Does wealth increase parental investment biases in child education? Evidence from two African populations on the cusp of the fertility transition[1]

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ABSTRACT
Why fertility declines is still a matter of intense debate. One theory proposes that fertility decline may be partly driven by shifts in parental investment strategies: couples reduce family sizes as demographic and economic changes cause investment in quality of children to become more important than investment in quantity of children. A key driver for this change is a shift from subsistence-based to skills-based economies, in which education enhances child quality. Evolutionary anthropologists have modified this theory to propose that parental investment will diverge during the demographic transition according to resource availability: couples with greatest access to resources will invest more in quality than quantity of children. Here we test the impact of resources on educational investment in two populations on the cusp of fertility decline: the patrilineal Arsi Oromo of Ethiopia and the matrilineal Chewa of Malawi. In both populations increased wealth is associated with greater biases in the allocation of education between children. In richer families, early born children are prioritized over later born, though early born sons are favored in the patrilineal population, early born daughters in the matrilineal population. Poorer families invest less in their children's education, but also discriminate less between children.

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INTRODUCTION

The dramatic decline in fertility associated with modernization and increasing availability of resources is still something of a conundrum (Bulatao & Casterline 2001, Caldwell et al. 2006). It seems to make little intuitive sense that as societies become healthier and wealthier individuals should restrict the number of children born to a far greater extent than those in less healthy and poorer societies. This is a particular problem for evolutionary anthropologists, for whom reproductive decisions should maximize reproductive fitness (number of surviving offspring, and grand offspring: Borgerhoff Mulder 1998). One influential theory which has been proposed to explain this fertility transition is a shift in parental investment strategies (proposed by economists, e.g. Becker 1991, and subsequently modified by evolutionary anthropologists, e.g. Kaplan 1996, Kaplan et al. 2002). As mortality declines, and as the economic costs and benefits of children change, investment in the quality of children provides a greater economic return than investment in the quantity of children. In high mortality, subsistence economies, producing many children is necessary in order to ensure that at least some survive. Children are also able to offset some of the costs of raising them by contributing subsistence and domestic labor (Kramer 2005, Lee and Kramer 2002). Mortality decline, reducing the need for 'insurance' births, tends to coincide with a shift to skills-based market economy where investment in the quality of children becomes important to ensure children are more competitive in the new environment (Kaplan 1996, Kaplan et al. 2002). Educational investment is critical in this new skills-based economy. This investment is costly, however, both intrinsically and because education takes children away from the household and reduces the ability of children to contribute to household labor. It has the potential to yield increasing payoffs to investment, but its costly nature requires parents to be more discriminative (Kaplan 1996, Kaplan et al. 2002). Couples therefore begin to limit births but invest more in each child. Such behavior may not maximize fitness at all, but is driven by evolved tendencies to allocate parental investment in ways which produce the most competitive offspring (Kaplan 1996, Mace 2007, but see Mace 1998, McNamara and Houston 2006 for theoretical evidence that such behavior might ultimately enhance fitness in the long term).

This model predicts that wealthier families will begin to shift towards a child quality, and away from a child quantity, strategy before poorer families (Kaplan 1996, Kaplan et al. 2002). Mortality will be lower in wealthier families, reducing the risks of concentrating investment in a small number of children, and such families will be able to bear the costs of educating children more easily than poorer families. Such families may also be able to 'add value' to their children's education, by being better able to capitalize on educational opportunities (for example, traveling to job opportunities which may result from education). Evidence suggests that wealthy families were indeed the leaders of the fertility transition (e.g. Clark & Cummins 2009, Woods 1984). To fit this model, biased allocation of parental investment should therefore be more evident among the richer sections of the community, with less parental discrimination among the less wealthy (Gibson and Lawson, submitted, Lawson and Mace, in press).

Here we test this model by investigating parental investment in child education in two societies on the cusp of fertility decline: rural Ethiopia and rural Malawi. In both cases, fertility is still high and mortality relatively high (though declining). Educational levels are also still relatively low in both populations, though increasing. Both populations are still largely subsistence economies, though integration into a market based economy is beginning. We test whether biased allocation of parental investment in education is seen in these populations, and how it is affected by resource availability: does wealth increase parental discrimination between offspring?

We test for biased parental investment by determining whether sibling configuration – the composite of number of siblings, their sex and birth order - affects the amount of education a child receives. Sibling configuration is more useful than overall number of siblings for exploring parental investment biases in such pre-transitional populations, because differences in wealth between groups may be confounded with family size (Gibson and Lawson, submitted). Here we are measuring the outcome of investment – amount of education received – rather than parental investment itself, but this is a common strategy in this literature given that investment itself is hard to measure. Previous research has found that aspects of sibling configuration are frequently associated with differential parental investment, as measured by child outcomes. For example, among Western populations there is a negative relationship between a child's order of birth and height (Lawson and Mace 2008), education and IQ (Bjerkedal et al. 2007, Boomsma et al. 2008, Steelman et al. 2002), income generation (Black, Devereux, and Salvanes 2005) and survival (Modin 2002). Social scientists make the general assumption that more siblings simply dilute a child's allocation of parental resources: the "resource dilution effect" (Blake 1989). Evolutionary explanations provide a more nuanced interpretation suggesting that firstborns receive more investment because they have higher reproductive value: within a family, older, compared to younger, children are more likely to survive to adulthood having already survived the most risky period of early infancy. They are also closer in age to starting reproduction, thereby shortening generation time. Jeon (2008) provides a mathematical model of parents allocate resources among multiple dependent children, which supports the hypothesis that older children will usually be favored over younger; though it is worth noting that this model concerns the allocation of parental resources at a given point in time, rather than the sequential decisions likely to characterize parental investment in education for different aged children.

However results are not always consistent with the resource dilution model, most notably among non-Western populations where higher birth order is associated with improvements in child well-being e.g. intrauterine growth (Ghosh and Bandyopadhyay 2006) early child survival (Magadi, Madise, and Diamond 2001) and fertility (Draper and Hames 2000). A number of alternative explanatory models have explored the possibility that investment in children may not simply decline with increasing birth order. Some emphasize the cooperative breeding strategy of our species, and the potential for older children to contribute to investment in their younger siblings through labor-force participation or helping with childcare or extended networks of kin (e.g. Caldwell 1976, Sear et al. 2002; Eloundou-Enyegue & Williams 2006), while others underline the importance of increasing parental experience in determining child well-being (Hertwig, Davis, and Sulloway 2002). The "terminal investment hypothesis" emphasizes the increasing value of each offspring relative to its parent's residual reproductive value with increasing parental age (Clutton-Brock 1984). It predicts that parents coming to the end of their own reproductive lives should increase investment in later born offspring, because they represent the last opportunity to invest in direct offspring. Incorporating both terminal investment and resource dilution effects, some models predict a non-linear relationship between birth order and parental investment outcomes. First and last born offspring benefit from periods of exclusive parental investment, with middle-born offspring being at a disadvantage (Faurie et al. 2009, Hertwig, Davis, and Sulloway 2002, Salmon and Daly 1998, Sulloway 1998).

Parents may also bias investment by sex of child, reflecting the relative costs and benefits of each sex. Some evidence indicates that sons, as the more expensive sex to rear, reduce investment in all later born offspring measured by reductions in birth weight (Nielsen et al. 2008), adult height (Rickard 2008) and reproductive success (Rickard, Russell, and Lummaa 2007, Sear, Mace, and McGregor 2003). Sons may receive more investment from parents because they can benefit more, in terms of reproductive success, from parental resources than daughters can. This may explain why the majority of human societies which hold inelastic heritable resources (e.g. limited land and cattle) practice patriliny, or male-biased wealth inheritance. Competition between brothers is particularly evident in such societies, where males with many brothers have been found to have higher risks of dying in childhood (Voland and Dunbar 1995), as well as lower education levels, less inheritance, fewer marriage opportunities (Beise and Voland 2008, Borgerhoff Mulder 1998) and lower reproductive success (Low 1991, Mace 1996).

Parental biases in investment between daughters, in general, appear to be less pronounced. A few studies have provided evidence for same-sex competition between sisters, for example, older sisters are associated with poorer growth among females in Ethiopia (Clegg and Pawson 1978) and lower educational attainment in the US (Butcher and Case 1994). But in many pre-transitional populations, older sisters may actually offset costs of large families by helping with childcare (Quinlan and Flinn 2005, Sear et al. 2002) and, in bridewealth societies, by improving their brothers' marriage opportunities (Borgerhoff Mulder 1998). However, few studies have been undertaken under conditions of matriliny. Societies are matrilineal where daughters benefit more from inherited resources than sons, and in such societies girls are likely to be in greater competition with elder sisters for resources, including inherited wealth (e.g. Holden, Sear, and Mace 2003, Sear 2008).

Here, we test for effects of sex, birth order and sibling configuration in two culturally distinct populations, a patrilineal agro-pastoralist society in Ethiopia and matrilineal horticulturalists in Malawi. We test the following in each population:
a) Does sibling configuration (number of elder or younger, same-sex or opposite sex siblings) influence education outcomes?
b) Does investment vary according to household resource availability?

We predict that the influence of sibling configuration may differ in the two populations (specifically, sons are more likely to be favored in the patrilineal population, daughters in the matrilineal), but that the influence of household resource availability on parental discrimination between children will be the same in both populations.

STUDY SITES

Ethiopia

The Arsi Oromo are agropastoralists, combining cattle rearing with maize, wheat, sorghum and teff farming in the low-lying areas of Arsi region, in Southern Ethiopia. Once described as the "bread basket of Ethiopia" in recent years the region has experienced irregular rainfall and poor agricultural productivity. High population growth and a shortage of land have resulted in increasing competition for resources both within and between households (Gibson 2008, Gibson and Mace 2006). Fertility and mortality are still high in this population; while childhood and adult undernutrition are prevalent (see Table 1). Inheritance patterns are patrilineal and post-marital residence is predominantly patrilocal. There is a strong cultural preference expressed for sons and for other members of the patrilineage. Polygyny is present in just under 30% of households. Herd size is considered to be the best measure of wealth in this population. Demographic, socio-economic, and education data used in this study were collected from 240 households during a household survey undertaken by MG in 2003-4 in 4 villages.

Malawi
The Chewa are largely horticulturalists, growing maize, though a small proportion are also involved in income-generating activities such as wage labor or trade (91% of this sample consider their main subsistence activity to be farming; about 30% in total engage in other activities). They occupy the Central and Southern regions of Malawi, and are similarly experiencing high population growth and a shortage of land. Fertility and mortality are also still high in this population, though slightly lower than in Ethiopia (Table 1). Inheritance patterns are predominantly matrilineal and post-marital residence matrilocal, though there is some evidence that inheritance patterns may be changing towards a relatively flexible strategy. Land ownership mainly resides with women, and passes from mother to daughter, but in a small fraction of households in the dataset used here (20%) men owned this household resource (Sear 2008). These households tended to be wealthier than those in which women owned land. Wealth is measured using a combination of garden size and whether the household is involved in any income generating activities. Almost all marriages are monogamous. Data used here were collected during a household survey undertaken by RS in 1997 in 2 villages in the Southern region.

METHODS
Table 1 shows descriptive statistics for education and background socio-demographic characteristics for the study populations. The outcome variable measuring level of education varied between models. In the Ethiopian sample, overall levels of education were low, only 34% had received any education and less than 15% of school-aged children had spent more than a year in school, as such the outcome variable became a simple dichotomous variable indicating any level of education (0=no education, 1=any education). Only children of school age (7-17 years old) were included in the analyses to control for secular changes in education (n=400). In polygynous households, only the first wife's offspring were included, to control for known effects of lower investment in junior wives offspring (Gibson and Mace, 2007). In the Malawian sample, 73% of children were in education, so the dependent variable measured was the total number of years in education (at the survey date). This sample included 1792 Chewa children from 702 households; here school age is defined as 6-19 years of age. Logistic regression was used to determine the effects of siblings on educational attainment in Ethiopia; linear regression was used for the Malawian analyses described below.

To test for sib effects in educational investment within households, we first determined the relationship between overall birth order and educational attainment for each population, controlling for family size (total number of siblings). Model 1 analyses the relationship between education and a quadratic function of birth order, in order to pick up any non-linear effects of birth order. For each population, we first ran this model on all children, including co-variates for sex and wealth. Then, to explore the effects of sex and wealth on the relationship between birth order and education, we divided the sample by sex and wealth and ran the model separately for boys and girls, and for rich and poor households. In both cases, 'poor' households include approximately the bottom half of the wealth distribution, 'rich' household approximately the top half (in Ethiopia 'poor' equates to households with less than 3 cattle, 'rich' as those with greater than or equal to 4 cattle; in Malawi 'poor' indicates households with 2 or fewer hectares of land, 'rich' as those with more than 2 hectares, or involved in income-generating activities). All models control for child's age and age squared, mother's age and family size.

Overall birth order may be confounded by the sex of siblings, however. So we then investigated the effects of sibling configuration on educational investment. In Model 2 we tested the effects of number of older brothers, number of younger brothers, number of older sisters and number of younger sisters on our education outcomes. Again, we first ran the model on all children, including variables for sex and wealth, then divided the sample by sex and wealth and ran the model separately for girls and boys and rich and poor households. All models control for child's age (as a quadratic function) and mother's age.

RESULTS

Ethiopia

The results of the logistic regression analysis on the probability of school attendance shown in Table 2 suggests that female children were disadvantaged, with girls being significantly less likely to receive education for their age than boys. For all children there is a linear reduction in the likelihood of receiving education with increasing birth order, which is more evident among male offspring. These birth order effects appear to be driven by discriminative parental investment in the richest households, since birth order effects are absent in poor households. Model 2 (presented in Table 3, and illustrated in Figure 1) identifies more specifically that earlier born sons are prioritized in educational investment at the expense of later born sons in rich households. Number of elder brothers is negatively associated with the probability of a male child receiving education. This pattern of unequal investment among male siblings is not found between female siblings. There is some suggestion that younger brothers may be beneficial, since in rich households younger brothers have a positive impact on educational attainment, particularly for girls.

Malawi

The results of the linear regression analysis on the total number of years of education shown in Table 2 suggests that again female children were disadvantaged, with girls having significantly fewer years of education than boys. Birth order also affects the amount of education received, though here this relationship appears to be quadratic, suggesting an early- and a late-born advantage in education. As in Ethiopia, however, these effects appear to be driven by biased parental investment in rich households: they are seen for both sexes in rich households, but for neither sex in poor households. When included in the same model as birth order, family size has a positive relationship with education, perhaps capturing an unmeasured effect of wealth (when included in preliminary models without birth order, family size has the predicted negative effect on education: results not shown). This effect also seems to be driven by rich households. A similar trend for a positive effect of family size is observed in the Ethiopian dataset, but in this case only among females.

When investigating sibling configuration in more detail, birth order effects in Malawi seem to be largely driven by a biased investment in older daughters, in that having older sisters has a negative effect on the amount of education received (Tables 4). But again these effects are more substantial in richer households. In poor households, boys suffer from the presence of elder sisters, but no other kind of sibling has any affect on boys or girls. In rich households, elder siblings of either sex are favored over younger (illustrated in Figures 2a and 2b). As in Ethiopia, there appears to be a beneficial effect of younger brothers, this time for both sexes.

Finally, it is worth noting that there is overall a positive effect of wealth on education in both populations. For traditional forms of wealth this effect is either rather weak (for herd size in Ethiopia) or non-existent (for garden size in Malawi). In Malawi, however, a newer form of wealth appears to be more strongly associated with education: children in families which engage in income generating activities are substantially better educated than children in families without income generation.

DISCUSSION

Among two rural African populations we find clear evidence of biased parental investment in education according to child's birth order. In both populations, early born children are favored in terms of parental investment in education, at the expense of later born children. In line with Kaplan's model of the demographic transition (Kaplan 1996, Kaplan et al. 2002), where the shift from child quantity to child quality occurs first among the wealthy, we find biased allocation of education investment to be more evident in wealthier households. By investing heavily in a few elder offspring, wealthy parents seem to be attempting to provide them with a competitive advantage in the acquisition of both resources and mates. Poorer parents opt for a more opportunistic strategy of educational investment which does not discriminate between offspring. A similar 'bet hedging' strategy in terms of education has been observed in a poor South African community, where parents divide educational investment equally across all their offspring (Liddell, Barrett, and Henzi 2003). The authors argue that living under uncertain conditions with high environmental risks, parents cannot predict which child will be successful, so educate all equally. Under conditions of improved resource availability and reduced environmental risk parents may become more discriminative. This may also explain why a negative effect of family size on schooling has become more pronounced in recent decades in Cameroon (Eloundou-Enyegu and Williams 2006); and why, in a neighboring Ethiopian community, where a new development initiative has improved access to a clean water supply (and reduced extrinsic mortality risks), there has been an overall increase in investment in child education, but also greater inequality between siblings within the household (Gibson and Lawson submitted).

Among both Arsi Oromo and Chewa, investment tradeoffs in rich families are largely resolved in favor of early born offspring. Sex also matters, however. Among the patrilineal Arsi Oromo, parents express the strongest overall preference for educating sons, who also inherit lineage titles, land and cattle. Sibling competition is also greatest among brothers, with later born sons losing out to their elder brothers for educational opportunities. Incremental reductions in land size and bridewealth payments with son order are also found among the Arsi Oromo (Gibson, in prep). Daughters, who leave the patrilineage (and village) upon marriage represent a drain on the patrilineage, are less likely to receive any education and represent little competition for their siblings.

A different pattern emerges among the largely matrilocal/matrilineal Chewa, as daughters remain within the lineage at marriage and benefit from inheritable resources (Sear 2008). In this case, though daughters receive slightly less education than sons overall, elder daughters are prioritized for education. However, among the richest Chewa households, elder boys also gain privileged access to education. This mirrors the shift towards investment in sons in terms of inherited resources (land) in the wealthiest households, and is consistent with research in other populations suggesting accumulation in wealth results in a shift to patriliny (Holden and Mace 2003). These biases towards educating males may also occur because they are better able to capitalize on employment opportunities arising from an emerging skills-based economy in the towns and cities in both countries (particularly construction and tourism industries).

An overall early born advantage is something of a simplification for both societies. There is some evidence for a ‘middleborn disadvantage’, as there is a curvilinear relationship between birth order and education attainment in Malawi, which may result from terminal investment in later born offspring, though again this effect is only seen in wealthy households. The analysis of sibling configuration suggests this effect may be driven by a beneficial effect of younger brothers, since having younger brothers is correlated with increased educational attainment. In Ethiopia, there is a similar trend indicating a positive effect of younger brothers in wealthy households. The mechanisms which bring this about are not clear, though it could simply reflect an unmeasured effect of wealth, as wealthier families may experience lower mortality among sons and/or produce more energetically expensive sons than poorer families. In support of this argument, previous research in this Ethiopian population has shown that mothers in better body condition produce a higher proportion of sons (Gibson and Mace, 2003).

CONCLUSION

Here we tested the impact of resources on parental investment decisions, by measuring sibling configuration effects on education in two African populations. We find that wealthier parents have more educated offspring, but that greater wealth also results in greater educational inequalities between children within the same family. This suggests that the spread of education and integration into a market- and skills-based economy is beginning to change the cost and benefit calculations of parents. In line with Kaplan’s model of the demographic transition (Kaplan 1996, Kaplan et al. 2002) it appears to be the wealthier parents which are beginning to manipulate the educational attainment of their children most. There is also suggestive evidence from Malawi that parents who are most integrated into the new market economy are capitalizing most on educational opportunities for their children. These are both populations in which fertility is not yet being controlled substantially, and in both there remains a positive relationship between wealth and reproductive success typical of pre-transition societies (Gibson and Mace 2007, Holden, Sear, and Mace 2003). In the near future, these changing cost-benefit calculations of parents may lead to a reduction in family size, so parents can invest most intensively in a fewer children.

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Table 1: Description of the study populations

	ETHIOPIAN AGROPASTORALISTS (2003-2004)		MALAWIAN HORTICULTURALISTS (1997)	
Total fertility rate	7.86		5.89	
Under 5 mortality	23.2%		12%	
Residence/ Inheritance	Patrilocal/ Patrilineal		Matrilocal/ Matrilineal	
Sample	n	% educated	n	Years of education mean±SD
Overall	410	33.7%	1792	2.5±2.5 Range 0-14
Girls	201	33.5%	893	2.3±2.3
Boys	209	33.8%	899	2.7±2.6
Rich	257	35.8%	942	2.7±2.6
Poor	151	29.8%	850	2.3±2.3
Birth order:				
1	76	36.8%	426	2.8±2.5
2-4	177	40.7%	866	2.5±2.5
5-7	116	25%	391	2.2±2.2
8+	33	21.2%	109	2.5±2.7
Mean age (yrs)	11.34±3.3		12.11±3.9	

Table 2: Model 1: The effect of family size and birth order on measure of education

	All			Males			Females		
	n	Beta±SE	p	n	Beta±SE	p	n	Beta±SE	p
ETHIOPIA	400			196			204		
Sex (female)		-.741±.312	*						
Birth order		-.259±.132	*		-.382±.231	+		-.252±.169	
Birth order sq		.008±.027			-.006±.046			.014±.038	
Family size		.118±.111			.143±.187			.158±.143	
Wealth (herd size)		.093±.054	+		.232±.094	*		-.050±.094	
Rich (>4 cattle)	253			118			135		
Sex (female)		-.610±.386							
Birth order		-.386±.162	*		-.528±.286	*		-.376±.218	+
Family size		.187±.133			.115±.227			.332±.178	+
Poor (<=3 cattle)	147			78			69		
Sex (female)		-1.19±.596	*						
Birth order		.034±.259			.076±.035			-.036±.333	
Family size		-.045±.237			.226±.452			-.428±.351	
MALAWI	1777			891			886		
Sex (female)		-.205±.096	*						
Birth order		-.461±.078	**		-.534±.111	**		-.403±.109	**
Birth order sq		.028±.007	**		.033±.010	**		.024±.010	*
Family size		.091±.032	**		.094±.046	*		.091±.044	*
Wealth(garden size)		-.004±.029			.014±.042			-.025±.040	
Wealth (income)		1.281±.178	**		1.278±.244	**		1.290±.264	**
Rich	933			482			451		
Sex (female)		-.205±.135							
Birth order		-.742±.104	**		-.674±.142	**		-.883±.158	**
Birth order sq		.043±.009	**		.039±.012	**		.053±.014	**
Family size		.170±.044	**		.128±.060	*		.225±.065	**
							435		
Poor	844			409					
Sex (female)		-.193±.135							
Birth order		-.048±.121			-.286±.197			-.125±.147	
Birth order sq		-.002±.012			.016±.020			-.016±.015	
Family size		.019±.046			.043±.072			-.040±.059	

Notes: Controlling for age, age squared, sex and mother's age; +<0.1, *<0.05, **<0.01

Table 3: Model 2: Ethiopian education (ever educated) and sibling configuration by wealth group

ETHIOPIA	n	All Beta±SE	p	n	Males Beta±SE	p	n	Females Beta±SE	p
Sex (female)	400	-.716±.315	*	196			204		
Older brothers		-.326±.140	*		-.598±.238	*		-.160±.183	
Young brothers		.262±.146	+		.352±.229			.197±.203	
Older sisters		-.018±.137			-.074±.213			-.050±.189	
Young sisters		.030±.837			-.054±.250			.114±.184	
Rich (>4 cattle)	253			118			135		
Sex (female)		-.632±.395							
Older brothers		-.435±.188	*		-.827±.328	*		-.192±.232	
Young brothers		.460±.196	*		.466±.307			.523±.274	+
Older sisters		.004±.171			-.197±.273			.140±.236	
Young sisters		.090±.176			-.026±.314			.220±.220	
Poor(<=3 cattle)	147			78			69		
Sex (female)		-.989±.580	+						
Older brothers		-.155±.228			-.155±.313			-.307±.399	
Young brothers		.065±.259			.348±.445			-.477±.418	
Older sisters		.064±.260			.416±.334			-.633±.430	
Young sisters		-.060±.291			.121±.521			-.250±.399	

Notes: Logistic regression controlling for age, age squared, mother's age and wealth (herd size); $^{+}$<0.1, *<0.05.

Table 4: Model 2: Malawian education (years completed) and sibling configuration by wealth group

MALAWI	n	All Beta±SE	p	n	Males Beta±SE	p	n	Females Beta±SE	p
Sex (female)	1777	-.207±0.096	*	891			886		
Older brothers		-.051±.048			-.082±.074			-.014±.063	
Young brothers		.129±.0.49	**		.172±.072	*		.101±.066	
Older sisters		-.187±.045	**		-.248±.066	**		-.126±.063	*
Young sisters		.066±.049			.029±.070			.097±.068	
Rich (>2 ha, income)	933			482			451		
Sex (female)		-.258±.139	*						
Older brothers		-.112±.065	*		-.188±.097	*		-.060±.090	
Young brothers		.257±.069	**		.269±.094	**		.234±.102	*
Older sisters		-.231±.062	**		-.190±.089	*		-.268±.087	**
Young sisters		.055±.069			.035±.095			.091±.102	
Poor(<=2 ha)	844			409			435		
(Sex) female		-.199±.136							
Older brothers		.045±.074			.115±.115			-.001±.093	
Young brothers		-.016±.072			.151±.119			-.078±.087	
Older sisters		-.157±.070	*		-.377±.101	**		.058±.094	
Young sisters		.050±.072			.040±.109			.074±.093	

Notes: Linear regression controlling for age, age squared, mother's age and wealth (garden size and income-generating activities); $^{+}$<0.1, *<0.05, **<0.01

Figure legends

Figure 1: Percentage of Ethiopian male children receiving education by number of same sex elder siblings, data for rich and poor households

Figure 2a: Mean years of education for Malawian male children by number of same sex elder siblings, data for rich and poor households

Figure 2b: Mean years of education for Malawian female children by number of same sex elder siblings, data for rich and poor households

Figure 1: Percentage of Ethiopian male children receiving education by number of same sex elder siblings, data for rich and poor households

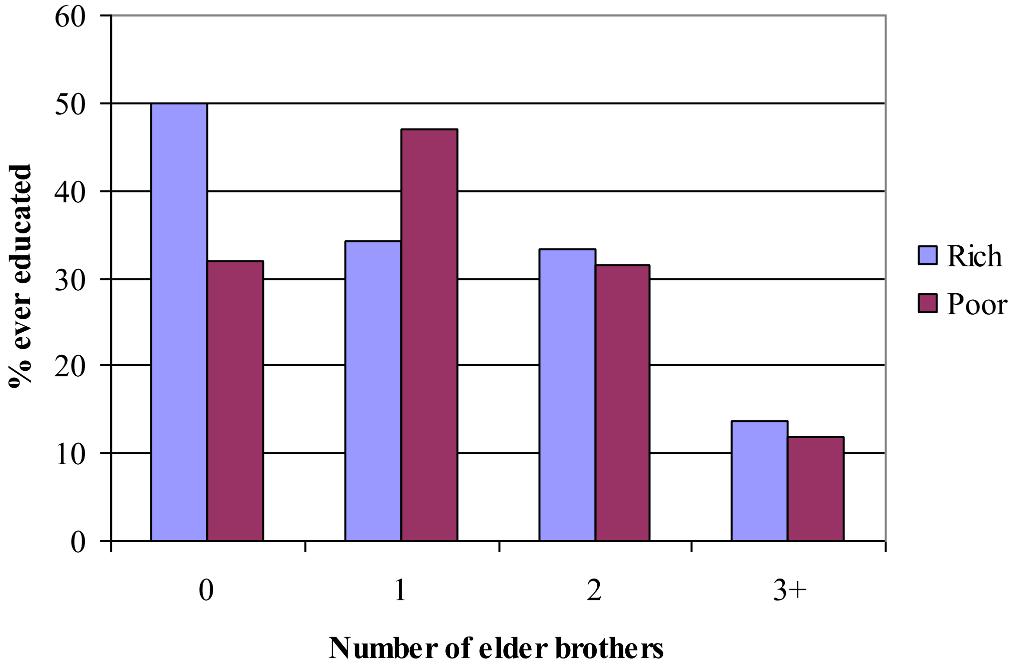

Figure 2a: Mean years of education for Malawian male children by number of same sex elder siblings, data for rich and poor households

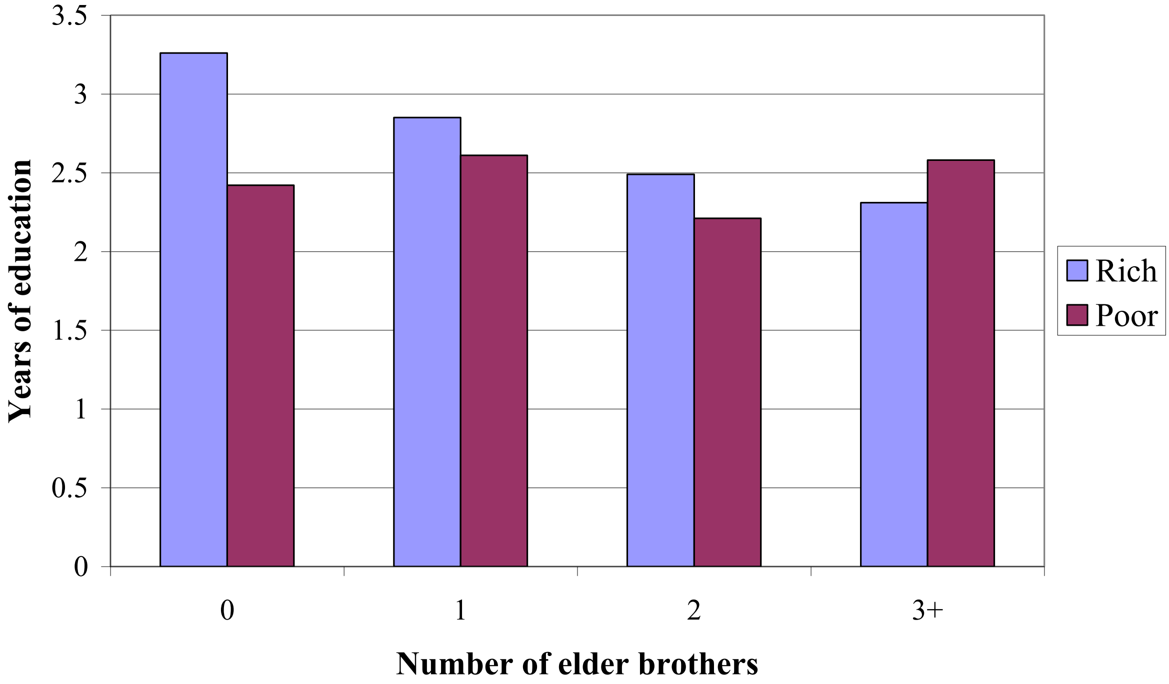

Figure 2b: Mean years of education for Malawian female children by number of same sex elder siblings, data for rich and poor households