25 y.)	0.345	*	0.146	0.142		0.089	0.202	**	0.074	0.214	**	0.083
	Born in rural area	0.035		0.129	-0.110		0.079	-0.046		0.067	0.033		0.077
	Trained in university	0.330		0.176	0.294	**	0.102	0.218	*	0.086	0.178		0.095
	Trained in NW province	-0.020		0.134	0.096		0.078	0.134	*	0.066	0.100		0.075
	Positive attitude towards rural lifestyle	0.056		0.038	0.012		0.023	0.020		0.020	0.057	*	0.023
	Conservative attitude	-0.029		0.042	0.041		0.026	0.052	*	0.022	0.043		0.026
	Pro 'Welfare state' attitude	-0.015		0.038	-0.020		0.023	-0.021		0.020	-0.025		0.023
	Pro-poor attitude	-0.042		0.052	0.010		0.032	0.026		0.027	0.030		0.031
Overseas job	Alternative-specific constant	-0.839		0.575	-1.131	**	0.423	-1.214	***	0.368	-1.242	**	0.398
	Salary (in R 1,000)	0.008	***	0.001	0.006	***	0.001	0.005	***	0.001	0.005	***	0.001
	Status recognised overseas [not fully recognised]	1.131	***	0.097	1.059	***	0.075	0.988	***	0.061	1.019	***	0.064
	Male	0.664	***	0.152	0.738	***	0.110	0.786	***	0.097	0.769	***	0.102
	White	0.800	***	0.224	0.823	***	0.165	0.801	***	0.147	0.819	***	0.153
	Young (<25 y.)	0.842	***	0.132	0.731	***	0.097	0.755	***	0.086	0.771	***	0.090
	Born in rural area	0.172		0.123	-0.041		0.094	0.000		0.083	0.064		0.087
	Trained in university	0.184		0.153	0.293	**	0.113	0.439	***	0.099	0.430	***	0.103
	Trained in NW province	1.078	***	0.121	0.794	***	0.090	0.868	***	0.080	0.898	***	0.084
	Positive attitude towards rural lifestyle	-0.010		0.037	-0.082	**	0.028	-0.113	***	0.025	-0.095	***	0.026
	Conservative attitude	0.052		0.041	0.068	*	0.031	0.064	*	0.027	0.060	*	0.028
	Pro 'Welfare state' attitude	-0.010		0.036	-0.004		0.028	-0.044		0.024	-0.057	*	0.025

	Pro-poor attitude	0.006		0.050	0.025		0.038	0.020		0.033	0.017		0.035
Rural job	Alternative-specific constant	-0.039		0.576	-0.035		0.425	0.261		0.395	0.246		0.440
	Salary (in R 1,000)	0.025	***	0.003	0.021	***	0.002	0.019	***	0.002	0.020	***	0.002
	Clinic [hospital]	0.198	**	0.069	0.255	***	0.053	0.239	***	0.050	0.216	***	0.055
	No shortage of supply/drugs [regular shortages]	0.572	***	0.068	0.519	***	0.053	0.491	***	0.050	0.495	***	0.055
	Waiting time (per year) to get study leave	-0.163	***	0.017	-0.136	***	0.013	-0.123	***	0.012	-0.128	***	0.014
	Service for underserved [services for all]	0.009		0.068	-0.031		0.053	-0.018		0.050	-0.024		0.055
	Male	0.229		0.126	0.188	*	0.092	0.175	*	0.085	0.119		0.094
	White	0.202		0.209	0.376	*	0.148	0.218		0.132	0.024		0.142
	Young (<25 y.)	0.387	***	0.110	0.239	**	0.081	0.261	***	0.076	0.277	***	0.083
	Born in rural area	0.605	***	0.093	0.494	***	0.071	0.440	***	0.068	0.425	***	0.075
	Trained in university	-0.336	*	0.132	-0.506	***	0.096	-0.453	***	0.088	-0.353	***	0.096
	Trained in NW province	0.762	***	0.095	0.616	***	0.071	0.578	***	0.067	0.556	***	0.074
	Positive attitude towards rural lifestyle	0.142	***	0.028	0.106	***	0.021	0.114	***	0.020	0.144	***	0.023
	Conservative attitude	-0.090	**	0.031	-0.044		0.024	-0.022		0.022	-0.026		0.025
	Pro 'Welfare state' attitude	-0.010		0.028	0.003		0.021	-0.014		0.020	-0.034		0.022
	Pro-poor attitude	0.055		0.038	0.063	*	0.029	0.057	*	0.027	0.045		0.030
Urban job	Salary (in R 1,000)	0.031	***	0.003	0.025	***	0.002	0.024	***	0.002	0.025	***	0.002
	Clinic [hospital]	0.369	***	0.074	0.225	***	0.052	0.230	***	0.048	0.284	***	0.054
	No shortage of supply/drugs [regular shortages]	0.376	***	0.076	0.363	***	0.052	0.373	***	0.048	0.359	***	0.054
	Waiting time (per year) to get study leave	-0.210	***	0.019	-0.127	***	0.013	-0.112	***	0.012	-0.131	***	0.013
	Service for underserved [services for all]	-0.122		0.074	-0.018		0.052	-0.030		0.048	-0.061		0.054

Note: *** p<0.001, ** p<0.01, * p<0.05

Firstly, in terms of goodness-of-fit, all four models perform differently in their prediction of the alternative chosen first by respondents (they all predict it well in half of the cases). But when looking at more rank-ordering of the job preferences (the correct prediction of the first two choices, and of all four choices), model I, which only uses information from the preferred option, performs unsurprisingly less well than the others. Interestingly, the model using the best and worst option (model IV) performs virtually as well as model III, which uses the full ranking. Besides, its inferior log-likelihood could signal that it is dealing with less variance in the choices made, confirming the intuition that individuals have stronger views about extreme choices. These preliminary remarks tend to suggest that using the full-ranking in the present case is not necessarily an unreliable option.

Further inspection of the estimation of the coefficients in the different specifications provides more 'qualitative' insights. To start with, overall there is no major difference in the results found on the relative importance of job characteristics. Only the size of some parameter estimates differs quite strongly between model I and model III and IV, most notably the alternative-specific constant terms. For example, when considering only the 1st choice, the overseas alternative-specific constant is not significantly different from the urban one. However, the descriptive presentation of the results highlighted that the overseas alternative triggered particularly contrasting preferences[113]. A similar argument can be made for the alternative specific constant of the private option, whose size is significantly bigger in model I[114]. The different models also provide very similar results for the analysis of the role of individual variables on job preferences. Most parameter estimates of interaction terms with labels remain relatively stable (in sign, size and significance), although those coefficients that are 'borderline' significant in one model (just below the 5% threshold) might be found to be no longer significant when using less ranks.

Overall, these results are relatively comforting for the use of the full ranking given by respondents. The proximity between the results given by model III and IV could suggest that ranks 2 and 3 do not provide a lot more additional information, and that in fact what seems to be determinant are the extreme choices.

113 It was shown earlier that this type of job was ranked as the preferred option in nearly 16% of the choice sets, while it was ranked as the least favourite one in 64% of the choice sets.

114 This certainly comes from the fact that the private option was the least chosen as a 1st choice– only 12.7% of all job sets. Yet, it was often placed in the higher part of the lower ranks.

Appendix 7.1: Instructions provided to study participants before the policy choice experiment

In this questionnaire we want to investigate the characteristics of the facilities that you would choose to work in.

IMAGINE THAT YOU HAVE JUST COMPLETED COMMUNITY SERVICE AND YOU ARE OFFERED A JOB POSTING IN TWO DIFFERENT PUBLIC SECTOR HEALTH FACILITIES. YOU HAVE TO MAKE A CHOICE BETWEEN THE TWO JOBS.

ONE OF THE FACILITIES IS IN A RURAL AREA AND THE OTHER IS IN AN URBAN AREA.

RURAL FACILITIES ARE LOCATED IN SMALL VILLAGES OR REMOTE RURAL AREAS WHERE INFRASTRUCTURE IS POORLY DEVELOPED AND ACCESS TO SERVICES SUCH AS SHOPS AND SCHOOLS MAY BE LIMITED.

URBAN FACILITIES ARE LOCATED IN CITIES OR LARGE TOWN WITH WELL-DEVELOPED FACILITIES AND GOOD ACCESS TO ALL SERVICES.

The facilities also differ in:

1. The **type** of facility (Hospital or clinic).
2. The **salary** offered (Basic salary with or without an additional rural allowance).
3. The number of years you would have to work at this facility before getting **study leave** to specialise (2 or 6 years).
4. The subsidised **housing** available at that facility.
5. The time you have to be in your position before you could be **promoted** (1 or 2 years).
6. Some jobs in rural areas also include a monthly **car allowance** which is a perk not usually available to professional nurses.
7. The organisational culture and **management** style.

You can assume that other characteristics of the jobs not mentioned in the above list are the same for both facilities.

There are 16 questions with two job choices (Rural Facility and Urban Facility) for each question.
Indicate which of the two jobs you would choose for each question by ticking the appropriate box.
Please answer all 16 questions. That means you **must** make a choice between the two facilities offered.
There are no right or wrong answers.
A sample question is shown on the next page.

Appendix 7.2: Coding of attributes and levels

ATTRIBUTES	RURAL POST		URBAN POST	
	Level description	Coded	Level description	Coded
Type of facility	• Clinic • Hospital	1 0	• Clinic • Hospital	1 0
Annual salary	• R120,000 / yr • R120,000 + 10% • R120,000 + 20% • R120,000 + 30%	Dummy variables, reference category = R120,000	• R120,000 /yr	120
Provision of subsidised housing	• single room in share flat • small two bed-house	0 1	• None • single room in share flat	0 1
Time to wait before getting study leave to specialise	• 6 years • 2 years	6 2	• 6 years	6
Car Allowance	• None • R500 per month	0 6*	• None	0
Number of years to be spent in the facility until being eligible for promotion	• 2 years • 1 year	2 1	• 2 years • 1 year	2 1
Workplace management and culture	• Hierarchical • Relational	0 1	• Hierarchical • Relational	0 1

* This was recoded as a benefit per year to match with the salary units (R1,000 per year).

Appendix 7.3: Influence of rural background on the effects of policies – estimates from a mixed logit model

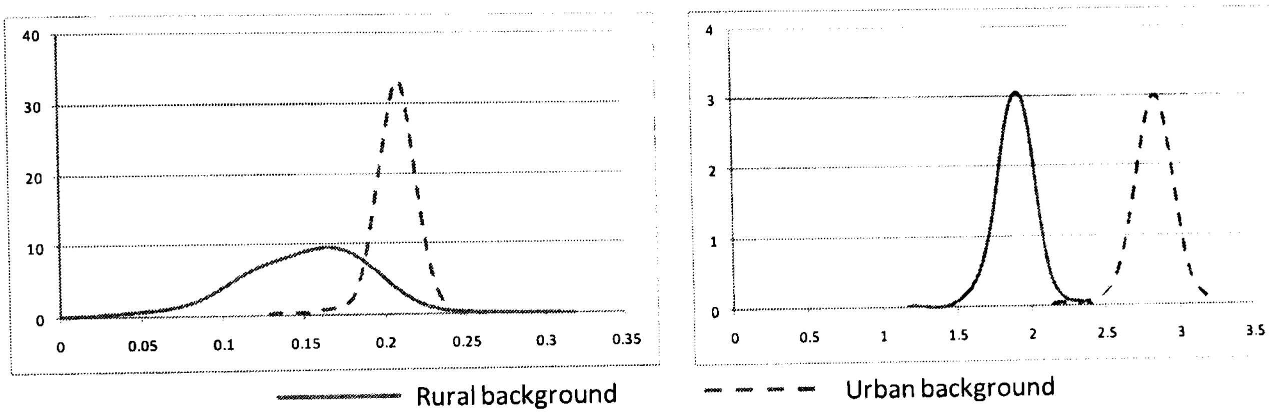
Variable	Description	Model R1			Model R2 - Rural background			Model R3 – Urban background		
		Coeff.	St. Error	P-value	Coeff.	St. Error	P-value	Coeff.	St. Error	P-value
Rural job –job characteristics										
FIXED PARAMETERS										
Alternative-specific constant		-2.823	0.309	0.000	-1.484	0.404	0.000	-2.756	0.426	0.000
Post in a clinic [hospital]		0.256	0.083	0.002	0.282	0.125	0.025	0.239	0.113	0.035
Time to wait for promotion (in years)		-0.106	0.084	0.206	-0.008	0.126	0.949	-0.176	0.117	0.131
Relational management [rule-oriented management]		0.170	0.079	0.032	0.089	0.121	0.461	0.224	0.109	0.041
RANDOM PARAMETERS										
Salary increase by 10%	Population average effect	1.477	0.172	0.000	1.280	0.592	0.015	1.698	0.034	0.000
	Random parameter mean	*1.647*	*0.151*	*0.000*	*1.313*	*0.180*	*0.000*	*1.698*	*0.165*	*0.000*
	Random parameter standard deviation	*0.146*	*0.348*	*0.674*	*0.607*	*0.267*	*0.023*	*0.036*	*0.419*	*0.931*
	Heterogeneity in mean - Being born in rural areas	*-0.786*	*0.227*	*0.001*	-	-	-	-	-	-
Salary increase by 20%	Population average effect	2.036	0.565	0.000	1.956	0.561	0.000	2.193	0.681	0.001
	Random parameter mean	*2.134*	*0.172*	*0.000*	*1.975*	*0.214*	*0.000*	*2.185*	*0.192*	*0.000*
	Random parameter standard deviation	*0.566*	*0.241*	*0.019*	*0.559*	*0.330*	*0.091*	*0.667*	*0.288*	*0.021*
	Heterogeneity in mean - Being born in rural areas	*-0.171*	*0.239*	*0.474*	-	-	-	-	-	-
Salary increase by 30%	Population average effect	2.398	0.616	0.000	1.890	0.403	0.000	2.819	0.385	0.000
	Random parameter mean	*2.765*	*0.175*	*0.000*	*1.897*	*0.194*	*0.000*	*2.831*	*0.195*	*0.000*
	Random parameter standard deviation	*0.475*	*0.219*	*0.030*	*0.419*	*0.317*	*0.186*	*0.398*	*0.354*	*0.260*
	Heterogeneity in mean - Being born in rural areas	*-0.786*	*0.227*	*0.001*	-	-	-	-	-	-
Provision of 2-bed house [shared flat]	Population average effect	0.407	0.235	0.042	0.165	0.311	0.297	0.620	0.007	0.000
	Random parameter mean	*0.607*	*0.108*	*0.000*	*0.178*	*0.125*	*0.155*	*0.620*	*0.117*	*0.000*
	Random parameter standard deviation	*0.197*	*0.179*	*0.273*	*0.325*	*0.200*	*0.105*	*0.007*	*0.232*	*0.974*
	Heterogeneity in mean - Being born in rural areas	*-0.438*	*0.157*	*0.005*	-	-	-	-	-	-

Car allowance	Population average effect	0.179	0.071	0.006	0.151	0.078	0.027	0.206	0.039	0.000
	Random parameter mean	*0.204*	*0.020*	*0.000*	*0.149*	*0.023*	*0.000*	*0.208*	*0.021*	*0.000*
	Random parameter standard deviation	*0.077*	*0.026*	*0.003*	*0.087*	*0.034*	*0.011*	*0.042*	*0.052*	*0.428*
	Heterogeneity in mean - Being born in rural areas	*-0.056*	*0.028*	*0.042*	-	-	-	-	-	-
Time to wait to obtain study leave (in years)	Population average effect	-0.413	0.233	0.038	-0.384	0.220	0.040	-0.448	0.251	0.037
	Random parameter mean	*-0.442*	*0.038*	*0.000*	*-0.384*	*0.041*	*0.000*	*-0.446*	*0.040*	*0.000*
	Random parameter standard deviation	*0.330*	*0.022*	*0.000*	*0.315*	*0.032*	*0.000*	*0.341*	*0.029*	*0.000*
	Heterogeneity in mean - Being born in rural areas	*0.047*	*0.053*	*0.383*	-	-	-	-	-	-
Rural job -	**Demographic, Education and attitudinal individual characteristics**									
Rural job	Male	0.054	0.196	0.781	0.362	0.272	0.184	-0.444	0.281	0.114
	White	0.427	0.293	0.145	-2.917	1.010	0.004	0.146	0.365	0.690
	Young (<25 y.)	0.320	0.169	0.059	0.208	0.256	0.416	0.478	0.224	0.033
	Born in rural area	1.168	0.255	0.000	-0.286	0.250	0.252	-0.162	0.342	0.637
	Trained in university	-0.445	0.200	0.026	0.401	0.221	0.069	0.912	0.214	0.000
	Trained in NW province	0.649	0.151	0.000	0.132	0.069	0.056	0.407	0.066	0.000
	Rural lifestyle score	0.273	0.047	0.000	-0.076	0.066	0.251	0.045	0.062	0.468
	Pro 'Welfare state' attitude	0.031	0.045	0.483	-0.038	0.092	0.681	0.181	0.084	0.031
	Pro-poor attitude	0.090	0.061	0.138	-0.006	0.078	0.942	-0.127	0.065	0.050
	Conservative attitude	-0.054	0.049	0.273	0.362	0.272	0.184	-0.444	0.281	0.114
Urban job – job characteristics										
Being posted in a clinic [hospital]		0.342	0.081	0.000	0.344	0.125	0.006	0.360	0.113	0.001
Provision of housing [no housing]		0.548	0.087	0.000	0.532	0.131	0.000	0.566	0.119	0.000
Time to wait to obtain study leave (in years)		-0.445	0.022	0.000	-0.431	0.034	0.000	-0.465	0.031	0.000
Time to wait for promotion (in years)		-0.342	0.082	0.000	-0.299	0.124	0.016	-0.358	0.112	0.002
Relational management [rule-oriented management]		-0.484	0.084	0.000	-0.539	0.128	0.000	-0.434	0.116	0.000

Note: for dummy variable in job characteristics, the reference category is indicated in brackets.

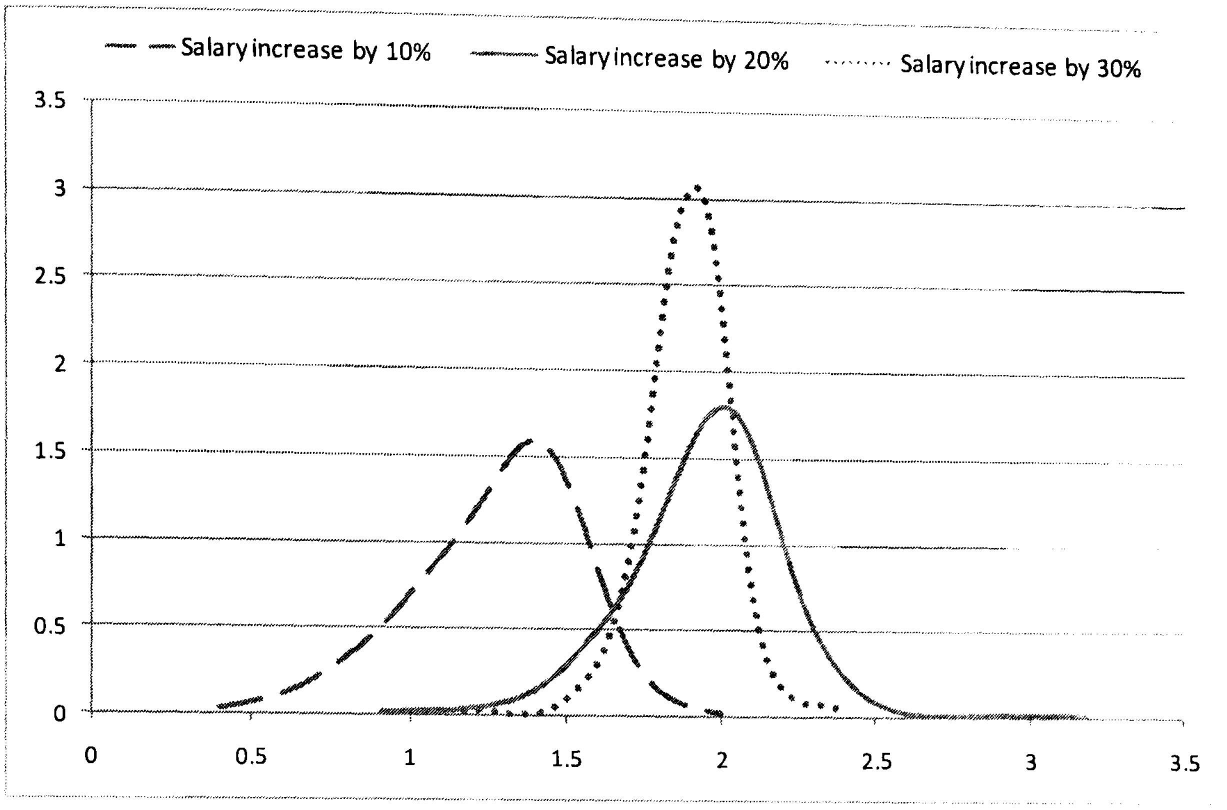
Models R2 and R3 report findings from this sub-group analysis. Whilst the coefficients associated with job characteristics in both models are in the same direction, the utility provided by greater benefits in rural jobs is systematically less important for people from rural backgrounds. Figure below provides a graphic illustration of the differences in preference distributions for better housing and a 30% salary increase. As noted earlier, this is likely to stem from their higher global preference for rural posts (compared to their 'urban' colleagues), which is reflected here in the difference observed in constant terms – people from rural background have a smaller aversion for rural in general.

Figure VII.1: Distribution estimates of preferences for better housing (left) and salary increase by 30% (right), for people from different origins



Another interesting difference between the two groups relates to the effects of salary increases. While salary preferences are behaving as expected in the urban group (i.e. non-linear increasing effect in the salary increase), the results are more surprising for nurses with rural origins. Indeed, on average, the results suggest that their utility is increased more by a 30% rural allowance than it is by a 20% salary increase. A closer look at the distribution of these coefficients amongst the population shows that these unusual preferences might arise only from a small group of individuals. For these individuals, this could be interpreted as an evidence of a crowding out effect of their intrinsic motivation to go and work in rural areas. Such adverse effects of incentives have been underlined in the literature on intrinsic motivation.

Figure VII.2: Illustration of heterogeneity in the distribution of random parameter estimates for salary increases amongst individuals of rural origins



Comparisons between models R2 and R3 also reveal interesting aspects in the determinants of job preferences of these two groups of individuals. In both groups, having trained at university (rather than in a nursing college) and in the North-West province (compared to Gauteng) makes individuals more likely to favour rural positions. However, there are unique features in the two groups. For example, amongst people with rural origins, white people are less inclined to choose rural posts, while this feature is not determining in the urban group. In that group, positive attitudes towards rural areas and towards a more pro-active role of the government are positively associated with greater preference for rural jobs. Surprisingly, in the urban group, those who have more pro-poor views are less likely to prefer rural jobs.

\ppendix 7.4: Results of the simulated scenarios under the four different acility configurations (sampled population)

Scenario description	Predicted uptake of rural posts			
	Urban hospital, rural hospital	Urban hospital, rural clinic	Urban clinic, rural hospital	Urban clinic, rural clinic
Base scenario	**31.85**	**35.11**	**27.7**	**30.78**
SINGLE INCENTIVES				
Salary increases				
10% rural allowance	51.92	55.56	47.03	50.68
20% rural allowance	59.77	63.17	55.11	58.6
30% rural allowance	64.81	68.16	60.14	63.65
Additional allowances				
Car allowance of R500/month	46.10	49.69	41.33	44.88
Housing opportunities				
2-bedroom house	36.77	40.27	32.26	35.61
Better training opportunities				
Study leave in 2 years	56.42	61.23	49.85	54.78
Better career path				
Promoted after 1 year in post	33.18	36.50	28.96	32.10
Better management				
Relational type of management	34.00	37.34	29.73	32.90
MULTIPLE INCENTIVE PACKAGES				
Financial packages				
10% salary increase + car allowance	66.67	69.92	62.1	65.53
20% salary increase + car allowance	73.24	76.08	69.18	72.24
30% salary increase + car allowance	77.61	80.23	73.8	76.68
"Status" packages				
Better housing + car	51.80	55.45	46.89	50.56
Better housing + car + 10% increase	71.94	74.96	67.63	70.88
Better housing + car + 20% increase	77.93	80.49	74.20	77.02
Career-related packages				
Quick promotion + car	47.58	51.18	42.79	46.36
Quick promotion + 10% salary increase	53.44	57.06	48.55	52.20
Quick promotion + 20% salary increase	61.19	64.56	56.56	60.04
Quick promotion + 10% increase + car	68.04	71.23	63.54	66.92
'Education' packages				
Study leave soon + car	75.26	78.97	69.76	73.93
Study leave soon + 10% increase	81.70	84.79	76.93	80.56
Study leave soon + 20% increase	86.90	89.19	83.27	86.04
Study leave soon + 10% increase + car	91.93	93.51	89.33	91.33

Appendix 7.5: Comparison between simulated package effects and additive effects

Scenario description	Predicted (average) distribution		Impact measures on proportion of rural uptake	
	% in rural posts	% in urban posts	Computed effect	Additive effect
Base scenario	31.36	68.64	-	-
SINGLE INCENTIVES				
Salary increases				
10% rural allowance	51.30	48.70	19.94	-
20% rural allowance	59.16	40.84	27.80	-
30% rural allowance	64.19	35.81	32.83	-
Additional allowances				
Car allowance of R500/month	45.50	54.50	14.14	-
Housing opportunities				
2-bedroom house	36.23	63.77	4.87	-
Better training opportunities				
Study leave in 2 years	55.57	44.43	24.21	-
Better career path				
Promoted after 1 year in post	32.69	67.32	1.33	-
Better management				
Relational type of management	33.49	66.51	2.13	-
MULTIPLE INCENTIVE PACKAGES				
Financial packages				
10% salary increase + car allowance	66.06	33.95	34.70	34.08
20% salary increase + car allowance	72.69	27.32	41.33	41.94
30% salary increase + car allowance	77.08	22.92	45.72	46.97
"Status" packages				
Better housing + car	51.18	48.83	19.82	19.01
Better housing + car + 10% increase	71.35	28.65	39.99	38.95
Better housing + car + 20% increase	77.41	22.59	46.05	46.81
Career-related packages				
Quick promotion + car	46.98	53.02	15.62	15.47
Quick promotion + 10% salary increase	52.81	47.19	21.45	21.27
Quick promotion + 20% salary increase	60.59	39.41	29.23	29.13
Quick promotion + 10% increase + car	67.43	32.57	36.07	35.41
'Education' packages				
Study leave soon + car	74.48	25.52	43.12	38.35
Study leave soon + 10% increase	81.00	19.01	49.64	44.15
Study leave soon + 20% increase	86.35	13.65	54.99	52.01
Study leave soon + 10% increase + car	91.53	8.48	60.17	58.29

Appendix 7.6: Running policy simulations on different sub-samples

Because weighting is not a possibility in the RPL models of NLOGIT, the only way to simulate policy interventions on different populations is to select a sub-sample of the population on which the model was run (in this case, model II presented in Table 7.3). Therefore, four populations were "fabricated" to match the following proportions of rural/urban: 0-100, 25-75, 75-25, 100-0. These sub-samples were created by randomly drawing the necessary number of individuals from each of the two sub-groups. For example, to create population #2, all urban individuals were used, and 67 individuals were randomly selected from the rural sub-group to make up for the 25% of rural individuals.

	Original		**Population #1 0% rural**		**Population #2 25% rural**		**Population #3 75% rural**		**Population #4 100% rural**	
	N	%	N	%	N	%	N	%	N	%
Rural	176	46.68	0	0	67	25	176	75	176	100
Urban	201	53.32	201	100	201	75	59	25	0	0

Appendix 7.7: Uptake of rural posts under various simulated scenarios, under the four different facility configurations (simulated population sample)

1. *Results of simulations with sample #1 – 0% rural, 100% urban*

Scenario description	Predicted uptake of rural posts (%)				
	Average	Urban hospital, rural hospital	Urban hospital, rural clinic	Urban clinic, rural hospital	Urban clinic, rural clinic
Base scenario*	**20.46**	**20.84**	**23.64**	**17.42**	**19.94**
Single incentive policies					
Salary increases					
10% rural allowance	41.43	42.03	45.78	37.13	40.77
20% rural allowance	48.61	49.23	52.95	44.27	47.97
30% rural allowance	57.76	58.40	62.02	53.45	57.16
Additional allowances					
Car allowance of R500/month	35.63	36.18	39.74	31.60	35.00
Housing opportunities					
2-bedroom house	27.40	27.87	31.13	23.80	26.81
Better training opportunities					
Study leave in 2 years	40.20	41.02	46.44	34.09	39.23
Better career path					
Promoted after 1 year in post	21.58	21.97	24.86	18.44	21.04
Better management					
Relational type of management	22.27	22.68	25.62	19.07	21.73
Multiple incentive policies					
Financial packages					
10% salary increase + car	59.26	59.90	63.48	54.99	58.67
20% salary increase + car	65.69	66.31	69.59	61.71	65.17
30% salary increase + car	73.67	74.24	77.12	70.11	73.23
"Status" packages					
Better housing + car	44.19	44.80	48.52	39.90	43.55
Better housing + car + 10%	67.53	68.15	71.40	63.57	67.02
Better housing + car + 20%	73.22	73.78	76.66	69.65	72.77
Career-related packages					
Quick promotion + car	37.08	37.64	41.25	32.99	36.45
Quick promotion + 10% salary	42.97	43.58	47.35	38.63	42.31
Quick promotion + 20% salary	50.15	50.78	54.49	45.80	49.52
Quick promotion + 10% increase +	60.76	61.40	64.93	56.52	60.18
Training packages					
Study leave soon + car	65.29	66.22	70.90	59.51	64.56
Study leave soon + 10% increase	73.50	74.39	78.48	68.24	72.90
Study leave soon + 20% increase	80.04	80.78	84.01	75.79	79.59
Study leave soon + 10% increase +	88.69	89.21	91.27	85.85	88.43

2. *Results of simulations with sample #2 – 25% rural, 75% urban*

Scenario description	Predicted uptake of rural posts (%)				
	Average	Urban hospital, rural hospital	Urban hospital, rural clinic	Urban clinic, rural hospital	Urban clinic, rural clinic
Base scenario*	25.73	**26.17**	**29.20**	**22.38**	**25.18**
Single incentive policies					
Salary increases					
10% rural allowance	46.19	46.80	50.51	41.89	45.55
20% rural allowance	53.76	54.38	57.95	49.55	53.16
30% rural allowance	60.79	61.42	64.92	56.59	60.22
Additional allowances					
Car allowance of R500/month	40.38	40.95	44.54	36.27	39.75
Housing opportunities					
2-bedroom house	31.60	32.11	35.50	27.81	31.00
Better training opportunities					
Study leave in 2 years	47.73	48.58	53.72	41.78	46.84
Better career path					
Promoted after 1 year in post	26.96	27.41	30.51	23.52	26.39
Better management					
Relational type of management	27.71	28.17	31.32	24.22	27.14
Multiple incentive policies					
Financial packages					
10% salary increase + car allowance	62.49	63.12	66.55	58.36	61.93
20% salary increase + car allowance	69.07	69.66	72.73	65.32	68.59
30% salary increase + car allowance	75.20	75.75	78.52	71.77	74.78
"Status" packages					
Better housing + car	47.46	48.07	51.77	43.16	46.83
Better housing + car + 10% increase	69.24	69.84	72.99	65.38	68.74
Better housing + car + 20% increase	75.16	75.71	78.44	71.76	74.74
Career-related packages					
Quick promotion + car	41.85	42.43	46.05	37.70	41.22
Quick promotion + 10% salary	47.72	48.34	52.05	43.40	47.09
Quick promotion + 20% salary	55.25	55.87	59.42	51.05	54.66
Quick promotion + 10% increase +	63.93	64.56	67.93	59.85	63.39
Training packages					
Study leave soon + car	69.77	70.63	74.84	64.49	69.13
Study leave soon + 10% increase	77.17	77.96	81.57	72.48	76.65
Study leave soon + 20% increase	83.17	83.81	86.59	79.49	82.78
Study leave soon + 10% increase +	90.04	90.51	92.34	87.51	89.81

3. *Results of simulations with sample #3 – 75% rural, 25% urban*

Scenario description	Predicted uptake of rural posts (%)				
	Average	Urban hospital, rural hospital	Urban hospital, rural clinic	Urban clinic, rural hospital	Urban clinic, rural
Base scenario*	**38.08**	**38.64**	**42.19**	**34.04**	**37.46**
Single incentive policies					
Salary increases					
10% rural allowance	57.45	58.09	61.66	53.19	56.86
20% rural allowance	65.74	66.34	69.55	61.84	65.22
30% rural allowance	68.26	68.87	72.05	64.37	67.76
Additional allowances					
Car allowance of R500/month	51.63	52.25	55.88	47.37	51.02
Housing opportunities					
2-bedroom house	41.70	42.29	45.96	37.50	41.07
Better training opportunities					
Study leave in 2 years	65.12	66.00	70.45	59.61	64.42
Better career path					
Promoted after 1 year in post	39.53	40.10	43.68	35.44	38.91
Better management					
Relational type of management	40.42	40.99	44.59	36.30	39.79
Multiple incentive policies					
Financial packages					
10% salary increase + car allowance	70.35	70.94	74.00	66.58	69.86
20% salary increase + car allowance	77.09	77.61	80.18	73.88	76.70
30% salary increase + car allowance	79.29	79.80	82.26	76.19	78.92
"Status" packages					
Better housing + car	55.57	56.20	59.82	51.29	54.97
Better housing + car + 10% increase	73.82	74.39	77.27	70.25	73.38
Better housing + car + 20% increase	80.10	80.59	82.96	77.11	79.75
Career-related packages					
Quick promotion + car	53.14	53.76	57.37	48.88	52.53
Quick promotion + 10% salary	58.95	59.58	63.12	54.72	58.36
Quick promotion + 20% salary	67.09	67.69	70.84	63.26	66.59
Quick promotion + 10% increase + car	71.65	72.23	75.22	67.96	71.18
Training packages					
Study leave soon + car	80.30	81.00	84.11	76.23	79.86
Study leave soon + 10% increase	85.77	86.37	88.83	82.44	85.44
Study leave soon + 20% increase	90.37	90.80	92.51	88.02	90.15
Study leave soon + 10% increase + car	93.38	93.72	94.98	91.59	93.23

4. Results of simulations with sample 4 – 100% rural, 0% urban

Scenario description	Predicted uptake of rural posts (%)				
	Average	Urban hospital, rural hospital	Urban hospital, rural clinic	Urban clinic, rural hospital	Urban clinic, rural clinic
Base scenario*	**43.81**	**43.15**	**48.21**	**39.45**	**44.42**
Single incentive policies					
Salary increases					
10% rural allowance	62.57	62.00	66.73	58.33	63.22
20% rural allowance	71.21	70.74	74.84	67.47	71.81
30% rural allowance	71.53	71.06	75.17	67.79	72.13
Additional allowances					
Car allowance of R500/month	56.76	56.16	61.04	52.44	57.40
Housing opportunities					
2-bedroom house	46.30	45.65	50.71	41.91	46.92
Better training opportunities					
Study leave in 2 years	73.11	72.51	78.11	67.83	74.00
Better career path					
Promoted after 1 year in post	45.36	44.71	49.78	40.98	45.99
Better management					
Relational type of management	46.31	45.66	50.73	41.91	46.94
Multiple incentive policies					
Financial packages					
10% salary increase + car allowance	73.81	73.37	77.28	70.22	74.39
20% salary increase + car allowance	80.67	80.32	83.50	77.70	81.16
30% salary increase + car allowance	80.97	80.62	83.79	78.02	81.46
"Status" packages					
Better housing + car	59.15	58.56	63.36	54.88	59.79
Better housing + car + 10% increase	75.71	75.28	79.02	72.26	76.26
Better housing + car + 20% increase	82.20	81.87	84.87	79.39	82.67
Career-related packages					
Quick promotion + car	58.28	57.69	62.52	53.98	58.92
Quick promotion + 10% salary	64.05	63.49	68.15	59.87	64.69
Quick promotion + 20% salary	72.51	72.05	76.05	68.85	73.09
Quick promotion + 10% increase +	75.05	74.62	78.43	71.55	75.61
Training packages					
Study leave soon + car	84.97	84.62	88.20	81.46	85.60
Study leave soon + 10% increase	89.55	89.31	91.99	86.84	90.05
Study leave soon + 20% increase	93.55	93.41	95.12	91.80	93.88
Study leave soon + 10% increase +	94.77	94.65	96.07	93.30	95.05

Appendix 7.8: Probability of choosing rural options randomly

The probability of choosing a rural option k times out of 16 is:

$$P_k = \frac{C_{16}^k}{2^{16}} = \frac{16!}{k!\,(16-k)!} \times \frac{1}{2^{16}}$$

There are C_{16}^k ways to pick k choices out of 16

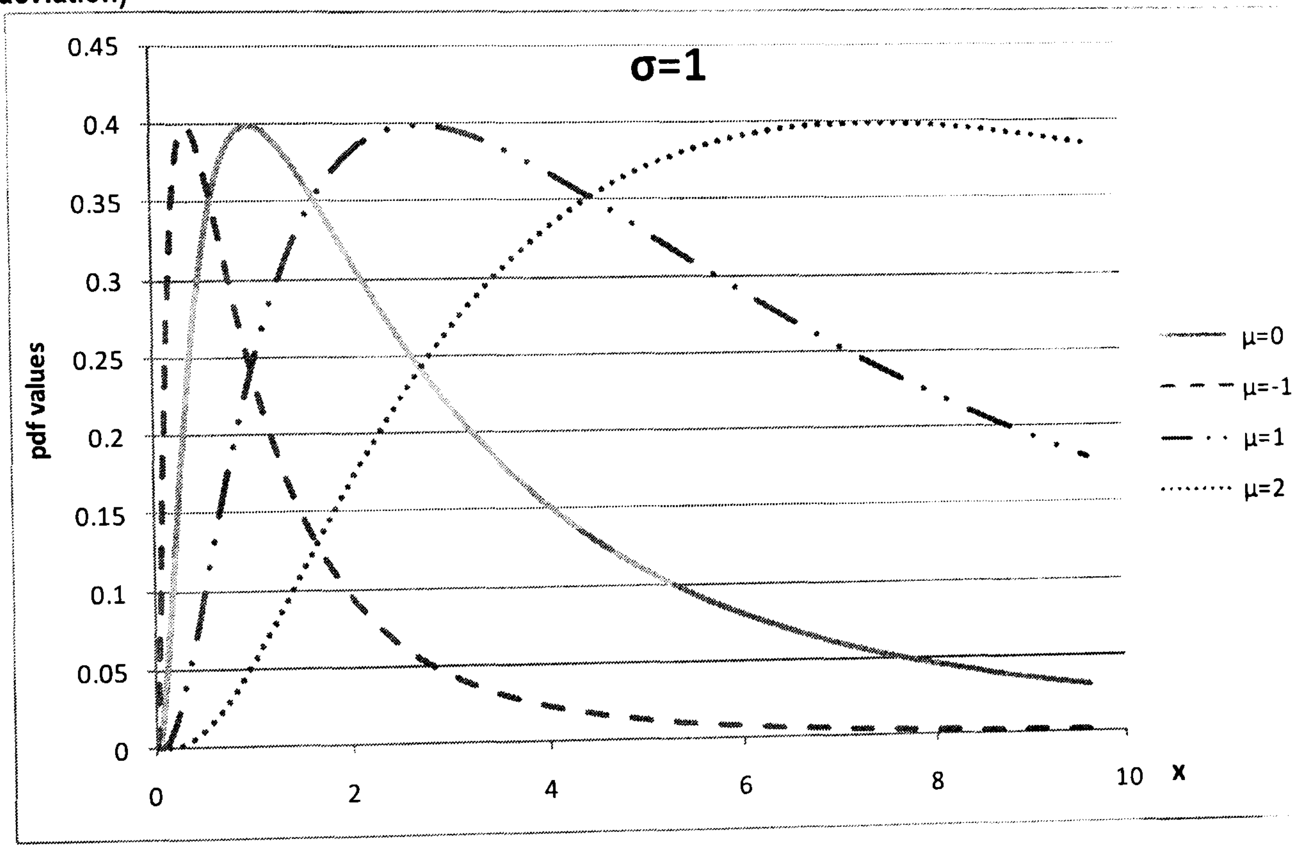
Actual and random proportion of repeated rural choices:

Number of choice sets (out of 16) where the rural option was chosen	N	Proportion of respondents	Random choice	Δ (actual-random)
0	10	2.69%	0.002%	2.688
1	2	0.54%	0.024%	0.516
3	5	1.34%	0.854%	0.486
4	8	2.15%	2.777%	-0.627
5	14	3.76%	6.665%	-2.905
6	25	6.72%	12.219%	-5.499
7	24	6.45%	17.456%	-11.006
8	20	5.38%	19.638%	-14.258
9	31	8.33%	17.456%	-9.126
10	38	10.22%	12.219%	-1.999
11	42	11.29%	6.665%	4.625
12	50	13.44%	2.777%	10.663
13	38	10.22%	0.854%	9.366
14	26	6.99%	0.183%	6.807
15	22	5.91%	0.024%	5.886
16	17	4.57%	0.002%	4.568

Appendix 8.1: Parameters of the lognormal distributions chosen for training uptake rates

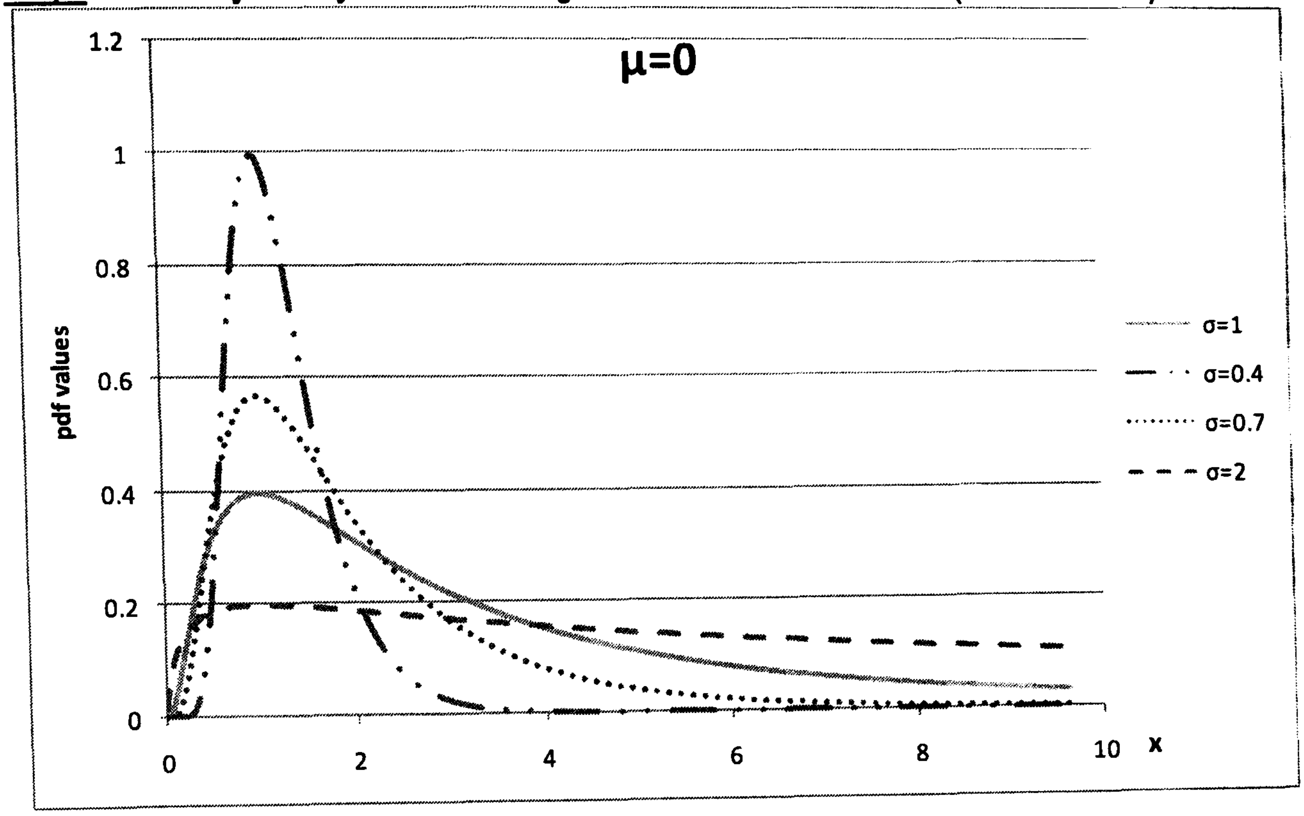
The graph below demonstrates why a mean of μ=0 was preferred to other values. Indeed, it was important to obtain a curve skewed towards the left, with high uptake rates at the beginning of the career. Yet it was important to spread that uptake over a few years, which is not the case here with μ=-1. Then the uptake rates had to fizzle out over time, and not remain at high levels, unlike what is the case with μ>1.

Graph 1: Probability density function of a lognormal distribution functions (constant standard deviation)



The second graph below illustrates why the standard deviation was chosen such as σ=0.7. For values higher than 1, the distribution flattens and the distribution loses its skewed characteristic. For values smaller than 1, the distribution takes higher values at the beginning, and converges towards zero more quickly than it does for σ=1. This latter characteristic is important, as one hypothesizes that there will be very few students who will specialize towards the end of their career. Therefore, a value smaller than σ=1 is chosen, but it is important to avoid that the values of the distribution

Graph: Probability density function of a lognormal distribution functions (constant mean)

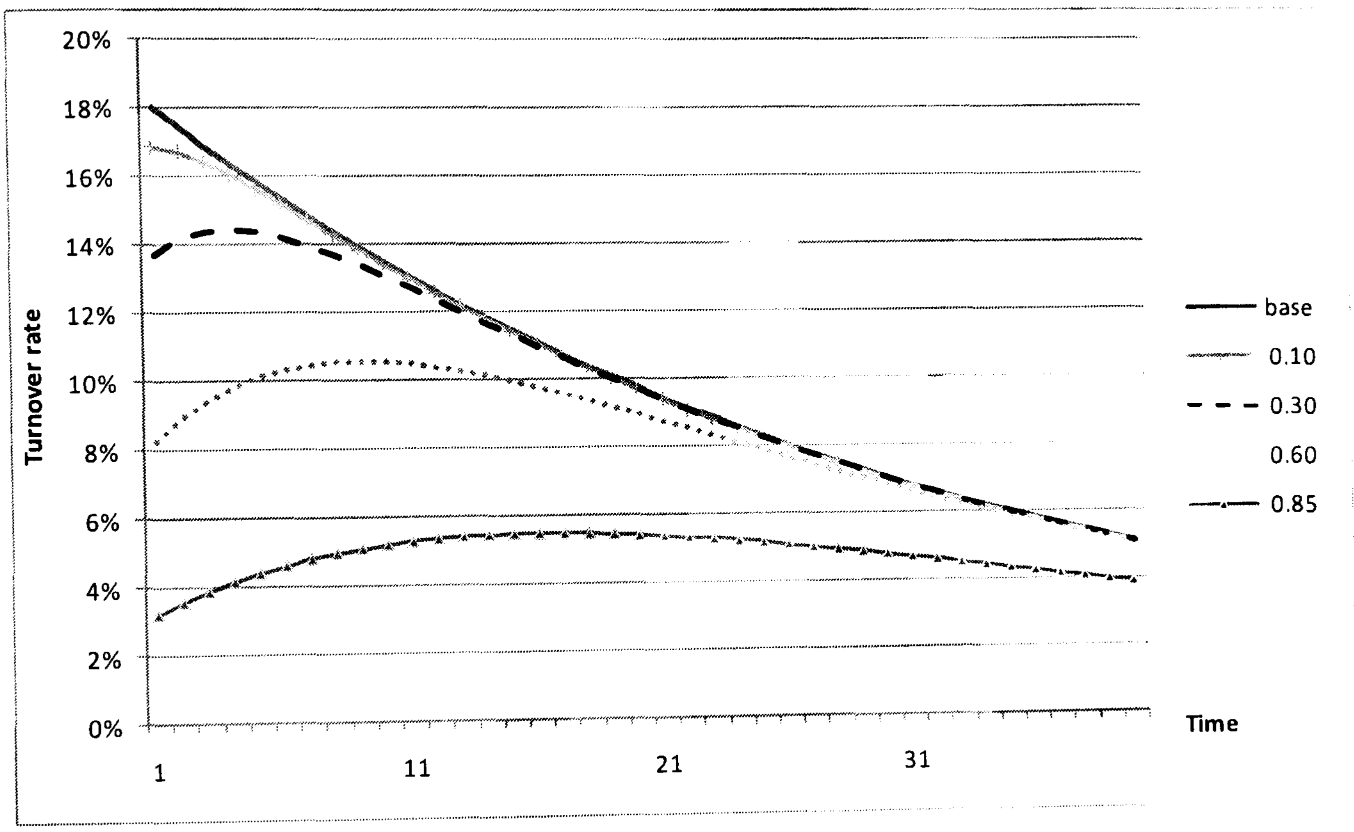


Appendix 8.2: Modelling the policy effects on turnover rates and controlling for hysteresis effect

It was explained that the turnover rate is affected by new employment conditions as follows:

$$TU'_{rt} = TU_{rt} \times \left(1 - \tau^{\left(1+\frac{t}{5}\right)}\right)$$

Where τ is the measure of the increased attractiveness of the rural job, assessed by the policy effect (the change in the proportions of nurses who initially take up rural positions). The graph below illustrates the problem of using values of τ that are close to 1, and the hysteresis phenomenon that is triggered.



Appendix 8.3: Distribution of nurses in the labour market, with cumulated cohorts

Distributions of nursing staff after the introduction of the incentives

Policy ID	Rural incentives	Domestic market			International market			
		Rural	Urban	Private	Rural	Urban	Private	Overseas
Base	Base scenario (no incentive)	21.22%	46.45%	32.32%	18.69%	40.90%	28.46%	11.95%
#6	10% rural allowance	27.21%	40.47%	32.32%	23.96%	35.63%	28.46%	11.95%
#9	20% rural allowance	29.57%	38.10%	32.32%	26.04%	33.55%	28.46%	11.95%
#11	30% rural allowance	31.08%	36.59%	32.32%	27.37%	32.22%	28.46%	11.95%
#2	2-bedroom house	22.69%	44.99%	32.32%	19.98%	39.61%	28.46%	11.95%
#3	Car allowance of R500/month	25.47%	42.21%	32.32%	22.43%	37.16%	28.46%	11.95%
#1	Promoted after 1 year in post	21.62%	46.05%	32.32%	19.04%	40.55%	28.46%	11.95%
#8	Study leave in 2 years	28.49%	39.18%	32.32%	25.09%	34.50%	28.46%	11.95%
#4	Quick promotion + car allowance	25.91%	41.76%	32.32%	22.82%	36.77%	28.46%	11.95%
#7	Quick promotion + 10% salary increase	27.67%	40.01%	32.32%	24.36%	35.23%	28.46%	11.95%
#10	Quick promotion + 20% salary increase	30.00%	37.68%	32.32%	26.42%	33.17%	28.46%	11.95%
#12	10% salary increase + car allowance	31.64%	36.03%	32.32%	27.86%	31.73%	28.46%	11.95%
#14	20% salary increase + car allowance	33.64%	34.04%	32.32%	29.62%	29.97%	28.46%	11.95%
#5	Better housing + car allowance	27.18%	40.50%	32.32%	23.93%	35.66%	28.46%	11.95%
#13	Better housing + car all. + 10% increase	33.23%	34.44%	32.32%	29.26%	30.33%	28.46%	11.95%
#16	Better housing + car all. + 20% increase	35.05%	32.62%	32.32%	30.86%	28.73%	28.46%	11.95%
#15	Study leave soon + car allowance	34.17%	33.50%	32.32%	30.09%	29.50%	28.46%	11.95%
#17	Study leave soon + 10% increase	36.13%	31.55%	32.32%	31.81%	27.78%	28.46%	11.95%
#19	Study leave soon + 20% increase	39.29%	28.38%	32.32%	34.60%	24.99%	28.46%	11.95%
#18	Study leave soon + 10% increase + car all.	37.74%	29.94%	32.32%	33.23%	26.36%	28.46%	11.95%

Distributions of nursing staff after 10 years

Policy ID	Rural incentives	Domestic market			International market			
		Rural	Urban	Private	Rural	Urban	Private	Overseas
Base	Base scenario (no incentive)	16.54%	36.80%	46.66%	14.83%	32.98%	41.83%	10.36%
#6	10% rural allowance	20.20%	34.16%	45.64%	18.13%	30.66%	40.96%	10.26%
#9	20% rural allowance	22.13%	32.91%	44.95%	19.88%	29.56%	40.37%	10.20%
#11	30% rural allowance	23.56%	32.04%	44.40%	21.17%	28.78%	39.90%	10.15%
#2	2-bedroom house	17.28%	36.22%	46.50%	15.49%	32.47%	41.69%	10.34%
#3	Car allowance of R500/month	18.96%	35.00%	46.04%	17.01%	31.40%	41.30%	10.29%
#1	Promoted after 1 year in post	16.73%	36.64%	46.63%	15.00%	32.85%	41.80%	10.35%
#8	Study leave in 2 years	19.64%	34.08%	46.28%	17.58%	30.50%	41.42%	10.50%
#4	Quick promotion + car allowance	19.26%	34.79%	45.94%	17.28%	31.21%	41.22%	10.29%
#7	Quick promotion + 10% salary increase	20.54%	33.93%	45.52%	18.44%	30.46%	40.86%	10.25%
#10	Quick promotion + 20% salary increase	22.52%	32.67%	44.81%	20.23%	29.34%	40.24%	10.19%
#12	10% salary increase + car allowance	24.13%	31.69%	44.18%	21.68%	28.48%	39.70%	10.14%
#14	20% salary increase + car allowance	26.36%	30.38%	43.25%	23.71%	27.33%	38.90%	10.06%
#5	Better housing + car allowance	20.17%	34.18%	45.65%	18.10%	30.67%	40.97%	10.26%
#13	Better housing + car all. + 10% increase	25.88%	30.66%	43.46%	23.28%	27.57%	39.08%	10.08%
#16	Better housing + car all. + 20% increase	28.18%	29.35%	42.46%	25.36%	26.42%	38.22%	10.00%
#15	Study leave soon + car allowance	23.77%	31.22%	45.02%	21.26%	27.93%	40.27%	10.54%
#17	Study leave soon + 10% increase	25.68%	30.01%	44.30%	22.98%	26.85%	39.64%	10.54%
#19	Study leave soon + 20% increase	29.54%	27.74%	42.73%	26.43%	24.82%	38.24%	10.50%
#18	Study leave soon + 10% increase + car all.	27.51%	28.92%	43.58%	24.61%	25.87%	38.99%	10.52%

Distributions of nursing staff after 20 years

Policy ID	Rural incentives	Domestic market			International market			
		Rural	Urban	Private	Rural	Urban	Private	Overseas
Base	Base scenario (no incentive)	14.94%	34.59%	50.46%	13.45%	31.14%	45.42%	10.00%
#6	10% rural allowance	17.24%	33.05%	49.71%	15.53%	29.77%	44.78%	9.91%
#9	20% rural allowance	18.57%	32.28%	49.16%	16.74%	29.10%	44.31%	9.86%
#11	30% rural allowance	19.59%	31.71%	48.69%	17.67%	28.60%	43.91%	9.82%
#2	2-bedroom house	15.39%	34.26%	50.35%	13.85%	30.84%	45.32%	9.98%
#3	Car allowance of R500/month	16.44%	33.55%	50.01%	14.80%	30.21%	45.04%	9.94%
#1	Promoted after 1 year in post	15.06%	34.51%	50.44%	13.55%	31.06%	45.40%	9.99%
#8	Study leave in 2 years	16.88%	32.97%	50.15%	15.18%	29.64%	45.09%	10.09%
#4	Quick promotion + car allowance	16.63%	33.43%	49.94%	14.98%	30.11%	44.98%	9.94%
#7	Quick promotion + 10% salary increase	17.47%	32.91%	49.62%	15.74%	29.65%	44.70%	9.90%
#10	Quick promotion + 20% salary increase	18.84%	32.13%	49.03%	16.99%	28.96%	44.20%	9.85%
#12	10% salary increase + car allowance	20.02%	31.49%	48.49%	18.06%	28.40%	43.74%	9.80%
#14	20% salary increase + car allowance	21.77%	30.59%	47.65%	19.65%	27.61%	43.02%	9.72%
#5	Better housing + car allowance	17.22%	33.06%	49.72%	15.52%	29.78%	44.79%	9.91%
#13	Better housing + car all. + 10% increase	21.38%	30.78%	47.84%	19.30%	27.78%	43.18%	9.74%
#16	Better housing + car all. + 20% increase	23.29%	29.83%	46.88%	21.04%	26.95%	42.35%	9.66%
#15	Study leave soon + car allowance	20.04%	31.04%	48.91%	18.02%	27.91%	43.98%	10.09%
#17	Study leave soon + 10% increase	21.77%	30.11%	48.12%	19.58%	27.09%	43.28%	10.06%
#19	Study leave soon + 20% increase	25.84%	28.07%	46.09%	23.27%	25.27%	41.50%	9.95%
#18	Study leave soon + 10% increase + car all.	23.59%	29.18%	47.23%	21.22%	26.26%	42.50%	10.02%

Distributions of nursing staff after 30 years

Policy ID	Rural incentives	Domestic market			International market			
		Rural	Urban	Private	Rural	Urban	Private	Overseas
Base	Base scenario (no incentive)	14.53%	34.60%	50.87%	13.12%	31.26%	45.95%	9.67%
#6	10% rural allowance	16.42%	33.34%	50.23%	14.85%	30.14%	45.41%	9.60%
#9	20% rural allowance	17.54%	32.71%	49.76%	15.86%	29.58%	45.01%	9.55%
#11	30% rural allowance	18.41%	32.23%	49.35%	16.66%	29.17%	44.66%	9.51%
#2	2-bedroom house	14.89%	34.33%	50.78%	13.45%	31.01%	45.87%	9.66%
#3	Car allowance of R500/month	15.76%	33.75%	50.49%	14.24%	30.50%	45.63%	9.63%
#1	Promoted after 1 year in post	14.62%	34.53%	50.85%	13.21%	31.19%	45.93%	9.67%
#8	Study leave in 2 years	16.13%	33.27%	50.60%	14.55%	30.03%	45.66%	9.75%
#4	Quick promotion + car allowance	15.92%	33.65%	50.43%	14.38%	30.41%	45.58%	9.62%
#7	Quick promotion + 10% salary increase	16.62%	33.23%	50.16%	15.02%	30.04%	45.34%	9.59%
#10	Quick promotion + 20% salary increase	17.77%	32.58%	49.65%	16.07%	29.47%	44.91%	9.54%
#12	10% salary increase + car allowance	18.78%	32.04%	49.18%	17.00%	29.00%	44.51%	9.50%
#14	20% salary increase + car allowance	20.32%	31.27%	48.41%	18.40%	28.32%	43.85%	9.42%
#5	Better housing + car allowance	16.41%	33.35%	50.24%	14.83%	30.15%	45.42%	9.60%
#13	Better housing + car all. + 10% increase	19.97%	31.44%	48.59%	18.09%	28.47%	44.00%	9.44%
#16	Better housing + car all. + 20% increase	21.70%	30.60%	47.70%	19.67%	27.74%	43.24%	9.36%
#15	Study leave soon + car allowance	18.91%	31.63%	49.46%	17.07%	28.55%	44.65%	9.73%
#17	Study leave soon + 10% increase	20.53%	30.79%	48.68%	18.54%	27.80%	43.96%	9.70%
#19	Study leave soon + 20% increase	24.73%	28.75%	46.52%	22.37%	26.01%	42.07%	9.56%
#18	Study leave soon + 10% increase + car all.	22.34%	29.89%	47.76%	20.19%	27.01%	43.16%	9.64%

Distributions of nursing staff after 40 years

Policy ID	Rural incentives	Domestic market			International market			
		Rural	Urban	Private	Rural	Urban	Private	Overseas
Base	Base scenario (no incentive)	14.42%	34.71%	50.87%	13.04%	31.40%	46.02%	9.54%
#6	10% rural allowance	16.19%	33.53%	50.28%	14.66%	30.36%	45.52%	9.47%
#9	20% rural allowance	17.24%	32.93%	49.83%	15.62%	29.83%	45.13%	9.42%
#11	30% rural allowance	18.07%	32.49%	49.44%	16.37%	29.44%	44.80%	9.38%
#2	2-bedroom house	14.76%	34.46%	50.78%	13.35%	31.18%	45.95%	9.52%
#3	Car allowance of R500/month	15.57%	33.91%	50.52%	14.09%	30.70%	45.72%	9.49%
#1	Promoted after 1 year in post	14.50%	34.64%	50.85%	13.12%	31.34%	46.01%	9.53%
#8	Study leave in 2 years	15.92%	33.47%	50.62%	14.39%	30.25%	45.75%	9.61%
#4	Quick promotion + car allowance	15.72%	33.82%	50.46%	14.23%	30.61%	45.67%	9.49%
#7	Quick promotion + 10% salary increase	16.38%	33.42%	50.20%	14.83%	30.26%	45.45%	9.46%
#10	Quick promotion + 20% salary increase	17.46%	32.81%	49.73%	15.82%	29.73%	45.05%	9.41%
#12	10% salary increase + car allowance	18.42%	32.31%	49.27%	16.69%	29.28%	44.66%	9.36%
#14	20% salary increase + car allowance	19.88%	31.58%	48.54%	18.03%	28.64%	44.03%	9.29%
#5	Better housing + car allowance	16.18%	33.54%	50.28%	14.65%	30.36%	45.52%	9.47%
#13	Better housing + car all. + 10% increase	19.55%	31.74%	48.71%	17.73%	28.78%	44.18%	9.31%
#16	Better housing + car all. + 20% increase	21.20%	30.94%	47.86%	19.24%	28.09%	43.44%	9.23%
#15	Study leave soon + car allowance	18.56%	31.91%	49.53%	16.78%	28.85%	44.78%	9.59%
#17	Study leave soon + 10% increase	20.14%	31.10%	48.76%	18.22%	28.13%	44.10%	9.55%
#19	Study leave soon + 20% increase	24.35%	29.08%	46.57%	22.06%	26.35%	42.19%	9.40%
#18	Study leave soon + 10% increase + car all.	21.93%	30.23%	47.85%	19.84%	27.36%	43.31%	9.49%

Appendix 8.4: Simulated distribution of nurses under the current conditions

This corresponds to the results of the combination of simulations from the two DCEs, under the current conditions offered on the market. Results for the "policy" DCE are presented in Chapter 6, with different types of simulated nursing populations.

Sample description	**% uptake of each type of post**			
	Overseas	**Rural**	**Private**	**Urban**
Original sample	11.95	30.74	28.46	28.83
Sample #1 (0% rural)	11.79	30.17	28.76	29.28
Sample #2 (25% rural)	11.72	30.40	28.73	29.15
Sample #3 (75% rural)	12.16	30.57	28.20	29.06
Sample #4 (100% rural)	12.15	31.39	28.13	28.33

Appendices to Chapter 9

Appendix 9.1: Details of the five stylised career paths used for salary costing

The figures in the table reflect the salaries earned by nurses. Costs to the government are 25% higher (accounting for fringe benefits)

T1: PN with linear career, no management posts			T2 : PN with linear career, some late management posts			T3: PN with successive management posts			T4: PN (4 years) then specialises			T5: PN (8 years) then specialises		
Salary	Grade	Salary notch	Salary	Grade	Salary notch	Salary	Grade	Salary notch	Salary	Grade	Salary notch	Salary	Grade	Salary notch
117,225	PN-A2	1	117,225	PN-A2	1	117,225	PN-A2	1	117,225	PN-A2	1	117,225	PN-A2	1
117,225		1	117,225		1	117,225		1	117,225		1	117,225		1
120,741		2	120,741		2	120,741		2	120,741		2	120,741		2
120,741		2	120,741		2	120,741		2	120,741		2	120,741		2
124,365		3	124,365		3	124,365		3	120,741		2	124,365		3
124,365		3	124,365		3	124,365		3	177,318	PN-B1	1	124,365		3
128,094		4	128,094		4	128,094		4	177,318	Specialist Nurse	1	128,094		4
128,094		4	128,094		4	128,094		4	182,640		2	128,094		4
131,937		5	131,937		5	131,937		5	182,640		2	177,318	PN-B1	1
144,174	PN-A3	1	144,174	PN-A3	1	205,563	PN - A5 (clinical programme coordinator grade1)	1	188,121		3	177,318	Specialist Nurse	1
144,174		1	144,174		1	205,563		1	188,121		3	182,640		2
144,174		1	144,174		1	211,728		2	193,761		4	182,640		2
148,500		2	148,500		2	211,728		2	193,761		4	188,121		3
148,500		2	148,500		2	218,082		3	199,575		5	188,121		3
152,955		3	152,955		3	218,082		3	218,082	PN-B2	1	193,761		4
152,955		3	152,955		3	224,625		4	218,082	Specialist Nurse	1	193,761		4
157,542		4	157,542		4	224,625		4	218,082		1	199,575		5
157,542		4	157,542		4	231,363		5	224,625		2	218,082	PN-B2	1
162,270		5	162,270		5	231,363		5	224,625		2	218,082	Specialist Nurse	1
177,318	PN-A4	1	177,318	PN-A4	1	238,305	PN - A6	1	231,363		3	218,082		1
177,318		1	177,318		1	238,305	clinical programme coordinator grade2	1	231,363		3	224,625		2
177,318		1	177,318		1	245,457		2	238,305		4	224,625		2

182,640	2
182,640	2
188,121	3
188,121	3
193,761	4
193,761	4
199,575	5
199,575	5
199,575	5
205,563	6
205,563	6
205,563	6
211,728	7
211,728	7
211,728	7
218,082	8
218,082	8
218,082	8
224,625	9
224,625	9
224,625	9
224,625	9

182,640		2
182,640		2
188,121		3
188,121		3
193,761		4
193,761		4
199,575		5
199,575		5
205,563	PN - A5	1
	Operational manager nursing	
205,563		1
211,728		2
211,728		2
218,082		3
218,082		3
224,625		4
224,625		4
231,363		5
231,363		5
238,305	PN - A6	1
238,305		1
245,457		2
245,457		2

245,457		2
260,403	PN - A7	1
260,403	Assistant Manager Nursing	
268,218		2
268,218		2
276,261		3
284,550		4
284,550		4
395,932	PN - A8	1
	Deputy Manager Nursing	
395,832		1
407,706		2
407,706		2
419,937		3
419,937		3
432,534		5
432,534		5
445,509		5
445,509		5
445,509	PN - A9	1
458,877	Manager Nursing	
458,877		2
472,644		3

238,305		4
245,457		5
245,457		5
245,457		5
252,819		6
252,819		6
260,403	PN-B3 Operational	1
260,403	manager nursing	1
268,218		2
268,218		2
276,261		3
276,261		3
284,550		4
284,550	PN-B4 Assistant manager	1
293,086	nursing	2
293,086		2
301,878		3
301,878		3
310,935		4
310,935		4
320,262		5
320,262		5

231,363		3
231,363		3
238,305		4
238,305		4
260,403	PN-B3 Operational	1
260,403	manager nursing	1
268,218		2
268,218		2
276,261		3
276,261		3
284,550		4
284,550	PN-B4 Assitant manager	1
293,086	nursing	2
293,086		2
301,878		3
301,878		3
310,935		4
310,935		4
310,935		4
320,262		5
320,262		5
320,262		5

Appendix 9.2: Price of standard accommodations in South Africa

	Bachelor	1-bed	2-bed
Johannesburg	2,757	3,164	3,819
Germinston	1,216	1,859	2,067
Pretoria	1,945	2,292	2,801
Nelspruit	2,045	2,561	3,193
Durban	1,901	2,578	3,297
Cape Town	2,189	2,661	3,319
Port Elisabeth	1,849	2,108	2,535
East London	1,727	2,165	2,710
Bloemfontein	1,215	1,738	2,100
AVERAGE	1,872	2,347	2,871
Standard Deviation	474.8	442.7	588.3

Source: Rode Report, 2008, 3rd quarter

Appendix 9.3: Costing education policies

Specialties are offered as 1-year post diploma courses. Nurses can follow different types of post-graduate training courses. Based on a sample of four nursing training colleges, the four most demanded specialties were:

- Primary Health care (135 students)
- Critical Care (81)
- Advanced Midwifery (71)
- Theatre techniques (52)

The other courses had numbers in the 30s and lower.

Most courses require a maximum tutor student ratio of about 1:18-20, while the PHC course requires a ratio of around 1:8-10. In consultation with one nursing college, it was estimated that the average salary for a lecturer would be R200k-R220k per annum.

For the cost estimation, a **unique tutor-student ratio of 18 was retained**, to reflect that the majority of courses will allow a higher number of students per tutor, but that the PHC specialty course might diminish the average ratio.

Budget of a nursing college:

Type of cost	Amount (R 1,000)	Proportion of salary costs
staff's salaries	22,600	100%
Goods and services	4,000	17.7%
Household items	100	0.4%
Maintenance	110	0.5%
Capital assets	1,100	4.9%
TOTAL	27,910	100%

From the budget detailed above, there are 23.5% of overhead costs on top of salary costs. Because this information was obtained from a relatively big training institution, it was assumed that the overheads could be slightly higher for smaller institutions where fixed costs couldn't be spread out so much. Therefore **a 25% overhead rate was assumed**.

The following are the student number across all Gauteng colleges for 2009, also across all years of study:

- 3241 college students of all years working to emerge as professional nurses (like the students in the cohort)
- 502 bridging students (enrolled nurses studying to become registered nurses)
- 732 training to be staff nurses (a mid-level category)
- 566 post-basic students attending specialist courses.

Therefore post-basic students who are specialising only represent a minority of all students in the training institutions (11.2%) in a province where one can assume that there is a high demand for specialist courses (due to the concentration of hospitals where specialist nurses will be mostly hired).

Appendix 9.4: Details of policy intervention costs

Scenario description \ Cost components	Car allowance	Housing allowance (flat)	Housing allowance (2-bed house)	Normal salary scale	Normal salary scale + 10%	Normal salary scale + 20%	Normal salary scale + 30%	Accelerated salary scale	Accelerated salary scale + 10%	Accelerated salary scale + 20%	Direct education costs	Standard career paths weights	Modified career paths weights
Base scenario		X		X							X	X	
SINGLE INCENTIVES													
Salary increases													
10% rural allowance		X			X						X	X	
20% rural allowance		X				X					X	X	
30% rural allowance		X					X				X	X	
Additional allowances													
Car allowance of R500/month	X	X		X							X	X	
Housing opportunities													
2-bedroom house			X	X							X	X	
Better training opportunities													
Study leave in 2 years		X									X		X
Better career path													
Promoted after 1 year in post		X						X			X	X	
MULTIPLE-INCENTIVE PACKAGES													
Financial packages													
10% salary increase + car allowance	X	X			X						X	X	
20% salary increase + car allowance	X	X									X	X	
30% salary increase + car allowance	X	X									X	X	
"Status" packages													
Better housing + car	X		X		X						X	X	
Better housing + car + 10% increase	X		X			X					X	X	
Better housing + car + 20% increase	X		X								X	X	
Career-related packages													
Quick promotion + car	X	X						X			X	X	
Quick promotion + 10% increase		X							X		X	X	
Quick promotion + 20% increase		X								X	X	X	
Quick promotion + 10% increase + car	X	X							X		X	X	
'Education' packages													
Study leave soon + car	X	X									X		X
Study leave soon + 10% increase		X			X						X		X
Study leave soon + 20% increase		X				X					X		X
Study leave soon + 10% increase + car	X	X			X						X		X

Appendix 9.5: Structure of costs by strategies (calculated over 40 cohorts)

	Salary	Car	Education direct cost	Housing cost
Base scenario	94.92%	0.00%	1.76%	3.32%
10% rural allowance	95.25%	0.00%	1.71%	3.04%
20% rural allowance	95.50%	0.00%	1.70%	2.80%
30% rural allowance	95.73%	0.00%	1.67%	2.60%
2-bedroom house	92.66%	0.00%	1.71%	5.63%
Car allowance	92.61%	2.40%	1.70%	3.29%
Promoted faster	95.02%	0.00%	1.74%	3.24%
Study leave soon	94.20%	0.00%	2.46%	3.34%
Quick promotion + car	92.77%	2.34%	1.68%	3.21%
Quick promotion + 10% salary increase	95.33%	0.00%	1.71%	2.96%
Quick promotion + 20% salary increase	95.59%	0.00%	1.69%	2.73%
10% salary increase + car allowance	93.13%	2.19%	1.68%	3.00%
20% salary increase + car allowance	93.53%	2.01%	1.69%	2.76%
Better housing + car	90.39%	2.35%	1.68%	5.58%
Better housing + car + 10% increase	91.10%	2.14%	1.68%	5.08%
Better housing + car + 20% increase	91.71%	1.97%	1.65%	4.67%
Study leave soon + car	91.63%	2.37%	2.74%	3.25%
Study leave soon + 10% increase	94.22%	0.00%	2.81%	2.97%
Study leave soon + 20% increase	94.58%	0.00%	2.74%	2.68%
Study leave soon + 10% increase + car	92.22%	2.11%	2.79%	2.89%

Appendix 9.6: Expected costs and effects for various downstream policies simulated for different populations

Results for sample #4 (100% rural nurses, 0% urban nurses)

Policy/scenario	Average expected costs	Average expected effects
Base scenario	R 1,451,889,888	5,332.94
10% rural allowance	R 1,813,275,634	6,126.94
20% rural allowance	R 2,113,183,655	6,612.94
30% rural allowance	R 2,300,351,413	6,649.62
2-bedroom house	R 1,511,170,964	5,455.87
Car allowance	R 1,596,859,971	5,842.24
Promoted faster	R 1,510,171,091	5,438.84
Study leave soon	R 1,681,299,635	6,239.72
Quick promotion + car	R 1,650,622,059	5,909.38
Quick promotion + 10% salary increase	R 1,874,142,176	6,188.95
Quick promotion + 20% salary increase	R 2,191,404,942	6,699.24
10% salary increase + car allowance	R 2,028,808,291	6,806.63
20% salary increase + car allowance	R 2,368,916,795	7,340.39
Better housing + car	R 1,657,306,529	5,949.70
Better housing + car + 10% increase	R 2,107,257,637	6,940.99
Better housing + car + 20% increase	R 2,445,856,043	7,448.65
Study leave soon + car	R 1,900,818,536	6,909.05
Study leave soon + 10% increase	R 2,188,065,776	7,274.49
Study leave soon + 20% increase	R 2,569,827,033	7,796.28
Study leave soon + 10% increase + car	R 2,358,516,755	7,662.05

Results for sample #3 (75% rural nurses, 25% urban nurses)

Policy/scenario	Average expected costs	Average expected effects
Base scenario	R 1,397,143,981	5,070.82
10% rural allowance	R 1,734,189,174	5,788.63
20% rural allowance	R 2,012,853,277	6,220.52
30% rural allowance	R 2,227,833,779	6,372.81
2-bedroom house	R 1,457,169,692	5,204.43
Car allowance	R 1,532,303,415	5,541.73
Promoted faster	R 1,449,917,525	5,157.82
Study leave soon	R 1,578,298,037	5,787.96
Quick promotion + car	R 1,582,961,811	5,602.46
Quick promotion + 10% salary increase	R 1,795,256,755	5,858.91
Quick promotion + 20% salary increase	R 2,085,042,444	6,294.81
10% salary increase + car allowance	R 1,959,393,226	6,504.66
20% salary increase + car allowance	R 2,291,033,876	7,019.73
Better housing + car	R 1,604,410,180	5,706.42
Better housing + car + 10% increase	R 2,074,815,820	6,772.13
Better housing + car + 20% increase	R 2,412,852,694	7,272.41
Study leave soon + car	R 1,824,101,004	6,559.66
Study leave soon + 10% increase	R 2,128,032,590	6,991.78
Study leave soon + 20% increase	R 2,627,213,458	7,833.86
Study leave soon + 10% increase + car	R 2,326,004,899	7,457.55

Appendix 9.7: Incremental cost-effectiveness ratios (ICER) for cost-effective strategies with less rural nursing populations

Strategy	ID	Results from the Probabilistic sensitivity analysis	
		ICER for 1 cohort	ICER for 40 cohorts
Results for sample #1 (0% rural nurses, 100% urban nurses)			
No intervention with sample #1	B1	Less effective than current baseline	
Study leave soon	E1	Less effective than current baseline	
Study leave soon + car	E2	R 365,175	R 352,472
Study leave soon + 10% increase + car	E4	R 478,867	R 419,090
Study leave soon + 20% increase	E5	R 499,258	R 471,401
Results for sample #2 (25% rural nurses, 75% urban nurses)			
No intervention with sample #2	B2	Less effective than current baseline	
Study leave soon	E1	dominated	dominated
Study leave soon + car	E2	R 315,402	R 299,669
Study leave soon + 10% increase + car	E4	R 495,003	R 465,762
Study leave soon + 20% increase	E5	R 529,447	R 502,963

Appendix 9.8: Calculating the present value of an average nurse year

The cost of a nurse to the government is given by the sum of salaries paid to the nurse. As indicated in Chapter 9, the flow of salaries over the course of a career depends on the career path taken by a nurse. The same "stylized" career paths presented in figure 9.2 are used and a weighted average of the five paths is taken to make the calculation.

The average present cost of a nurse working in a rural area in public sector over n years of career is therefore:

$$C_0 = \prod_{k=0}^{5} \omega_k \sum_{t=0}^{n} \frac{(1+\rho)s_{kt}^{b}}{(1+r)^{t}}$$

Where s_{kt}^{b} is the baseline (b) salary for career path k

Simplified example of five streams of salaries over four years

Year	Career path #1	Career path #2	Career path #3	Career path #4	Career path #5
0	120	120	120	120	120
1	120	120	125	130	130
2	120	125	125	130	140
3	125	125	130	140	140

For example, if the first four years of salaries in five career paths were as in the table above, then the present cost of those four years would be:

$$C_0=\omega_1\left(\frac{120*1.3}{(1+r)^0}+\frac{120*1.3}{(1+r)^1}+\frac{120*1.3}{(1+r)^2}+\frac{125*1.3}{(1+r)^3}\right)+\omega_2\left(\frac{120*1.3}{(1+r)^0}+\frac{120*1.3}{(1+r)^1}+\frac{125*1.3}{(1+r)^2}+\frac{125*1.3}{(1+r)^3}\right)$$

$$+\omega_3\left(\frac{120*1.3}{(1+r)^0}+\frac{125*1.3}{(1+r)^1}+\frac{125*1.3}{(1+r)^2}+\frac{130*1.3}{(1+r)^3}\right)$$

$$\ldots+\omega_5\left(\frac{120*1.3}{(1+r)^0}+\frac{130*1.3}{(1+r)^1}+\frac{140*1.3}{(1+r)^2}+\frac{140*1.3}{(1+r)^3}\right)$$

With $\omega_1 = 0.10$; $\omega_2 = 0.30$; $\omega_3 = 0.05$; $\omega_4 = 0.25$; $\omega_5 = 0.30$.

To obtain the average cost of a nurse year, it is necessary to divide that cost estimate by the present value of the n years (NY_0), which is:

$$NY_0 = \sum_{t=0}^{n} \frac{1}{(1+r)^{t}}$$

The average present value of a nurse annuity is therefore obtained by the ratio C_0 / NY_0.

With the actual data presented in appendix 9.1 we find that the present value of a nurse annuity is R238,324.