HIV and State Failure: Is HIV A Security Risk?*

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ABSTRACT

There is a growing recognition that infectious diseases can easily spill across national borders and threaten global peace and stability. This has resulted in a change in focus from reduction in HIV/AIDS being an component of development to also being an important consideration for security. This paper explores the interlinkages between HIV and state failure by empirically testing for any direct impact of HIV on different indicators of state fragility. In general, we do not find any conclusive evidence of a direct impact of HIV on state fragility.

Key Words: HIV, Fragility, Vulnerability, Resilience.
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"..the HIV/AIDS pandemic, if unchecked, may pose a risk to stability and security"

— UN Security Council Resolution 1308 (2000).

1 Introduction

There is a growing recognition that infectious diseases can easily spill across national borders and threaten global peace and stability. This has resulted in a change in focus from health being an component of development to also being an important consideration for security (McInnes and Lee, 2006). It is perhaps not surprising that most of this renewed emphasis has been on the HIV/AIDS pandemic. In US, intelligence reports warned that HIV/AIDS "could trigger ethnic wars and genocide and undermine democratic governments" (BBC, May 1, 2000). This realisation led to a shift in US government policy on HIV/AIDS (Gow 2002). Voicing similar concerns the UN High Level Panel has identified infectious diseases and in particular HIV/AIDS as one of the significant global threats of the 21st Century. This view has in general been supported by several governments including the European Union. This paper explores the interlinkages between HIV/AIDS and state failure by empirically testing for any direct impact of HIV on several indicators of state failure.

Concerns with infectious diseases affecting state security are not new. However, the scale and the nature of HIV/AIDS makes it unrivalled to any other diseases in the past. Over the last two decades more than 20 million people have died of AIDS and today close to 40 million people live with HIV (UNAIDS/WHO 2006). The impact of this deadly disease has mostly been felt in Sub-Saharan Africa where society and government resources are being stretched thin in the wake of this pandemic. Some of the poorest countries are also the ones which are being affected most severely. For instance, Swaziland which has a HIV prevalence rate of 33% is one of the

poorest countries with a Human Poverty Index of 52.5%. Similarly Zambia with a HIV prevalence of 17% has 75% of its population below $1 a day. To understand the full impact of this disease, it is important to investigate whether resource constrained countries such as Swaziland or Zambia, would be able to overcome the burden of this disease?

The literature has mainly focussed on broad discussions of the causal pathways through which HIV/AIDS can manifest itself into a global security risk (Feldbaum et al 2006). First there are concerns that strategic human resources such as soldiers or peace keepers may be disproportionately affected by the disease and in some cases may be the vectors of the disease (Tripodi and Patel, 2004; Elbe 2002). This would reduce their effectiveness and thus would reduce the states ability to maintain law and order. The second growing concern is that states with high prevalence of HIV, will be unable to cope with the strains of the disease, and will eventually become a failed state. States with high levels of HIV, may loose their prime age labour force, thus resulting in a low productivity and a genuine shortage of human capital. These together in turn will erode government institutions through low resource accumulation and hamper their ability to implement policy and deliver public goods and services. The breakdown in the institutions will eventually make the state fragile. This worrying implication of HIV has in today's world given rise to strategic concerns with regards to the fight against terrorism. It has led the US State Department to use HIV prevalence as an indicator with which to characterize failed states (Fourie 2006).

Yet, in the absence of proper empirical foundations, both these causal pathways from HIV/AIDS to state failure has been questioned. Barnett and Prins (2006) in their report find no conclusive evidence to suggest that soldiers may be disproportionately affected by the disease. In a recent paper Young (2005) demonstrated that HIV will lead to a higher standard of living

for the future generations. The argument is that lower population will indeed increase overall labour productivity. Following this line of reasoning one would come to the conclusion that HIV prevalence in the long run would eventually make the countries economically stronger and the institutions viable thus contradicting the earlier hypothesis that high HIV prevalence will create failed states.

Peterson and Shellman (2006) is one of the very few papers to provide an empirical analysis of the impact of AIDS on state fragility. Based on the AIDS data for 1999-2000 and using a 3SLS estimation they find that while AIDS does not have any direct impact on state fragility, it does indirectly result in state failure through its impact on socioeconomic and political factors.[1] In this paper, we mainly test for the direct effect of HIV on state failure using cross-country regressions. To distill the effect of HIV prevalence rate on state failure we control for a broader set of variables that may effect state failure. To check for robustness, we examine the impact of HIV on state failure under different specifications. Further, given that state failure is itself a complex concept, and has multiple meanings, in our analysis we include several different measures (discussed later) to represent state failure. Similar to Peterson and Shellman (2006) we do not find any conclusive evidence of a direct impact of HIV on state failure.

The next section of the paper discusses the different measure of state failure used in this paper. Section 3 describes the data used in this paper and Section 4 provides the empirical analysis. The final section concludes the paper.

[1] It is, however, not clear from their paper whether the coefficients derived through 3SLS (or 2SLS) is significantly different from OLS estimates. In particular, the Durbin-Wu-Hausman specification test is not reported. If there is no significant difference between the OLS and 3SLS estimates, then OLS is to be prefered on the grounds of being more efficient estimators.

2 Concepts of State Failure

Before we start our empirical investigation it is important to define some of the concepts clearly, particularly those related to a country's instability. The central hypothesis that we want to investigate is whether high prevalence of HIV indeed makes states weak and more prone to instability. However, what is meant by state failure is unclear, given that by its very nature an ambiguous and difficult concept to capture. In the literature there are several interpretation of state failure and terms are used interchangeably. For instance, state failure has been interpreted as institutional failure; it has also been interpreted as inability of a country to cope with shocks, natural and economic; political instability is commonly as an indicator for state failure as is conflict.

In this paper, to overcome the definitional ambiguity, we use three different measures of state failure that captures different aspects of the concept, each with its different strengths and weakness. One of the first measures of state failure, that we term as fragility, is derived from two indicators: corruption and conflict. High levels of corruption in a country reflects serious issues of governance and also to quite an extent demonstrates institutional failures. Corruption reduces the effectiveness of government policy, can result in a distrust of the government and seriously weaken a government. The other indicator that we consider for our measure of fragility is the ratio of military expenditure to GDP. The intuition is that a higher proportion of military expenditure indicates greater level of conflicts that a country may be embroiled in Nadir (1999) has found that countries with higher military expenditure has higher levels of conflict thus lending empirical validity to the intuition. Let $C_i \in [0,1]$ be an measure of corruption in country i and $ME_i \in [0,1]$ be an index of military expenditure. Fragility, F_i, then by our definition is an equally weighted average of corruption and military

expenditure, i.e.,

$$F_i = 0.5C_i + 0.5ME_i. \tag{1}$$

An issue that may be raised with this measure is that although we have derived the corruption index from the ordinally scaled corruption perception index (CPI), we have interpreted the index as a cardinal scale. Therefore, what we are assuming is that if the corruption index is interpreted cardinally then doubling of the index would reflect twice the amount of corruption, whereas under an ordinal interpretation a doubling of the index may reflect more than twice or even less then twice the level of corruption. While this may be a valid criticism of the measure, given the hidden nature of corruption, whether this difference in interpretation significantly alters the fragility measure cannot be ascertained. In the literature, however, most empirical papers on corruption using the CPI do interpret it cardinally (see for instance Pellegrini and Gerlagh (2004)).

The next measure of state failure that we will employ, which mainly has an economic dimension, is the oft used economic vulnerability index (EVI) by Bruguglio and Galea (2003). The underlying intuition is that proness of a country to shocks (both economic and natural) depends on certain economic factors that includes a country's, (a)level of openness (with respect to trade), (b)dependence on limited number exports, (c)dependence on strategic imports and finally (d) whether the country is accessible or insular. So for instance if the country is extremely open to international trade (i.e. has a high trade to Gross Domestic Product (GDP) ratio) it will be more vulnerable to trade shocks. Similarly if it is dependent on exports of one or two commodities or imports of vital commodities, any small shocks in the trade flows of those commodities will make the country more vulnerable. In our context, the shocks to trade flows can arrive through a pandemic such as HIV which may effect production for those vital commodities. So for instance, if a country's exports are concentrated on a few agricultural goods

and if the migrant labour needed for the production of those goods are the ones who are most severely affected by the disease, then this may have a serious knock-on effect on exports and the balance of trade.

The EVI is a composite index, which aggregates over these four different dimension using the following indicators: (a) ratio of trade to GDP (TR_i), (b) concentration ratio of in trade of goods and services (CR_i), (c) ratio of imported to domestically produced energy (ER_i) and (d) the ratio of transport and freight costs to imports (FC_i). Therefore,

$$EVI_i = 0.25TR_i + 0.25CR_i + 0.25ER_i + 0.25ER_i. \tag{2}$$

The final measure of state failure that we use in this paper captures the coping abilities of countries when faced with shocks. The measure, developed by Bruguglio et al (2004), is intended to account for the inherent resilience that a country may have.. Similar to the EVI, the resilience index, $RI_i \in [0, 1]$, is a composite measure that includes (a) macro economic stability (MS_i) (b) microeconomic efficiency (ME_i), (c) governance (G_i) and (d) social development (SD_i). Hence,

$$RI_i = 0.25MS_i + 0.25ME_i + 0.25G_i + 0.25SD_i. \tag{3}$$

Each of these components are themselves a composite index of several other variables. The macroeconomic stability component includes, fiscal deficit, external debt along with inflation and unemployment; microeconomic efficiency takes in to account the size of the government and trade restrictions such as tariffs which may effect efficiency; governance captures judicial independence, rule of law including protection of property rights; social development includes life expectancy at birth and adult literacy rate. What the measure in essence captures is a country's ability to both resist and recover from shocks. Inability of a country to do just that can be thought

of as its failure and hence irresilience (IR), measured as $(1 - RI_i)$, can be an indicator of state failure (Ikpe (2007)). In this paper we are interested in irresilience because HIV/AIDS can effect the different dimensions that the measure captures. For instance, high levels of HIV/AIDS can lead to unemployment, may effect the size of the government and it will definitely reduce life expectancy.

3 Data

In this section we provide a broad discussion of some of the key variables of interest. For our analysis, we create a data set around each of the different indicators of state failure discussed above, resulting in three different data sets. We cover roughly between 80 to 100 countries in our depending on the measure of state failure. Specifically for fragility we cover around 100 countries, whereas for the other two measures we have around 86 countries. The Appendix shows the countries covered under the different measures.

Our HIV prevalence data covers 2003 and 2005 and is from UNAIDS/WHO. This is a much improved data compared to other data sets on HIV/AIDS (Ghys et al (2006)). Although, for both years range estimates are available for HIV prevalence, we have only considered the point estimates. Where the point estimates were not available we have considered the minimum value from the range estimates. For our purpose we have derived the HIV prevalence data for 2004 through a linear extrapolation from 2003 and 2005 data. Presuming there is no substantial volatility in the HIV data, the extrapolated estimates will a close approximation.

The data on corruption is the Transparency International (2003) Corruption Perception Index (CPI). It is a survey of international business persons on their perception of corruption in a country on a scale of 0 to 10 with 10 indicating lowest levels of corruption. This is the most widely available data on corruption and has been used in cross country studies. For

the purposes of the paper we constructed an index from this data such that the index varies between [0,1], with 0 representing lowest corruption. There are, however, serious limitations in using this data in a cardinal fashion.

The EVI and the RI is adapted from Bruguglio and Galea (2003) and Bruguglio et al (2004) . However, it is not really clear from both these papers about the exact sources and time period of their data. The data they use to construct their index is from 2002 to 2004. So the vulnerability index that we use for 2003 and 2004 may not be really aligned to those years.

Among our variables of interest, we also include two different measures of inequality. For income inequality, we took the reported Gini from the World Income Inequality Database (WIDER (2007)). We also consider the Ethno-Linguistic Fragmentation (ELF) index to represent socio-cultural inequalities. The index calculates the probability that any two person picked in random within a country, will come from different ethinic and liguistic background. The ELF data is from Okediji (2005) who uses the same measure as Taylor and Hudson (1972). We also use the Freedom House Index (2007) rankings of countries based on political rights and civil liberties as an indicator of democracy. Other variables of interest that we consider for our analysis, such as public health expenditure, per capita Gross National Income (GNI), military expenditure, inflation and Human Development Indexes (HDI) have been mainly extracted from the Human Development Reports (UNDP 2003, 2004) and the World Development Indicators (World Bank 2006). We describe each of the three data sets in detail in the following section.

4 Empirical Findings

4.1 Fragility

Our data sample is for the year 2003 and the variables that we consider reflects dimensions, apart from HIV prevalence rate, that may help explain fragility. We consider the ratio of public expenditure on health to GDP and the Human Development Index (HDI) in the analysis to capture broad social development trends. The per capita Gross National Income (GNI) indicates the level of economic development. The Freedom Index (FI) reflects the level of political and civil participation that people enjoy. In other words the index can be thought of as a measure of democracy. Typically, conflict, which by our definition is a part of fragility, is exacerbated through inequalities. We, therefore, include both the Gini coefficient and the ethnolinguistic fragmentation index (ELF) to capture both income inequality and sociocultural divisions. We also include dummy variables for Africa and Islam because both typically one would expect these countries to be both conflict and corruption prone and hence fragile. The data is summarised in the following Table

Insert Table 1

It is clear from Table 1 that there are large variations in the number of countries covered by the different variables. Out of the 101 countries, 23 are from Africa and 24 of the countries are Islamic.

To understand the broad relationship among the variables, we calculate the pairwise correlation between each of these variables shown below

Insert Table 2

As expected the correlation matrix shows that fragility is positively correlated with the two indicators of inequality (ELF and the Gini). African

countries and Islamic countries also are more prone to conflict. It is interesting to note that while HIV has a positive correlation with fragility, the correlation is not statistically significant. The factors that are negatively correlated with fragility in an increasing order are the HDI, freedom index, ratio of public expenditure on health and per capita income. When it comes to considering the correlation of HIV with other variables, the negative and significant effect of Africa is clear. Interestingly the other factors that are negatively correlated with HIV are the two inequality indicators.

Although the correlation matrix gives us an broad indication of the link between the different variables, it only shows the partial correlations, i.e., it does not tell us what the correlations are among two variables, in the presence of other variables. Therefore, to estimate the effect of HIV prevalence on fragility, F_i, we use the OLS regression

$$F_i = \alpha + \beta HIV_i + \gamma X_i + \delta Z_i + u_i \tag{4}$$

where X_i is a vector of variables present in all specifications of (4), Z_i represents the vector of variables accounted in some specifications of (4) but not all, and u_i is the error term. We compute seven different specifications of (4), and the results are presented in Table 3.

Insert Table 3

The significance of Islamic dummy in (1) indicates that Islamic countries may be quite fragile. This relationship, however, may actually be driven by other factors such as income, public health expenditure or inequalities. The rest of the specifications controls for different variables of interest.

Several broad trends seems to emerge from these different specifications. First, specifications (5), (6) and (7) highlights that income is negatively and significantly associated with fragility. In other words, countries with high

income are less fragile. Along similar lines Nafziger and Auvinen (2002) also found that higher income reduces conflict. More interestingly, in the presence of income, inequalities are not significantly correlated with fragility. Second, as specification (4) shows, social development (as measured by HDI), is also negatively and significantly correlated with fragility. As in the case of income, in the presence of HDI inequalities are not correlated with fragility. Third, (2) (3) and (4) indicates that higher freedom, which we take as an indicator of democracy, is associated with lower fragility. Political and civil liberties do reduce the chances of intra-state conflict but it also indicates that these liberties, perhaps through giving voices to the people, acts as a bulwark against corruption. Fourth, for most of the specifications HIV prevalence does not effect fragility, however, in the presence of HDI in specification (4), it is negatively associated with fragility. In other words as HIV increase, fragility decreases. One explanation for this may be that when HDI is controlled, an increase in HIV prevalence rate means that more funding needs to go towards health care and social development to maintain similar levels of HDI, which then is associated with lower fragility. We also find in specification (1) that HIV has a significant and positive impact on fragility, however comparison of the R^2 indicates that (1) may not as robust as (4).

4.2 Vulnerability

For the vulnerability index (EVI) we have data for 2003 and 2004 across 86 countries. This gives us an opportunity to construct a panel data to evaluate the effect of HIV prevalence on vulnerability. Since the EVI captures economic vulnerability we take in to consideration variables such as inflation which may effect trade balances and hence vulnerability. The other control variables that we consider are military expenditure, freedom index along with the per capita GNI and HDI. A summary of the data is given

in the following table

Insert Table 4.

The number of observation is different for each variable with EVI covering 86 countries over two periods and HIV prevalence covering 78 countries over the same period. The correlation matrix, which indicates the broad links among the variables of interest, is as follows

Insert Table 5.

Table 5 indicates that there is no significant correlation between EVI and the other variables of interest including HDI and Income per capita. As mentioned above, however, the pairwise correlations between variables may change when we control for other variables. Therefore, we run panel regressions, both fixed and random effect, of HIV on EVI. The fixed effect regression that we estimate is

$$EVI_{it} = \alpha_i + \beta X_{it} + u_{it}, \tag{5}$$

where α_i captures the state specific effects, EV_{it} is the poverty head count ratio for country i in year t, X_{it} is a vector of explanatory variables such as, inflation, military expenditure, per capita income and the human development index. u_{it} is the error term. Similarly the random effects regression is as follows

$$EVI_{it} = \alpha + \beta X_{it} + \varepsilon_i + u_{it}, \tag{6}$$

where $\varepsilon_i \backsim N(0, \sigma_\varepsilon^2)$ represents the country specific random effects.

The results for the random effects are presented in Table 6 below.

Insert Table 6

The HIV prevalence rate and inflation are included in all the five specifications while the rest of the variables are controlled in at least one of the specifications. Several interesting results emerge from the random effect regressions. First, as expected, inflation is positively and significantly correlated with fragility in all the specifications. Second, income per capita also plays a significant role but quite surprisingly it effects vulnerability positively, i.e. rich countries will be more vulnerable. While it is quite acceptable that higher inflation can make a country more economically vulnerable by distorting terms of trade and thereby effecting terms of trade flows, it can be quite surprising to observe that under specifications (4) and (5) higher GNI per capita will lead to increased EVI. However, the latter fact may not be so counter intuitive since some of the richer countries are more open in terms of their economy and recall that openness is a criteria in the EVI. So if a country has become richer through more trade, then a higher GNI per capita may well reflect a higher vulnerability. Third, HIV prevalence rates does not increase vulnerability which implies a lack of direct effect from HIV to economic vulnerability.

We also ran these five models under fixed effects, the results of which are presented in Table 7.

Insert Table 7

Similar to the random effects regression, we run five different specifications for the fixed effect regressions with HIV prevalence rate and inflation included in all the specifications. In none of the specifications HIV prevalence rate has a significant impact on economic vulnerability. However, this could be because there is very little variation in the HIV prevalence rate between the two years. The role of inflation is also less stronger compared to the random effects model in the sense that it is not significant under all the different specifications. Still it retains the positive sign, indicating that inflation worsens vulnerability. Income retains its positive correlation with

economic vulnerability, but the coefficient are much stronger. HDI also shows a positive and significant effect on vulnerability, i.e. higher HDI like income and inflation, worsens economic vulnerability.

To check between whether to consider fixed and random effects regression, for each of the five models, we ran both the Breusch-Pagan test and the Hausman tests. The Hausman test checks for the difference in coefficients between random effect and fixed effect models, where as the Breusch-Pagan test checks for the presence of random effects. For all the models, both the tests indicate that random effects is a more appropriate model. Thus, to summarise, HIV prevalence rate does not have any impact on economic vulnerability.

4.3 Irresilience Index

The last measure of state failure that we consider is the irresilience index for 86 countries which is the obverse of resilience. The sample consists of 12 African and 15 Islamic countries. The data, summarised below, is for the 2004 mainly because the resilience index is only available for that year.

Insert Table 8

The variables that we consider here are similar to those that we considered for fragility which includes economic and social development indicators, measures of inequality, a variable for democracy and HIV prevalence. We haven't been able to include, the public spending on health because of a lack of data for 2004. We also included two new variables: growth of HIV prevalence rate and tuberculosis (TB) rate. The growth of HIV prevalence is calculated as the average growth rate in HIV prevalence over the two years from 2003 to 2005. Including this helps one to distinguish whether it is the level of HIV prevalence rate or the growth of it that effects resilience. Note

that there are countries with negative growth rate and the mean growth is quite close to zero. In our earlier analysis of fragility we could not include this variable because there were no reliable data available for HIV prevalence rate before 2003. The other variable , TB rate which is only available for 2004, have been included because we thought that it would allow us to conduct some interesting comparative analysis with HIV on its impact on irresilience.

As before, we calculate the correlation matrix between the different variables of interest.

Insert Table 9

Irresilience is correlated, as expected with most of the variables of interest. Thus, measures of inequality, both ELF and the gini coefficient, it is positively correlated, i.e. as inequality increase, countries become less resilient. On other hand with more economic and social development countries become more resilient. Note that with HIV prevalence rate irresilience is positively correlated. When it comes to HIV growth rate, it indicates that with higher HIV growth, higher resilience, however, the correlation is not significant. It is also interesting to note that TB has a higher positive correlation with irresilience than HIV.

To estimate the effect of HIV prevalence rate on irresilience (IR) under different specifications we use the following regression

$$IR_i = \alpha + \beta HIV_i + \gamma X_i + \delta Z_i + u_i$$

where X_i are the variables in all the specifications (in our case its is the Islamic and Africa dummy) and Z_i is the vector of the variables of interest used as control variables under different specifications. The results from

the analysis is presented in Table 10

Insert Table 10

The first six specifications looks at the effect of HIV prevalence rate on irresilience controlling for different variables. Specification (7) investigates whether TB has any effect on irresilience.

Under all the six different specifications we find that HIV prevalence rate has no significant impact on resilience. There is, however, some evidence that HIV growth rate may have a negative effect on irresilience (specification (5)). What it implies, is that higher HIV growth may improve resilience, but the reason behind it is not immediately apparent. For countries having negative HIV growth, this implies a lower level of resilience. The results also indicate that both HDI and income per capita have an significant and negative impact on irresilience. When it comes to the inequality measures we find counter intuitive result in some cases. Consider specification (6), which has the highest R^2 of 0.81 and yet a higher ELF, which indicates higher sociocultural inequalities, will lead to greater resilience. This significant and negative association of ELF on irresilience is also evident in (7). Again, the reason behind such results are not clear. When it comes to income inequality, however, it has a positive and significant impact on irresilience (specification (3)), but not in the other specifications. Finally, unlike HIV prevalence rate, a higher TB rate would reduce resilience. But as Table 9 shows that TB and HIV rates are highly correlated, which then might imply that although HIV may not have a direct impact on resilience, it may effect resilience through other variables such as TB.

5 Conclusion

In this paper we attempted to under take a rigorous empirical study of the impact of HIV on state failure. We have considered three plausible measures of state failure and regressed them on HIV prevalence rate and a broad set of control variables. Overall, we do not find any conclusive evidence of a direct impact of HIV on state fragility. However, delving a little deeper in to the details we find that depending on the state failure measure the impact of HIV is different. For the economic vulnerability index and the irresilience index, HIV does not have any direct impact. On the other hand for the fragility index there is some evidence of HIV having a significant effect but the direction of the impact (whether positive or negative) remains inconclusive.

The analysis to quite an extent has been hampered by the lack of data particularly of the fragility indicators and the HIV prevalence rates. The indicators of state failure used in this paper also may not be satisfactorily capturing the notion of a failed state. What is a good measure of state failure is still an open question and how best to integrate the different dimensions of state failure to form a composite index remains unclear. The HIV prevalence rates which are available for only 2003 and 2005, does not have much variation, thus giving very little information on disease progression. This prevents a temporal understanding of the interlinkages between state failure and HIV. As better data over a longer horizon becomes available, a more robust analysis of the link from HIV to fragility can be performed.

References

Barnett, T. and G. Prins (2005). HIV/AIDS and Security: Fact Fiction and Evidence, A Report to UNAIDS, LSE.

Bruguglio, L. and W. Galea (2003). Updating and Augmenting the Economic Vulnerability Index. Occasional paper, University of Malta.

Bruguglio, L., G. Cordina, S. Bugeja and N. Farrugia (2004). Conceptualizing and Measuring Economic Resilience, Mimeo, University of Malta.

Elbe, S. (2002). HIV/AIDS and the Changing Landscape of War in Africa, *International Security*, 27, 159-177.

Freedom House (2007). Freedom in the World Country Ratings. Available at
http://www.freedomhouse.org/uploads/fiw/FIWAllScores.xls

Fourie, P. (2006). The Relationship between the AIDS Pandemic and State Fragility, Mimeo, University of Johannesburg.

Feldbaum, H., K. Lee and P. Patel. (2006) The National Security Implications of HIV/AIDS. *PLoS Med* 3(6).

Ghys, P. D., N. Walker and G. P. Garnett (2006). Improving Analysis of the Size and Dynamics of AIDS Epidemic, *Sexually Transmitted Infections*, 82.

Gow, J. (2002). The HIV/AIDS Epidemic in Africa: Implications for US Policy, *Health Affairs*, 21, 57-69.

Ikpe, E. (2007). Challenging the Discourse on Fragile States, *Conflict Security & Development*, 7, 85-124.

McInnes and Lee (2006) Health, Security and Foreign Policy, *Review of International Studies*, 32, 5-23.

Nadir, A.L. Mohammed (1999). Civil Wars and Military Expenditure: A Note. World Bank

Nafziger, E.W., J. Auvinen (2002). Economic Development, Inequality, War and State Violence, *World Development*, 30, 153-163.

Okediji, T. (2005). The Dynamics of Ethnic Fragmentation, *American Journal of Economics and Sociology*, 64, 637-662.

Pelligrini, L. , R. Gerlagh (2004). Corruption's Effects on Growth and Its Transmission Channels, *KYKLOS*, 57, 429-456.

Peterson, S. and S. M. Shellman (2006). AIDS and Violent Conflict: The Indirect Effects of Disease on National Security, Mimeo.

Tripodi, P. and P. Patel (2004). HIV/AIDS, Peace Keeping and Conflict Crises in Africa, *Medicine Conflict and Survival*, 20, 195-208.

UNAIDS/WHO (2006) AIDS Epidemic Update 2006. Available at www.unaids.org/en/HIV_data/epi2006

UNDP (2005) Human Development Report 2005. Available at http://hdr.undp.org/reports/global/2005

UNDP (2006) Human Development Report 2006. Available at http://hdr.undp.org/hdr2006

Taylor, C. L. and M. Hudson (1972). World Handbook of Political and Social Indicators, New Have: Yale University Press.

Transparency International (2003). Global Corruption Report 2003, Profile Books.

WIDER (2007). World Income Inequality Database. UNU-WIDER, Helsinki. Available at http://www.wider.unu.edu/wiid/wiid.htm

World Bank (2006). World Development Indicators 2006. Available at http://devdata.worldbank.org/wdi2006

Young, A. (2005). Gift of the Dying: The Tragedy of AIDS and the Welfare of Future African Generations. *Quarterly Journal of Economics*, 120, 423-466

Table 1. Descriptive statistics: fragility

Variables	Observation	Mean	Standard. deviation	Min	Max
Fragility	101	0.381	0.134	0.02	0.591
HIV	100	1.956	4.469	0.05	24
Islam Dummy	101	0.228	0.421	0	1
Africa Dummy	101	0.238	0.428	0	1
Public Health Expenditure to GDP	100	3.638	2.130	0.5	8.8
Ethno-Linguisitc Fragmentation (ELF)	50	36.640	29.567	1	89
Freedom index	100	0.670	0.290	0	1
HDI	100	0.732	0.175	0.298	0.963
GNI per capita	100	7916.500	11727.830	150	44230
Inequality	73	41.241	11.212	22.1	60.9

Table 2. Pair wise Correlation: Fragility

Variables	Fragility	HIV	Islam Dummy	Africa Dummy	Ratio of Public Health Expenditure to GDP	ELF	Freedom index	HDI	GNI per capita	Inequality
Fragility	1									
HIV	0.124	1								
Islam Dummy	0.404*	-0.111	1							
Africa Dummy	0.251*	0.587*	0.307*	1						
Ratio of Public Health Expenditure to GDP	-0.723*	-0.143	-0.419*	-0.323*	1					
ELF	0.486*	0.317*	0.397*	0.413*	-0.595*	1				
Freedom index	-0.693*	-0.058	-0.619*	-0.305*	0.673*	-0.481*	1			
HDI	-0.641*	-0.485*	-0.424*	-0.684*	0.690*	-0.619*	0.557*	1		
GNI per capita	-0.830*	-0.215*	-0.316*	-0.331*	0.778*	-0.475*	0.596*	0.687*	1	
Inequality	0.555*	0.290*	0.111	0.325*	-0.671*	0.297	-0.434*	-0.697*	-0.596*	1

Note: * indicates significance at 5%

Table 3. OLS estimates: Fragility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HIV	0.004* (0.002)	0.000 (0.003)	0.002 (0.001)	-0.003** (0.002)	0.002 (0.003)	0.001 (0.001)	-0.001 (0.002)
Islam Dummy	0.130* (0.022)	-0.009 (0.063)	-0.028 (0.040)	$1.36x10^{-5}$ (0.027)	0.088* (0.036)	0.016 (0.019)	0.049** (0.028)
Africa Dummy	0.015 (0.024)	-0.012 (0.032)	-0.030 (0.027)	-0.124* (0.039)	0.009 (0.035)	-0.021 (0.019)	-0.009 (0.037)
Ratio of Public Health Expenditure to GDP		-0.024* (0.007)	-0.013** (0.007)	-0.010 (0.007)	-0.006 (0.011)	-0.002 (0.005)	0.000 (0.006)
ELF		$3.65x10^{-5}$ ($0.005x10^{-1}$)			$9.36x10^{-5}$ (0.001)		
Freedom index		-0.304* (0.118)	-0.237* (0.065)			-0.136* (0.039)	
HDI				-0.886* (0.171)			
GNI per capita ($x10^{-6}$)					-7.13* (1.90)	-7.19* (1.00)	-7.66* (1.12)
Inequality			0.003* (0.001)	0.000 (0.001)			0.002 (0.001)
Constant	0.338* (0.018)	0.668* (0.095)	0.460* (0.089)	1.101* (0.174)	0.429* (0.039)	0.531* (0.026)	0.354* (0.070)
Number of Observation	100	50	71	71	50	98	71
R^2	0.197	0.709	0.594	0.639	0.743	0.762	0.712
F test	13.39*	24.11*	14.86*	21.62*	25.90*	31.95*	32.49*

Notes: The values in the parenthesis are the robust standard errors. * indicates significance at 5% and ** indicates significance at 10%.

Table 4. Descriptive statistics: Vulnerability

	Observations	Mean	Standard Deviation	Min	Max
Vulnerability	172	0.364	0.217	0	1
HIV	157	1.069	2.478	0.06	18.705
Ratio of Military Expenditure to GDP	158	2.037	1.652	0	8.98
Inflation	170	5.783	7.052	-6.35	51.46
Freedom index	170	0.762	0.262	0.08	1
HDI	172	0.795	0.145	0.42	0.965
GNI per capita	169	11724.670	13669.880	220	58050

Table 5. Partial correlation between variables: Vulnerability

	Vulnerability	HIV	Ratio of Military Expenditure to GDP	Inflation	Freedom index	HDI	GNI per capita
Vulnerability	1						
HIV	0.027	1					
Ratio of Military Expenditure to GDP	0.104	-0.076	1				
Inflation	0.100	0.036	-0.031	1			
Freedom index	-0.103	-0.142	-0.363*	-0.232*	1		
HDI	-0.124	-0.429*	0.016	-0.215*	0.672*	1	
GNI per capita	-0.110	-0.222*	-0.057	-0.357*	0.548*	0.716*	1

Note: * indicates significance at 5%

Table 6. Random effects estimates: Vulnerability

	(1)	(2)	(3)	(4)	(5)
HIV	$-2.3x10^{-5}$ (0.008)	$-0.002x10^{-1}$ (0.008)	-0.002 (0.009)	0.004 (0.009)	0.003 (0.008)
Ratio of Military Expenditure to GDP	0.017 (0.015)	0.016 (0.015)	0.016 (0.016)		0.010 (0.016)
Inflation	0.007* (0.002)	0.007* (0.002)	0.007* (0.002)	0.009* (0.002)	0.008* (0.002)
Freedom index		-0.011 (0.087)	0.037 (0.151)	-0.115 (0.112)	-0.129 (0.117)
HDI			-0.103 (0.292)		
GNI per capita ($x10^{-6}$)				4.13* (1.77)	4.92* (1.77)
Constant	0.276* (0.042)	0.286* (0.082)	0.333* (0.162)	0.347* (0.074)	0.314* (0.092)
Number of Observation	144	144	144	154	143
No. of groups	74	74	74	79	74
R^2 (within)	0.060	0.059	0.057	0.232	0.217
Wald test	10.94*	10.91*	11.63*	27.90*	26.13*
P value of Hausman test	0.022	0.042	0.000	0.152	0.111
P value Breusch Pagan	0.000	0.000	0.000	0.000	0.000

Notes: The values in the parenthesis are the robust standard errors. * indicates significance at 5%.

Table 7. Fixed effects estimates: Vulnerability

	(1)	(2)	(3)	(4)	(5)
HIV	0.045 (0.078)	0.037 (0.074)	0.055 (0.069)	0.039 (0.096)	0.015 (0.058)
Ratio of Military Expenditure to GDP	-0.192 (0.069)	-0.174* (0.066)	-0.127* (0.056)		-0.148* (0.060)
Inflation	0.006 (0.002)	0.005* (0.002)	0.003 (0.002)	0.008* (0.002)	0.006* (0.002)
Freedom index		0.565** (0.322)	0.148 (0.279)	0.421 (0.276)	0.475 (0.296)
HDI			5.587* (1.634)		
GNI per capita ($x10^{-6}$)				14.50* (1.40)	13.50* (1.41)
Constant	0.626 (0.152)	0.176 (0.294)	-4.041* (1.302)	-0.217 (0.230)	0.049 (0.268)
Number of Observation	144	144	144	154	143
No. of groups	74	74	74	79	74
R^2 (within)	0.160	0.195	0.381	0.366	0.431
F	6.19*	6.42*	7.59*	32.12*	29.37*

Notes: The values in the parenthesis are the robust standard errors. * indicates significance at 5% and ** indicates significance at 10%.

Table 8. Descriptive statistics: Irresilience

Variables	Observation	Mean	Standard Deviations	Min	Max
Irresilience	86	0.547	0.225	0	1
HIV	77	1.087	2.509	0.06	18.61
HIV growth	77	0.057	0.180	-0.475	0.929
Islam Dummy	86	0.174	0.382	0	1
Africa Dummy	86	0.140	0.349	0	1
ELF	53	32.434	28.363	1	89
TB	86	127.512	183.333	2	888
Freedom index	85	0.766	0.264	0.08	1
HDI	86	0.798	0.146	0.421	0.965
GNI per capita	84	12817.860	14887.110	250	58050
Inequality	65	40.147	11.584	22.1	60.9

Table 9. Pair wise correlation among the variables: Irresilience

	Irresilience	HIV	HIV growth	Islam Dummy	Africa Dummy	ELF	TB	Freedom index	HDI	GNI per capita	Inequality
Irresilience	1										
HIV	0.296*	1									
HIV growth	-0.021	-0.136	1								
Islam Dummy	0.347*	-0.004	0.111	1							
Africa Dummy	0.351*	0.529*	0.074	0.434*	1						
ELF	0.361*	0.453*	0.268	0.209	0.264	1					
Tuberculosis	0.597*	0.640*	-0.102	0.252*	0.582*	0.579*	1				
Freedom index	-0.621*	-0.159	-0.122	-0.546*	-0.344*	-0.412*	-0.400*	1			
HDI	-0.865*	-0.436*	0.034	-0.400*	-0.524*	-0.577*	-0.786*	0.667*	1		
GNI per capita	-0.731*	-0.222	-0.133	-0.241*	-0.243*	-0.413*	-0.431*	0.541*	0.715*	1	
Inequality	0.549*	0.332*	-0.119	0.134	0.258*	0.281	0.408*	-0.622*	-0.748*	-0.684*	1

Note: * indicates significance at 5%

Table 10. OLS estimates: Irresilience

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HIV	0.024 (0.018)	0.015 (0.010)	0.063 (0.051)	-0.007 (0.005)	-0.003 (0.008)	-0.026 (0.016)	
HIV growth	-0.034 (0.086)	-0.099 (0.085)	-0.158 (0.514)	$0.003x10^{-1}$ (0.039)	-0.167** (0.101)	0.042 (0.160)	
Islam Dummy	0.208* (0.073)	0.021 (0.081)	0.009 (0.145)	-0.036 (0.051)	-0.068 (0.084)	-0.037 (0.071)	-0.011 (0.091)
Africa Dummy	0.039 (0.096)	0.034 (0.077)	0.016 (0.116)	-0.128* (0.057)	0.173* (0.077)	-0.059 (0.060)	0.020 (0.081)
Freedom index		-0.501* (0.114)	-0.248 (0.343)			-0.026 (0.223)	-0.278 (0.234)
ELF			-0.001 (0.001)			-0.002* (0.0008)	-0.001* (0.0006)
HDI				-1.964* (0.277)		-1.946* (0.376)	
GNI per capita ($x10^{-6}$)					-7.85* (2.28)		-7.80* (2.44)
Inequality			0.008* (0.003)	-0.003 (0.002)	0.002 (0.002)		
Tuberculosis ($x10^{-1}$)							0.004* (0.002)
Constant	0.486* (0.030)	0.914* (0.108)	0.350 (0.428)	2.270* (0.315)	0.530* (0.119)	2.210* (0.196)	0.844* (0.179)
Number of Observation	77	77	40	60	60	47	52
R^2	0.220	0.461	0.536	0.737	0.561	0.818	0.704
F test	4.57*	18.42*	10.76*	28.77*	9.63*	42.74*	22.58*

Notes: The values in the parenthesis are the robust standard errors. * indicates significance at 5% and ** indicates significance at 10%.

Appendix

List of Countries: Fragility Data Set

Country	Country	Country	Country	Country
Algeria	Denmark	Ireland	Mozambique	Singapore
Angola	Dominican Republic	Italy	Myanmar	Slovak Republic
Argentina	Ecuador	Jamaica	Namibia	Slovenia
Armenia	Egypt	Japan	Netherlands	South Africa
Australia	El Salvador	Kazakhstan	New Zealand	Spain
Austria	Estonia	Kenya	Nicaragua	Sri Lanka
Azerbaijan	Finland	Kyrgyz Republic	Nigeria	Sudan
Bangladesh	France	Latvia	Norway	Sweden
Belarus	Gambia, The	Lebanon	Pakistan	Switzerland
Belgium	Georgia	Lithuania	Papua New Guinea	Tajikistan
Bolivia	Germany	Luxembourg	Paraguay	Tanzania
Botswana	Ghana	Macedonia	Peru	Thailand
Brazil	Greece	Madagascar	Philippines	Tunisia
Cameroon	Guatemala	Malawi	Poland	Uganda
Canada	Honduras	Malaysia	Portugal	Ukraine
Chile	Hungary	Mali	Romania	United States
China	Iceland	Mauritius	Russia	Uruguay
Colombia	India	Mexico	Senegal	Uzbekistan
Congo, Rep.	Indonesia	Moldova	Serbia and Montenegro	Venezuela, RB
Cote d'Ivoire	Iran	Morocco	Sierra Leone	Zambia

List of Countries: Vulnerability and Resilience Data Set

Country	Country	Country	Country	Country
Argentina	Czech Republic	Israel	New Zealand	South Africa
Australia	Denmark	Italy	Nicaragua	Spain
Austria	Dominican Repubic	Jamaica	Nigeria	Sri Lanka
Bangladesh	Egypt	Japan	Norway	Sweden
Barbados	El Salvadore	Jordan	Pakistan	Switzerland
Belgium	Estonia	Kenya	Panama	Thailand
Belize	Finland	Kuwait	Papua New Guinea	Trinidad and Tobago
Bolivia	France	Latvia	Paraguay	Tunisia
Brazil	Germany	Lithuania	Peru	Turkey
Cameroon	Greece	Luxembourg	Philippines	Uganda
Canada	Honduras	Madagascar	Poland	United Kingdom
Chile	Hong Kong	Malaysia	Portugal	United States
China	Hungary	Malta	Romania	Uruguay
Colombia	Iceland	Mauritius	Russian	Venezuela
Costa Rica	India	Mexico	Senegal	
Cote d'ivoire	Indonesia	Morocco	Singapore	
Croatia	Iran,	Nepal	Slovak Republic	
Cyprus	Ireland	Netherlands	Slovenia	