University of Cape Town

Submission of the mini dissertation (5023W) for the completion of the MCom in Economics:

A Cross-Country Analysis of the Determinants of Antiretroviral Drug Coverage

Prepared by **Peter M. Schwardmann** (SCHPET032)
Email address: pschwardmann@yahoo.com

Supervisor: **Prof. Nicoli Nattrass**

I know that plagiarism is wrong. I did not plagiarise.

Signed by candidate

Abstract

This paper employs regression analysis in an attempt to identify the factors that impact on the coverage of highly active antiretroviral treatment (HAART) and mother-to-child transmission prevention (MTCTP) in different countries. Both HAART and MTCTP are based on the administration of antiretroviral drugs and constitute an integral part of a successful response to the HIV/AIDS epidemic. Governments play an important role in determining the level of HAART and MTCTP coverage in a country.

Ordinary least squares estimation reveals that the concentration of the HIV/AIDS epidemic in urban areas and the share of GDP a country spends on health care have a positive impact on HAART coverage and that the incident of health crises other than AIDS negatively impacts on MTCTP coverage. A high HIV prevalence rate and a high influx of international aid are associated with higher levels of HAART and MTCTP coverage. There are significant regional differences in HAART and MTCTP coverage even after the effects of several explanatory variables are controlled for.

Contents

Tables

1. Introduction

There has been a significant decline in the price of antiretroviral drugs (ARVs) since they first became widely available in the developed world in the mid 1990s (Ford *et al*, 2007). This, together with the availability of international HIV/AIDS-related aid, puts ARVs within financial reach of developing countries. Yet countries have succeeded to very different degrees in 'rolling' out antiretrovirals to those who need them. By employing the statistical tools of regression analysis this paper seeks to identify the potential determinants of cross-country performance with regard to providing ARVs for HIV prevention and treatment.

The dependent variables under investigation are the coverage of highly active antiretroviral treatment (HAART) in 2006 and the coverage of mother-to-child transmission prevention (MTCTP) in 2005.[1] ARV coverage, whether for HAART or MTCTP, is defined as the number of people receiving ARVs as the percentage of those who need them. In 2006, approximately 2 million of the estimated 7.1 million people in developing countries in need of HAART received treatment (WHO 2007:15); in 2005, 220 000 of the estimated 2 million women in need of MTCTP received antiretroviral prophylaxis (ibid:31). Table 1 and Figure 1 illustrate the divergence of both HAART and MTCTP coverage in different regions and countries. It is evident that some regions and countries have been considerably more successful than others in achieving high ARV coverage.

Table 1: HAART and MTCTP coverage in different regions of the world

Region	HAART coverage (2006)	MTCTP coverage (2005)
Sub-Saharan Africa	28%	11%
Latin America and the Caribbean	72%	24%
East. South, and South-East Asia	19%	50%
Europe and Central Asia	15%	75%
North Africa and Middle East	60%	10%
Total	28%	11%

Source: WHO (2007).

[1] HAART coverage (2006) and MTCTP coverage (2005) were obtained from UNAIDS/WHO Global HIV Data Base: http://www.who.int/globalatlas/dataQuery/default.asp.

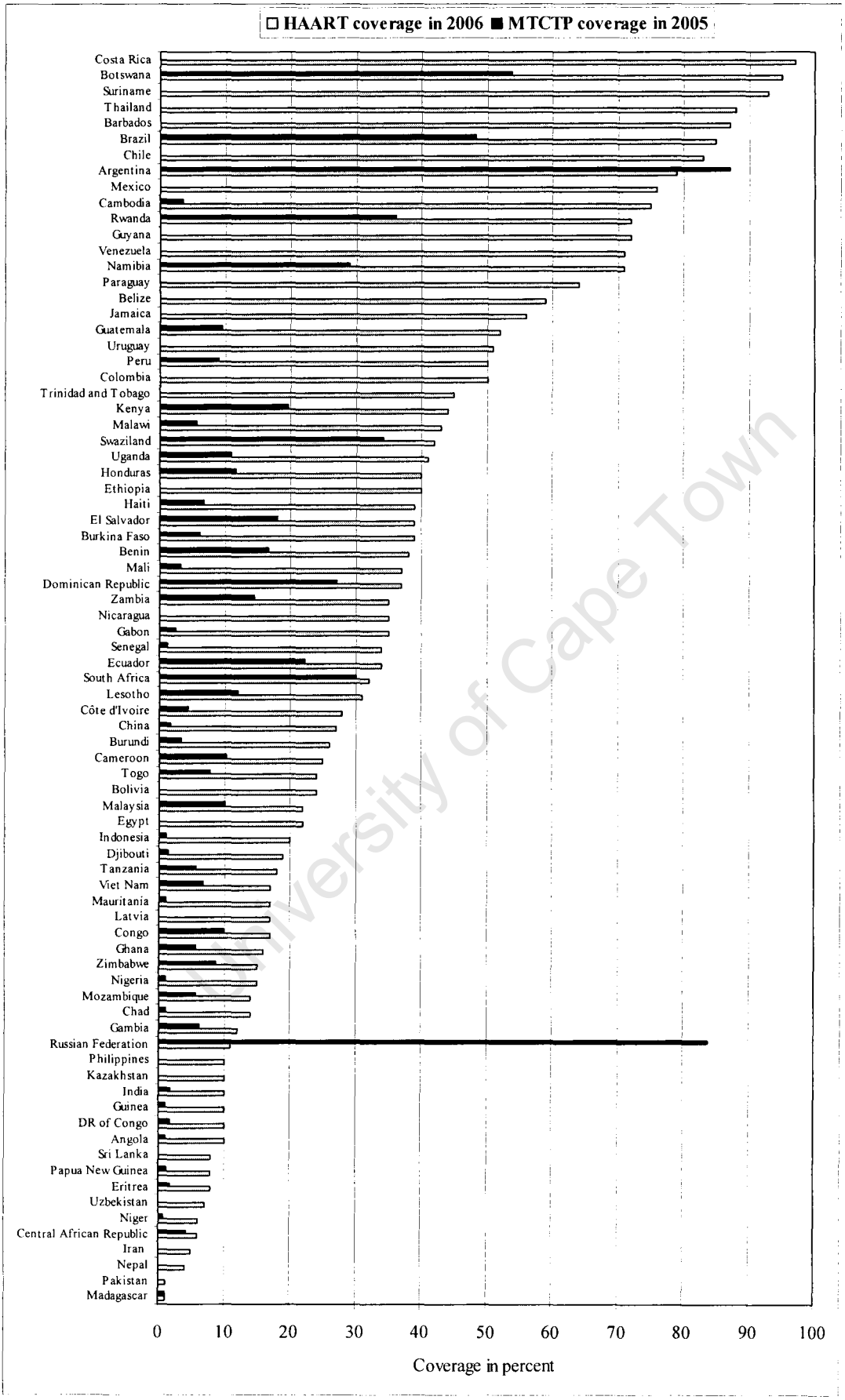

Figure 1: HAART and MTCTP coverage in different countries

Regression analysis can determine the extent to which the variation in ARV coverage across countries can be 'explained' by the variation in a set of explanatory variables. I run ordinary least square regressions of HAART coverage and MTCTP coverage on respective sets of explanatory variables. Following Nattrass (2006), regressions are run over a sample of countries with adult HIV prevalence rates of 0.1% or above. The countries that constitute this sample are displayed in Figure 1.

Table 1 and Figure 1 indicate that HAART coverage and MTCTP coverage do not always vary together and hence may be driven by different factors. It is thus a good idea to run separate regressions on these two different forms of ARV coverage. To my knowledge this paper is the first attempt to investigate the determinants of MTCTP coverage using cross-country regressions. Results from these regressions are relevant and interesting in their own right. Furthermore, by comparing the results of HAART and MTCTP regressions, the analysis enables us to reflect more broadly on potentially different policy approaches to these two ARV-based interventions.

The next section explores the pivotal role countries' governments play in rolling out ARVs. Section 3 looks at important quantitative empirical studies concerned with the measurement of political will and government commitment, and the impact of these variables on ARV coverage and other AIDS-related policy outcomes. Section 4 describes the variables that constitute my empirical model. Section 5 discusses the statistical problem of endogeneigty. Section 6 presents the results of the regression analysis and Section 7 concludes.

2. Government's role in rolling out Antiretroviral Drugs

Governments play a crucial role in the provision of ARVs. In the absence of free or at least subsidized government provision of ARVs, the majority of people in need in developing countries simply cannot afford it. Therefore any large scale ARV intervention in developing countries necessarily has to be financed through either public funds or international aid. On average, only 25% of all spending on HIV constitutes out-of-pocket spending by households, but the percentage varies greatly from country to country (UNAIDS 2006: 232).

The importance of government and international organizations implies that simple economic modeling of ARV coverage based on profit-maximizing firms and utility-maximizing consumers would be inappropriate. Without a readily available (economic) theoretical model to identify testable hypotheses, we need to build up a set of plausible hypotheses from scratch. It is therefore important to understand how governments affect ARV coverage.

Developing country governments can affect the price and hence the availability of ARVs for their citizens by issuing compulsory licenses to produce or import generic equivalents of patented drugs, or by threatening to do so. This is a tactic which Brazil has used successfully to negotiate lower ARV prices from the large pharmaceutical companies (Ford *et al* 2007). The supply of ARVs to citizens also depends on the presence of an adequate health infrastructure and qualified health personnel to administer the therapy. Accordingly, the lack or poor quality of health infrastructure and human capital in some countries has been identified as a major obstacle to rolling out ARVs (e.g. Hosseinipour *et al* 2002; UNAIDS 2006, Global Fund 2007).

Whether a person will seek MTCTP or HAART is not only contingent on the economic costs associated with it. It also depends on social factors such as fear of stigma. Government pronouncements on HIV and its marketing of HIV testing and AIDS treatment services will thus affect the numbers of people seeking and obtaining the necessary ARV treatment. In other words, political will and commitment on behalf of government leaders is crucial as it affects both the supply of services and the social environment structuring the demand for them. As Bor puts it:

> *"Not only does political commitment generate policy responses; through frank and open discourse, political leaders can help educate the public, alleviate stigma, and generate an environment conductive to civil society initiatives and, ultimately, behavioral change." (2007: 1587)*

A government's ability and commitment to fight the HIV/AIDS epidemic is influenced by a number of political and economic considerations. First and foremost, a government is constrained by the availability of resources. Furthermore, a government's commitment to fighting the epidemic is likely to be influenced by the people in need of ARVs and those involved in supplying it. Influence is exerted through lobbying, legal action, or the democratic process.

In Brazil, for instance, the mobilization of civil society and the pressure this applied to the national government has been attributed a crucial role in achieving universal HAART rollout (Levi & Vitoria 2002; Oliveira-Cruz, Kowalsky & McPake 2004). In South Africa, people in need of ARVs have seen a decrease in drug prices and the provision of ARVs for both MTCTP and HAART as the direct result of the Treatment Action Campaign (an NGO of AIDS activists) taking on the government in a social disobedience campaign and in the country's legal courts (Iliffe 2006; Nattrass 2007). In many cases, however, the impact of such pressure from civil society on government is likely to be more subtle than in the Brazilian and South African examples.

Besides political and economic considerations a government's response to the HIV/AIDS epidemic also depends on its beliefs or subjective knowledge. For instance, if government doubts the effectiveness of using ARVs to combat the epidemic it is likely to commit fewer resources to MTCTP or HAART than to other interventions. If for whatever reason influential government officials doubt the scientific knowledge underpinning the use of ARVs, this is likely to impact negatively on government's commitment to a treatment intervention (for an example from South Africa see Nattrass (2007) and Mauchline (2008)). Governments may also be reluctant to rollout ARVs if they think the demographic impact is uncertain (Nattrass 2007). Such subtle differences in reasoning are impossible to capture using quantitative analysis. The best we can do is to try and measure the broader, more amorphous, notion of 'political will' to use ARVs.

3. Modeling political will

If one wishes to model political will or government commitment explicitly, it is necessary to find a good measure of the variable and include it in one's set of explanatory variables. Of course, the success of such a strategy depends fundamentally on the existence of an adequate measure of, or proxy for, political will.

Bor (2007) uses the political support score of the AIDS Program Effort Index (API) to capture political commitment with respect to AIDS which he conceptualizes as "the extent to which top-level government leaders support AIDS as a priority on the national agenda." (Bor: 1586). The API political support scores are constructed on the basis of objective events such as the existence of a national coordinating committee for AIDS programs and whether AIDS has been declared a national disaster, and a set of subjective rankings by respondents from government, academia, civil society, donor organizations and the private sector (API 2003).

Nattrass (2006) argues that the index is an inadequate measure of political commitment with respect to HAART rollout because of its subjective nature; because HAART rollout does not feature specifically as an issue in the construction of the index; and because some of the respondents may have an incentive to exaggerate their government's performance (most obviously, government officials themselves). The index's subjective nature may be reflected in the fact that less than ten percent of countries (a suspiciously small proportion) saw their political support scores decline between 2001 and 2003. In light of this criticism and the fact that using the API political support scores as an explanatory variable would decrease my sample size by up to 30 observations, I do not include the API in my empirical model.

Bor (2007) uses the API political support score as his dependent variable in a regression analysis that seeks to uncover the determinants of political commitment. He finds press freedom, political stability, foreign investment and income inequality to be important predictors of the API. Despite the criticism relating to Bor's dependent variable, I check how three of his explanatory variables relating to the political institutions in a country (i.e. electoral accountability, press freedom and political stability) fare as predictors of real policy outcomes such as HAART and MTCTP coverage.

Lieberman (2007) also uses regression analysis to investigate the determinants of political commitment to fight the AIDS pandemic. His argument is chiefly concerned with one of his explanatory variables, cultural fractionalization. One of the dependent variables employed by Lieberman is the number of times HIV/AIDS received a mention in a country's budget speech. I am, however, suspicious of whether this variable constitutes a good proxy for government commitment. First, the variable does not account for the context in which HIV/AIDS was mentioned in any particular budget speech. Thus it is impossible to tell whether the Finance Minister is mentioning the need for HIV/AIDS prevention messaging rather than rolling out ARVs, or discussing the government's commitment to providing ARVs. Second, politicians (including ministers of finance) may well be amongst the occupational groups whose rhetoric deserves the least trust.

Lieberman also uses a harder measure of political will, namely AIDS-related expenditure. While this may in fact capture political will very well, it cannot be included in my analysis. AIDS-related expenditure is itself a function of HAART and MTCTP coverage. In fact, the extent to which a country is rolling out ARVs may be the main determinant of AIDS-related expenditure. This bi-directional causal relationship leads to the statistical problem of endogeneigty (discussed further in Section 5). However, I include the cultural fractionalization variable of Lieberman's analysis in my set of explanatory variables.

In the absence of adequate measures of political will or government commitment one may be forced to simply render political will an omitted variable. Nattrass (2006) and AIDS Accountability International (2007) derive a measure of political will from the regression residual based on the premise that political will is in fact an omitted variable in regressions that have HAART as their dependent variable. Their logic is as follows. Run a regression controlling for factors which affect ARV coverage – but which government cannot be expected to influence in the short-term. The slope coefficients of the regression will pick up variation in the dependent variable which is not related to policy decisions with regard to providing ARVs. The variation in the dependent variable that is not explained as linear combinations of the explanatory variables gets picked up by the error term. Amongst other things, this residual variation in the error term contains *some* of the effect of omitted variables on the dependent variable. Therefore, if political will is the (only) important omitted variable in a HAART regression it may be synonymous with most of the variation in the error term. As

a result, the error term of a regression of HAART coverage on a comprehensive set of explanatory variables (excluding political will) may serve as a crude measure of political will.

The approach followed by Nattrass and AIDS Accountability International is problematic for a number of reasons. First, it presupposes enormous faith in the validity of the HAART regression's specification, since in the presence of a second important omitted variable the error term is no longer a valid measure of political will. Second, if political will, the omitted variable, is a function of an explanatory variable in the regression, this explanatory variable's slope coefficient captures some of the impact of political will on the dependent variable. The measure of political will that is captured in the error term may therefore only be a rather incomplete measure of the true political will. Third, a regression's error term also captures all the measurement error in the explanatory variables and all other noise in the data. Nattrass and AIDS Accountability International make the implicit claim that political will (or the share of political will that is not captured in the explanatory variables) dominates the other omitted variables, measurement error and noise that make up the error term. I am not comfortable making the same assumption and I therefore do not attempt to model political will in this way.

There are multiple observable and quantifiable economic, demographic and political variables that can be expected to have an effect on a government's commitment to fighting the HIV/AIDS epidemic and its ability to pursue a MTCTP or HAART rollout. I attempt to capture some aspects of political will and government commitment through the explanatory valiables featuring in the next section.

4. The empirical model

4.1 Dependent variables

The dependent variables in my analysis are HAART and MTCTP coverage. I take the natural logs of these variables, which is a monotonic transformation that compresses higher values more than lower ones. This has the dual purpose of negating the effect of high coverage outliers and accounting for the plausible hypothesis that the initial rollout (i.e. at low levels of coverage) is more challenging than the expansion of coverage at higher levels. Furthermore, using the logs of the dependent variables has the convenient effect of rendering the slope coefficients interpretable as partial elasticities (or elasticities, if the explanatory variable is logged too).

Although HAART and MTCTP are both based on the intake of ARVs they are different with respect to analytically relevant features. Most notably, MTCTP is a short-term prevention intervention, and HAART is a long-term treatment intervention. Also, governments may prioritize MTCTP over HAART for reasons of cost-effectiveness and moral judgment (it is easier to argue to save the lives of innocent babies than to extend the lives of those who may be blamed for becoming infected through their own behavior). However, to the extent that HIV-positive groups can mobilize a broader constituency around HAART, this political dimension may be negated by civil society organization.

4.2 Independent variables

4.2.1 Demographic variables

Adult HIV prevalence rate

The HIV prevalence in a country is likely to impact on ARV coverage in a number of ways. To begin with, a higher HIV prevalence is associated with a higher demand for ARVs both for MTCTP and HAART. Holding other things equal, a higher demand is likely to result in more democratic pressure to roll out ARVs being exerted by civil society on government.

Furthermore, in a high prevalence country, the epidemic is more likely to be in the public eye than in a low prevalence country and therefore, at least theoretically, HIV may be more likely to constitute a national priority in a high prevalence country.

On the other hand, governments faced with high HIV prevalence in the population will obviously find it more expensive and challenging to provide ARVs to all who need them. In a cross-country regression, Nattrass (2006) finds a negative association between prevalence and HAART coverage as of June 2004. She attributes this to the greater challenge faced by high prevalence countries. However, arguably because of the financial and technical assistance by international donors given to high prevalence countries in particular, Nattrass finds no significant relationship between prevalence and HAART coverage when using more recent data.

Because concentrated epidemics tend to go hand in hand with relatively low national prevalence rates, whereas generalized heterosexual epidemics are associated with high prevalence rates, prevalence may also constitute a proxy for whether a particular country is facing a concentrated or a generalized epidemic. Governments may find concentrated epidemics easier to target. And people in need of treatment who are socially or spatially concentrated may find it easier to organize and effectively lobby government for treatment. Therefore, to the extent to which lower prevalence is associated with higher concentration, this may well impact positively on treatment coverage. On the other hand, if there is a high concentration of the epidemic amongst risk groups that do not wield much political influence (or who are stigmatized, like injecting drug users), government may find it politically convenient to sideline these groups.

I use the adult HIV prevalence rate from 2005, which is the prevalence rate amongst people aged between 15 and 49. The variable is logged to reduce the effect of outliers and because, as Bor (2007) points out, it is theoretically plausible that a change in prevalence from 1% to 2% is far more politically significant than a change from say 24% to 25%.

The proportion of HIV positive people in urban areas

Nattrass (2006) finds that the concentration of HIV/AIDS epidemics in urban areas, as proxied for by the differential between urban and rural HIV prevalence rates, has a positive effect on HAART rollout. I include the proportion of HIV positive people in urban areas as an explanatory variable in the regression analysis as an attempt to capture the additional pressure exerted on government if people in the need of ARVs are concentrated in urban areas. Furthermore, the variable may also capture the fact that it is easier to roll out ARVs in cities as opposed to rural areas because of the concentration of patients and health care professionals in one place. On average, more than 75 percent of doctors are located in urban areas (Dal Poz *et* al 2006:10).

4.2.2 Economic variables

Gross Domestic Product (GDP) per capita

It is intuitive that a richer country is more likely to engage in a generally costly treatment intervention. A higher income *per capita* positively impacts on the private provision of ARVs as people in need of treatment are more likely to afford it. Furthermore, because government budgets tend to be roughly proportional to national income, a higher income also positively impacts on the public provision of ARVs. Highly correlated with a country's income and wealth is a country's health infrastructure which, if of a high quality, is likely to decrease the cost and increase the feasibility of a government-lead treatment intervention.

It is important to note that committing scarce government resources to rolling out ARVs comes at a substantial opportunity cost, since the short-term direct costs of rolling out ARVs could reduce the share of a government budget going to other areas, e.g. education or combating other diseases.[2] In other words, it is not only the money at a government's disposal that matters, but also what urgent problems are competing for a share of this money.

[2] Although it has been shown that governments can *save* money by providing ARVs in the long run, in that fewer AIDS-related opportunistic infections occur as a result of MTCTP and HAART (see Levi and Vitoria (2002) for Brazil and Nattrass and Geffen (2005) for South Africa).

I use the log of GDP *per capita* at purchasing power parity (PPP) from 2005 as a measure of a country's income. GDP per capita is logged to diminish the effect of high income outliers. Furthermore, because a logged GDP *per capita* variable attaches relatively more weight to changes in income at low levels, it takes into account that low income countries face a dual burden: low income; and the high opportunity cost of spending on ARVs due to their low level of development.

The share of GDP spent on health

The share of a country's total expenditure allocated to health care measures a countries consumption of health care relative to the consumption of all other goods in the country. This variable therefore reveals how much a society values health care over alternative uses of income. We would thus expect a positive relationship between the share of GDP spent on health and ARV coverage (for both MTCTP and HAART).

However, there may also be an element of opportunity cost inherent in this variable as it captures expenditure on all health issues faced by a country. If a relatively high expenditure on health as a percentage of GDP indicates the presence of other health crises competing with the HIV/AIDS pandemic for scarce resources, then we would expect this variable to have a negative relationship with ARV coverage. I use data from 2004 for this variable.

International donors

In many countries international donors and non-governmental organizations provide the funding that constitutes a necessary condition for a national rollout of MTCTP or HAART. The United States President's Emergency Plan for AIDS relief (PEPFAR) probably accounted for 75% of total AIDS-related bilateral aid in 2007 (UNAIDS 2006: 238). Two thirds of the PEPFAR money is allocated to 15 focus countries (12 of them African) and fifty-five percent of these funds are spent on HAART (UNAIDS 2006: 238). The Global Fund for HIV, Tuberculosis and Malaria is the largest multilateral fund for HIV-related policy support. Fifty-six percent of the Fund's money is spent on HIV (mainly treatment initiatives) and 60% of the Fund's commitments go to sub-Saharan Africa (UNAIDS 2006: 242; Global Fund 2007).

I construct a variable measuring the PEPFAR dollars received by a country divided by its population. I also calculate the Global Fund's HIV-related grants per capita received by a country.[3] Unfortunately, the data does not allow for a finer dissection of the aid money, whereby the share of the funds that goes towards treatment could be determined.

4.2.3 Health infrastructure

The percentage of births attended by skilled health personnel

Good infrastructure and human capital in the health sector are likely to increase the speed of a MTCTP or HAART rollout and, by making any such rollout feasible, they may also impact positively on the government's initial decision to undertake the intervention. Of course, the private provision of ARVs is also positively affected by the availability of health services.

The percentage of births attended by skilled health personnel captures the coverage of a country's health system and therefore the extent to which health infrastructure and human resources are available to the people.[4] Skilled health personnel may also impact on an ARV rollout directly. Iliffe (2006) points out the pivotal role played by doctors and nurses in lobbying for HIV-related government initiatives. They do so as advocates for their patients, but also for themselves as they comprise a group which is highly exposed to the risk of infection.

4.2.4 Political variables

Established Democracy

The set of explanatory variables contains a dummy variable that takes the value of 1 if a country is an established democracy and 0 if it is not.[5] If a country is an established

[3] The PEPFAR variable is constructed from a dataset that can be downloaded from the Center for Global Development's webpage: http://www.cgdev.org/section/initiatives/_active/hivmonitor/pepfardata; the Global Fund variable is constructed from disbursement data from the Global Fund's webpage: http://www.theglobalfund.org/en/funds_raised/commitments.

[4] There exists data on the number of doctors in a country, which may represent a better measure of human capital in the health sector. However, this data is sporadic and uneven (most countries have only one data point) and the date of collection varies significantly across regions The date of collection also varies for the births attended by skilled health personnel data, but it does not vary systematically across regions.

[5] This variable was sourced from Smith (2003).

democracy its government is likely to be more responsive to the demands of its citizens because civil society can impose its demands on government through the democratic process. Therefore, democracy is likely to have a positive impact on MTCTP and HAART coverage.

State legitimacy

In an effort to explain why being an African country seems to have a negative effect on economic growth in many empirical studies, Englebert (2000) develops the concept of state legitimacy. Low state legitimacy is found in countries in which state creation was exogenous and the domestic political leadership inherited its rule from the colonizers rather than shaping it itself. According to Englebert most African states

> *"...were born lacking legitimacy in the sense that they were not endogenous to their societies, that they were not historically embedded into domestic relations of power and domination and that they therefore suffered from a dichotomization between power and statehood." (Englebert, 2000: 1823)*

As a result of low state legitimacy, some postcolonial states may derive greater power payoffs from neo-patrimonial than from developmental policy choices. Englebert argues that developmental policies require some degree of loyalty on behalf of bureaucrats and trust in a country's institutions on behalf of civil society that are unlikely to exist in the absence of state legitimacy. Then, leaders may find it worthwhile to replace developmental with neo-patrimonial policy choices by, for example, substituting for the 'moral right to rule' with 'patron-client links' (*ibid*: 824).

It may be argued that a broadly based rollout of ARVs for MTCTP and HAART is more compatible with developmental policy choices than with a neo-patrimonial leadership strategy. It is of course possible that in some cases a low-income country could decide that developmental goals are best pursued by putting the marginal dollar into education rather than ARVs. However, holding other things equal, it is reasonable to suppose that a state pursuing developmental policies is likely to opt for ARV-based interventions before a state that has adopted a neo-patrimonial leadership style. A neo-patrimonial strategy implies the state's focus on the interests of a few strongmen or concentrated powerful groups. At least in

generalised epidemics this narrow policy focus probably contradicts any widespread ARV-based intervention.

Given the link between state legitimacy and neo-patrimony, state legitimacy may be a predictor of MTCTP and HAART coverage. Table 2 illustrates Englebert's construction of a dummy variable that divides countries into legitimate and non-legitimate states. A non-legitimate state has to fulfill five criteria. More specifically, the answers to the five questions in Table 2 all have to be located in the most right hand column in order for a particular state to qualify as non-legitimate.

Table 2: Construction of the state legitimacy dummy variable

		Legitimate (=1)	Non-legitimate (=0)
1)	Was the country colonized in modern times?	No	Yes (go to question 2)
2)	When reaching independence, did the country recover its previous sovereignty, identity or effective existence?	Yes	No (go to question3)
3)	If the country was created by colonialism, was there a human settlement pre-dating colonization?	No	Yes (go to question 4)
4)	Did the colonizers (and/or their imported slaves) reduce the pre-existing societies to numerical insignificance (or assimilate them) and become the citizens of the new country?	Yes	No (go to question 5)
5)	Does the post-colonial state do severe violence to pre-existing political institutions?	No	Yes

Source: Englebert (2000)

Electoral accountability, freedom of the press and political stability

Bor (2007) argues that there exists a relationship between electoral accountability and freedom of the press and the political commitment to fighting the AIDS pandemic. Sen (1999) provides the rationale for this relationship by arguing that by exposing crisis conditions, a free press together with electoral accountability, can help generate inescapable incentives for leaders to intervene. In a cross-country regression, Bor (2007) finds that freedom of press is indeed a significant determinant of his measure of political commitment. I use the updated versions of the variables used by Bor (electoral accountability and press freedom) to check whether they have any explanatory power over HAART and MTCTP coverage. As a measure

for electoral accountability I use the Freedom House 'Political Rights' Score from 2003 and as a measure of press freedom I use the Freedom House 'Freedom of the Press' Score from 2006.

Bor also finds political stability to be an important predictor of a country's commitment to fight the AIDS pandemic. He uses the World Bank's indicator for 'political stability' which measures the threat of extra-legal challenges to the state. Bor argues that the increased risk of a regime collapse has leaders discount the benefits of a robust response to AIDS. I include the World Bank's political stability indicator in my regressions.

Cultural fractionalization

Lieberman (2007) argues that cultural fractionalization in a country is likely to have a negative impact on a government's policy response to the AIDS pandemic. He hypothesizes that elites in culturally fractionalized countries are less likely to mobilize openly against a stigmatized disease for the fear of reputational damages. Lieberman argues that as a result of cultural fractionalization, political elites may also be more likely to allege that the risk is contained in other ethnic groups or that the threat is exaggerated.

Lieberman tests his hypothesis empirically using a cultural fractionalization index developed by Fearon (2003). According to Lieberman, Fearon's index is superior to competing measures of ethnic fractionalization because it explicitly puts weight on the social and political salience of ethnic dissimilarities and achieves a wide geographic coverage. In a regression analysis, Lieberman finds the index to be negatively related to a number of AIDS-related policy measures including HAART coverage (controlling for HIV prevalence, GDP *per capita*, government effectiveness, public health expenditure over GDP, whether a country is a democracy, whether a country is in Africa and whether a country is in Latin America or the Caribbean). I include the index of cultural fractionalization used by Lieberman in my set of explanatory variables.

4.2.5 Regional dummy variables

Table 1 indicates that there are large differences in ARV coverage across regions. I enter dummy variables for 'Latin America and the Caribbean', 'Eastern Europe and Central Asia' and 'East, South and South-East Asia'. Sub-Saharan Africa functions as the base. Since there are only two countries from North Africa and the Middle East in the sample, no dummy variable is included for this region.

Ideally, the other explanatory variables, which possess a concrete theoretical link to ARV coverage, should pick up inter-regional variation in coverage. If the set of explanatory variables fails to account for the differences in coverage across regions, a significant regional dummy variable will indicate that there is an important omitted variable that is related to a particular region. The countries in a region may share demographic, cultural and political characteristics. These characteristics may hold some significant determinants of ARV coverage.

Countries in southern Africa have experienced generalized heterosexual epidemics to an extent that no other region has seen (Iliffe 2006; Barnett and Whiteside 2002). I construct a dummy that takes the value of 1 for countries with an adult HIV prevalence rate above 15 percent. This 'Southern Africa mega epidemics' dummy may capture the impact of generalized epidemics on MTCTP and HAART coverage to the extent to which this is not already captured in the prevalence rate.

4.2.6 Disability Adjusted Life Years lost (DALYs) per capita due to non-AIDS related reasons

I follow AIDS Accountability International (2007) in including in my analysis the DALYs due to non-AIDS related reasons as a measure of other health demands in a country. The DALYs of a disease are the sum of the years of life lost due to premature mortality and years of healthy life lost due to disability incident cases of the health condition or disease (WHO 2008).

The DALYs due to non-AIDS related reasons are the years of healthy life lost due to all diseases other than AIDS. The non-AIDS DALYs measure a country's incedence of diseases other than AIDS and should thus capture the extent to which other diseases or medical conditions compete with AIDS for a share of private and public health budgets.

The non-AIDS DALYs are an explicit measure of the opportunity cost in terms of health of a dollar from the health budget spent on ARVs. By including this variable in the set of explanatory variables, it is hoped that the element of opportunity cost inherent in other explanatory variables such as 'GDP spent on health' is captured. I log the non-AIDS DAILYs per capita to negate the effect of outliers. The data for this variable is from 2002.

5. The problem of endogeneigty

5.1 The potentially endogenous variables

Endogeneigty arises when explanatory variables are correlated with the regression's error term. Endogenous variables result in biased and inconsistent ordinary least squares (OLS) estimators. The bias means that the estimated slope coefficients are different from their 'true' values and the inconsistency entails that the problem persists in large samples. Possible causes of endogeneigty are measurement error, bi-directional causality between HAART or MTCTP and an explanatory variable, and the existence of omitted variables that is correlated to an explanatory variable in the regression. If endogeneigty were indeed a problem in the regression models that follow the most likely culprits would be the HIV prevalence rate, the share of GDP spent on health, and the percentage of births attended by skilled health personnel.

HIV prevalence rates are notoriously hard to estimate and may thus contain a measurement error (for a critique of the accuracy of prevalence data see Chin 2007). The variable may also be correlated with an omitted variable such as political will. Furthermore, there may also exist a bidirectional causal relationship with the dependent variable. More specifically, HIV prevalence may be a function of HAART coverage because HAART increases the life expectancy of those who receive it. As people with HIV live longer in the presence of an effective rollout of HAART, prevalence increases. MTCTP, on the other hand, has a negative effect on prevalence. More specifically, MTCTP has been shown to reduce mother-to-child transmission of HIV by up to 40% (Jackson *et al.*, 2003).

Nevertheless, it is possible that the HIV prevalence rate is not endogenous. Endogeneigty is a statistical phenomenon that is blind to theory and interested only in the values particular data take. And some of the effects mentioned above may exert their influence in opposite directions. Furthermore, in most countries the rollout of HAART may not yet have had sufficient time to substantially impact on the life expectancy of the people receiving treatment. To illustrate this, between 2001 and 2005 the number of people receiving HAART in developing countries increased fivefold from 240 000 to approximately 1.3 million

(UNAIDS 2006:151) and the estimated total number of people infected with HIV in the world was 38.8 million in 2006 (UNAIDS 2006:8).

The share of GDP spent on health care may also be correlated with the error term because of a bidirectional causal relationship with HAART and MTCTP coverage. It is plausible that as people and governments have to pay for costly ARVs they are forced to spend less money on other items in their budgets thereby increasing the share of GDP spent on health. What speaks against this form of endogeneigty is that those countries that have achieved high ARV coverage have not necessarily experienced growth in their share of GDP spent on health between 2000 and 2004. This is reflected in the fact that the pairwise correlation coefficient for the difference in the share of GDP spent on health between 2004 and 2000 and HAART coverage is only 0.086.

An extensive rollout of ARVs may require that a country actively seeks to increase the number of health professionals within its borders. HAART and MTCTP may hence exert a positive effect on the percentage of births attended by skilled health personnel thereby rendering this variable endogenous. However, because the bulk of the data for this variable predates 2002 it is possible that efforts to roll out ARVs have not yet had enough time to significantly impact on this variable.

5.2 Testing for endogeneigty

A method frequently used to deal with the problem of endogeneigty is instrumental variable estimation. This technique employs an instrumental variable which, in simple terms, is used to 'stand in' for the endogenous explanatory variable. The instrumental variable needs to be valid and not too weak. An instrument is said to be strong and not weak if its correlation with the endogenous variable is high. It is valid if it is not itself correlated with the error term of the original regression. Amongst other things, this implies that an instrument cannot also be a significant determinant of the dependent variable.

The Hausman specification test by means of artificial regression allows us to test for endogeneigty based on the logic of instrumental variable estimation. The procedure is as follows: First, run a regression of the potentially endogenous variable on a suitable

instrumental variable and all the other explanatory variables. Then, run a second regression of the dependent variable on all the explanatory variables (including the potentially endogenous variable) and the error term of the first-stage regression. If the first-stage error term has a significant coefficient in the second-stage regression, endogeneigty is likely to be a problem. Because there are three potentially endogenous variables in my set of explanatory variables, three first stage regressions need to be run. Their three error terms are then included in the second stage regression.

I use a dummy variable that takes the value of 1 if a country is predominantly Muslim as an instrument for the adult HIV prevalence rate. In a cross-country regression, Nattrass (2008) finds that this variable has a significant negative effect on HIV prevalence. Since we are dealing with a disease that is most commonly transmitted sexually, it is plausible that a religion that imposes strict rules on sexual intercourse (rules that tend to limit sexual freedom, especially of women) has a dampening effect on prevalence. With respect to the instrument's validity, there is no reason to expect the Muslim variable to be related to ARV coverage.

The share of private expenditure on health financed by prepaid plans functions as the instrument for the share of GDP spent on health care. The share of prepaid plans measures the extent to which people in a particular country have access to private medical insurance. The availability of medical insurance is likely to be based mainly on the country's level of development and the quality of its institutions. People are risk averse. So if medical insurance is available they are likely to buy it. Furthermore, on average we expect people to spend more money on health if they have the chance to indulge their risk aversion. Therefore, holding other things equal, a higher coverage of private medical insurance is likely to be associated with a larger share of GDP being spent on health. The most likely source of invalidity for this instrument would be that prepaid plans also determine HAART or MTCTP coverage. However, I know of no incident in any of the countries included in the sample where the presence of *private* medical insurers has made a difference in the provision of ARVs.

I instrument the percentage of births attended by skilled health personnel with a country's adult literacy rate. The argument is straight forward. The number of skilled health personnel in a country is a function of that country's education system's ability to produce them; and a country's adult literacy rate proxies for the quality of the education system. It may be argued

that invalidity cannot be precluded because it is possible that the literacy rate has an impact on ARV coverage. However, it is by no means clear that there is a relationship between the level of education in a country and the social beliefs held with regards to AIDS and its treatment.

Table 3 contains the Hausman test for all three potentially endogenous variables in both the HAART and the MTCTP regressions. The diagnosis is that none of the three variables is endogenous. However, some caveats are necessary.

Instrumental variable estimates like the estimates in the second-stage regressions in Table 3 are consistent. They are, however, not unbiased in small samples. With sample sizes of 82 and 55 in the HAART and MTCTP regressions respectively, this small sample bias may cast a shadow of doubt over the test results. Furthermore, the bias in instrumental variable estimation increases with decreasing strength of the instrument (Hahn & Hausman 2005). High R^2s and significance levels of the instruments in the first-stage regressions of Table 3 indicate that the Muslim dummy and the adult literacy rate are strong instruments. The same is not true for the share of prepaid plans variable, which fails to be significant at the 10% level as a predictor of the share of GDP spent on health over the MTCTP sample.

Instrumental variable estimators are also less efficient than their OLS counterparts. As a result one is more likely to wrongly accept the null hypothesis that a slope coefficient is not significantly different from zero. In light of the lack of efficiency and the potential bias originating from a weak instrument and a small sample, it is possible that the Hausman test for the three variables fails to identify an endogeneigty problem even though it exists. The regression results that follow should thus be interpreted with caution and a healthy suspicion of endogeneigty.

Nevertheless, this section has presented an argument in which no conclusive proof, but some evidence against the presence of endogeneigty was provided. In the light of the lower efficiency and small sample bias of the instrumental variable estimators and in the absence of evidence for the presence of endogeneigty the next section employs standard OLS estimation as opposed to instrumental variable estimation.

Table 3: Hausman specification tests by means of artificial regression

		HAART coverage			MTCTP coverage		
		1	2	3	4	5	6
	Dependent variable:	Log of adult HIV prevalence	% of GDP spent on health	Skilled health personnel	Log of adult HIV prevalence	% of GDP spent on health	Skilled health personnel
Instruments	*Predominantly Muslim*	-1.01 ***			-0.87 ***		
		0.29			*0.29*		
	Prepaid plans as % of private expenditure on health		0.0319 ***			0.0343 *	
			0.0107			*0.0175*	
	Adult literacy rate			0.50 ***			0.41 **
				0.16			*0.16*
Independent variables	Log of adult HIV prevalence		0.30	-1.45		0.70	-3.25
			0.28	*1.62*		*0.43*	*2.32*
	Proportion of HIV + people in urban areas	0.52	-0.13	0.25	0.58	-0.56	1.70
		0.44	*0.77*	*6.49*	*0.57*	*1.10*	*8.99*
	Log of GDP per capita	0.15	-0.19	13.10 ***	0.04	-0.41	14.68 ***
		0.25	*0.65*	*3.04*	*0.26*	*0.91*	*3.63*
	Share of GDP spent on health (%)	0.08		0.56	0.13 ***		1.67
		0.06		*0.89*	*0.05*		*1.10*
	Births attended by skilled health personnel (%)	-0.01	0.00		-0.01	0.01	
		0.01	*0.01*		*0.01*	*0.02*	
	PEPFAR dollars per capita	0.00 ***	0.00	-0.01	0.00	0.00	-0.04
		0.00	*0.00*	*0.02*	*0.00*	*0.00*	*0.03*
	Global Fund (HIV) dollars per capit:	0.07 **	0.01	0.15	0.06 **	0.00	0.04
		0.03	*0.04*	*0.25*	*0.02*	*0.04*	*0.29*
	Established democracy	0.06	-0.05	4.56	-0.46 *	0.34	2.63
		0.28	*0.43*	*5.70*	*0.27*	*0.56*	*7.88*
	State legitimacy	-0.14	0.61	-4.32	-0.35	0.71	-4.41
		0.29	*0.41*	*4.48*	*0.33*	*0.65*	*5.43*
	Log of non-AIDS DALYs per capita	1.05 **	-0.42	-6.30	0.37	-0.30	-0.80
		0.43	*0.86*	*10.12*	*0.36*	*1.12*	*12.15*
	Latin America and the Caribbean	-0.94 *	0.98	-9.91	-1.02 *	1.90 **	-14.16 *
		0.48	*0.60*	*6.87*	*0.54*	*0.82*	*8.36*
	East, south and South-East Asia	-1.01 **	-0.85	-13.19 *	-0.83	0.07	-10.40
		0.47	*0.64*	*6.95*	*0.52*	*0.88*	*9.41*
	Eastern Europe and Central Asia	-0.76	0.95	1.15	-0.40	1.18	3.43
		0.51	*0.61*	*6.40*	*0.77*	*0.87*	*7.73*
	Southern Africa mega epidemics	1.48 ***	-0.06	-2.74	1.49 ***	-0.98	4.43
		0.41	*1.00*	*6.26*	*0.41*	*1.28*	*6.93*
	R^2	0.70	0.29	0.75	0.77	0.33	0.69
	F-statistic	19.29 ***	3.93 ***	18.89 ***	15.35 ***	3.78 ***	17.95 ***
	Observations (N)	82	82	82	55	55	55

	Dependent variable:	Log of HAART coverage (2006)	Log of MTCTP coverage (2005)
	Regression 1 error term	0.09	
		0.29	
	Regression 2 error term	0.17	
		0.15	
	Regression 3 error term	0.00	
		0.01	
	Regression 4 error term		-0.59
			0.42
	Regression 5 error term		-0.28
			0.22
	Regression 6 error term		0.02
			0.02
	And independent variables from above		
	R^2	0.63	0.80
	F-statistic	9.50 ***	68.401 ***
	Observations (N)	82	55

*Note: robust standard errors are in italics below the coefficients; *,**,*** stand for significance at the 10%,5% and 1% level respectively; regression constants are not reported.*

6. Results of the regression analysis

6.1 Estimation technique

This section looks at the results of various cross-country regressions of HAART and MTCTP coverage on their hypothesized determinants. The sample for the HAART coverage regressions consists of 82 countries, while there are only 54 countries over which the MTCTP coverage regressions are run. In both cases the sample size is constrained by the availability of data and an exclusion criteria (following Nattrass 2006) that holds that a country's adult HIV prevalence has to be 0.1% or above. The rationale behind this restriction is that it excludes countries in which the HIV/AIDS epidemic is not big enough a problem to warrant the special attention of the national government or international organizations.

The regressions are estimated using ordinary least squares. As with all applications of OLS estimation to cross-sectional data, heteroscedasticity (i.e. the variance of the error term being non-constant) may be a problem. Heteroscedasticity results in OLS estimators that are no longer efficient, which entails deflated t-statistics and the increased risk of wrongfully diagnosing a particular slope coefficient as insignificant. I use robust standard errors, which explicitly take into account the unequal variance of the error term, to avoid the pitfalls of heteroscedasticity.

A final qualification is in order: As the regressions are likely to contain important omitted variables (for example, the share of political will not captured by the explanatory variables and the price a particular country pays for ARVs) the estimated slope coefficients may vary from their exact 'true' values. While this does not void the qualitative insights of the regressions that follow, this study should be regarded as exploratory and we should be wary of using the slope coefficients for predictive purposes.

6.2 The determinants of HAART coverage

In Regression 1 in Table 4 the log of HAART coverage is regressed on five explanatory variables. A high adult HIV prevalence, a high proportion of HIV positive people in urban areas, a large GDP *per capita* and a big share of GDP spent on health are all associated with

significantly higher levels of HAART coverage. As indicated by the three stars, the slope coefficients for the proportion of HIV positive people in urban areas and the share of GDP spent on health are significant at the 1% level (i.e. in saying that these coefficients are statistically different from zero we are wrong less than 1% of the time). The percentage of births attended by skilled health personnel is not revealed to have a significant impact on HAART coverage.

Regression 2 includes the PEPFAR and Global Fund dollars spent *per capita*. The PEPFAR dollars *per capita* seem to be associated with higher HAART coverage, although the variable only achieves significance at the 10% level. The Global Fund HIV-related aid *per capita* is not revealed to have a significant impact. However, the impact of such international support may well be greater than indicated by these results. There exists a selection bias in these two variables because international aid organizations and bilateral donors are likely to lend their support to countries in particularly dire circumstances. Therefore, because of a propensity for selecting countries which face the largest obstacles to the use of ARVs, donors may not be revealed to have as large a positive effect on ARV coverage as they do in reality, unless the regression controls for all of the relevant obstacles.

Once the international aid variables are added, the adult prevalence rate loses significance and its coefficient decreases. This is probably because PEPFAR and Global Fund tend to target countries with high prevalence rates and before the two variables were added, the prevalence rate captured some of the effect of the PEPFAR and Global Fund dollars on HAART coverage.

In Regression 3, I add six political variables to the regression model. Only whether a country is an established democracy has a significant positive effect on HAART coverage. Electoral accountability, freedom of the press and political stability are all closely related to, if not features of democracy. The fact that these three political variables also used by Bor (2007) fail to come out significantly in Regression 3 may be taken as evidence that it is their meta institution, namely democracy, rather than electoral accountability, freedom of the press and political stability *per se* that matters. Accordingly, it may be regarded as troublesome that Bor fails to control for whether a country is a democracy or not in his regression analysis.

Table 4: The determinants of HAART coverage (2006)

Dependent variable: Log of HAART coverage (2006)						
	All countries					**SSA**
	1	**2**	**3**	**4**	**5**	**6**
Independent variables:						
Log of adult HIV prevalence	0.15 **	0.07	0.11	0.12	0.17 *	0.21
	0.06	*0.08*	*0.07*	*0.07*	*0.09*	*0.22*
Proportion of HIV + people in urban areas	0.99 ***	1.16 ***	0.94 **	1.04 ***	0.80 **	1.80 ***
	0.31	*0.32*	*0.38*	*0.34*	*0.32*	*0.56*
Log of GDP per capita	0.29 *	0.23	0.09	0.00	0.11	0.19
	0.15	*0.16*	*0.16*	*0.20*	*0.16*	*0.21*
Share of GDP spent on health (%)	0.17 ***	0.16 ***	0.11 **	0.14 ***	0.12 ***	0.18 ***
	0.04	*0.04*	*0.05*	*0.04*	*0.04*	*0.06*
Births attended by skilled health personnel (%)	0.0037	0.0037	0.0016	0.0020	0.0057	-0.0055
	0.0058	*0.0059*	*0.0058*	*0.0060*	*0.0051*	*0.0075*
PEPFAR dollars per capita		0.0027 ***	0.0024 ***	0.0023 ***	0.0022 **	0.0036 ***
		0.0005	*0.0007*	*0.0006*	*0.0009*	*0.0010*
Global Fund (HIV) dollars per capita		0.022	0.018	0.024 *	0.024 **	0.030 **
		0.015	*0.014*	*0.013*	*0.010*	*0.012*
Established democracy			0.48 **	0.46 **	0.11	0.45
			0.24	*0.20*	*0.20*	*0.32*
State legitimacy			0.05			
			0.28			
Electoral accountability			-0.09			
			0.09			
Press freedom			0.01			
			0.01			
Political stability			0.07			
			0.11			
Cultural fractionalisation			-0.48			
			0.64			
Log of non-AIDS DALYs per capita				-0.42	-0.17	0.36
				0.29	*0.24*	*0.40*
Latin America and the Caribbean					0.51 *	
					0.30	
East, south and South-East Asia					-0.08	
					0.38	
Eastern Europe and Central Asia					-0.80 **	
					0.37	
Southern Africa mega epidemics					-0.40	-0.30
					0.28	*0.37*
Constant	-0.83	-0.50	1.11	0.90	0.46	-0.08
	0.99	*1.02*	*1.59*	*1.19*	*1.11*	*1.40*
R^2	0.44	0.49	0.53	0.54	0.62	0.72
F-statistic	9.05 ***	20.24 ***	9.54 ***	13.60 ***	11.84 ***	8.65 ***
Observations (N)	82	82	79	82	82	37

*Note: Robust standard errors are in italics below the coefficients; *,**,*** stand for significance at the 10%, 5% and 1% level respectively.*

The fact that cultural fractionalization fails to be a significant predictor of HAART coverage provides evidence against the importance Lieberman (2007) places on this variable in explaining AIDS-related policy outcomes. The substantial decrease in the GDP *per capita*'s coefficient, and the fact that this variable is no longer significant once the political variables are entered, is likely to be the result of a country's GDP being a function of the democracy variable (for an example of arguments linking democracy to higher *per capita* incomes see Rodrik, 2000).

Regression 4 includes the non-AIDS DALYs per capita. While this variable has the hypothesized negative slope coefficient, its fails to be statistically significant. However, on inclusion of the non-AIDS related DALYs, the Global Fund variable achieves significance. This makes sense in light of the Global Fund's focus on countries with severe health crises. And this result also supports the premise that the international donors tend to be biased in that they select aid recipients that find themselves in the worst circumstances.

Regression 5 represents the best or most complete model of HAART coverage. It contains the regional dummy variables. The R^2 indicates that 62% in the cross-country variation of HAART coverage is explained by the variation in the set of explanatory variables. On average, HAART coverage is revealed to be significantly higher in countries in Latin America and the Caribbean and significantly lower in countries in Eastern Europe and Central Asia. The other explanatory variables cannot account for these regional differences.

Nattrass (2006) and Lieberman (2007) also find that countries in Latin America and the Caribbean are associated with significantly higher HAART coverage. Part of the explanation could be that epidemics in Latin America and the Caribbean disproportionately affect concentrated groups, especially gay men (Parker 2000). Mobilisation by middle-class, predominantly urban gay men may well account for additional pressure on governments to provide treatment. Another explanation may be that the early and significant treatment response to the AIDS epidemic exhibited by the Brazilian government yielded a demonstration effect and lower ARV prices throughout the region.

Once the regional dummy variables are added, the democracy dummy no longer achieves significance. This is probably because it proxied for the regional dummies in their absence.

More specifically, most countries from Latin America and the Caribbean in the sample are established democracies, while the countries from Eastern Europe and Central Asia are not. It is striking that neither the GDP *per capita* nor the births attended by skilled health personnel are significant in Regression 5. However, in the case of births attended by skilled health personnel the insignificant result should be interpreted with caution because the data quality is called into question by differences in the date of collection of the data across countries.

What can be said about the relative size of the effects the significant variables have on HAART coverage in Regression 5? To answer this question it is helpful to look at a specific example. Uganda has a population of roughly 27 million people and a HAART coverage of 41%. The proportion of HIV positive Ugandans living in urban areas is 0.3. The model in Regression 5 estimates the effect of a one unit increase of the proportion of HIV positive people living in urban areas on HAART coverage to be 66%. This means that if the urban proportion of HIV positive people in Uganda would be 0.4, the country's HAART coverage would be 6.6% higher, at a level of 43.7. If the percentage share of GDP spent on health in Uganda were to rise from its current level of 7.6 to 8.6, HAART coverage is estimated to increase from 41 to 45.5.

The coefficients of the significant international aid variables indicate that the effect of a Global Fund dollar per capita far exceeds that of a PEPFAR dollar. However, since PEPFAR provides more money to fewer countries the absolute effect of PEPFAR aid on an individual country is likely to be bigger. Suppose for a moment that the model can be used to predict the future. Then, if PEPFAR were to match its past disbursements to Uganda by committing another 3.5 billion US dollars to the country, Uganda's HAART coverage is predicted to rise 29 percent from 41% to 53%. If the Global Fund were to match its 34 million US dollars of past disbursements to Uganda, the country's HAART coverage would increase by 3%.

Note that the data measures the total PEPFAR and Global Fund dollars disbursed to a country, which includes the money spent on all AIDS related initiatives including education and prevention. The money spent on treatment required to bring about the changes in HAART coverage hypothesized above is thus much lower. In reality, the model cannot hope to make accurate predictions of the future. Instead, these hypothetical figures are merely meant to illustrate the important role played by international donors in rolling out ARVs.

In Regression 6 the empirical model is run over a sample of countries in sub-Saharan Africa. All significant variables in Regression 5 remain significant and preserve their signs. Since excluding all countries outside sub-Saharan Africa shrinks the number of observations to 37, the regression's results should be interpreted with due caution. Nevertheless, they provide some evidence for the robustness of the model.

6.3 The determinants of MTCTP coverage

Table 5 contains the results of six regression models describing the log of MTCTP coverage. In Regression 1, all five variables included in the model have a significant positive relationship with MTCTP coverage, even though GDP *per capita* only achieves significance at the 10% level. A one unit increase in the percentage of births attended by skilled health personnel is revealed to increase MTCTP coverage by 2%. The effect of an improvement in a country's health system coverage as proxied for by the births attended by skilled personnel is thus likely to be sizable. However, the poor quality of the data that makes up this variable should caution the interpretation of this significant result just as it cautioned the interpretation of the insignificant result in the HAART regressions.

In Regression 2 the PEPFAR and Global Fund dollars spent *per capita* are added to the model. Both are revealed to have a positive effect, but only achieve significance at the 10% level. The coefficients on the two variables are bigger than in the HAART regressions. This is probably because MTCTP is cheaper to administer and hence, a dollar of international aid can be expected to go further.

In Regression 3 a legitimate state is revealed to achieve MTCTP coverage that is on average 108% higher than the coverage achieved by a non-legitimate state. It may be argued that investing in a country's children (i.e. providing MTCTP) is a prime example of a developmental policy. Then, in regard to the previously established link between state legitimacy and the propensity of a government to engage in developmental policies, the revealed relationship is not surprising. Perhaps somewhat surprisingly, however, whether a country is an established democracy or not does not seem to matter. Again, none of the political variables proposed by Bor (2007) and Lieberman (2007) are significant.

Table 5: The determinants of MTCTP coverage (2005)

Dependent variable: Log of MTCTP coverage (2005)						
	All countries					**SSA**
	1	**2**	**3**	**4**	**5**	**6**
Independent variables:						
Log of adult HIV prevalence	0.28 ***	0.14	0.22 *	0.25 **	0.33 **	0.33
	0.09	*0.12*	*0.13*	*0.11*	*0.14*	*0.20*
Proportion of HIV + people in urban areas	1.19 **	1.29 **	1.19 **	1.16 **	0.84	0.74
	0.48	*0.49*	*0.56*	*0.53*	*0.52*	*0.81*
Log of GDP per capita	0.33 *	0.18	-0.02	-0.10	-0.36	-0.53
	0.19	*0.20*	*0.23*	*0.27*	*0.23*	*0.28*
Share of GDP spent on health (%)	0.19 **	0.18 ***	0.14 **	0.15 **	0.10	0.10
	0.08	*0.07*	*0.07*	*0.06*	*0.06*	*0.09*
Births attended by skilled health personnel (%)	0.020 ***	0.022 ***	0.024 ***	0.021 ***	0.021 ***	0.017 *
	0.006	*0.006*	*0.006*	*0.006*	*0.005*	*0.009*
PEPFAR dollars per capita		0.0041 *	0.0032	0.0035 *	0.0048 **	0.0056 ***
		0.0021	*0.0022*	*0.0019*	*0.0018*	*0.0018*
Global Fund (HIV) dollars per capita		0.034 *	0.026	0.010	0.023	0.032
		0.020	*0.028*	*0.024*	*0.024*	*0.027*
Established democracy			0.01			
			0.43			
State legitimacy			1.08 **	0.62 **	0.26	0.35
			0.46	*0.29*	*0.24*	*0.40*
Electoral accountability			-0.14			
			0.14			
Press freedom			0.00			
			0.01			
Political stability			-0.05			
			0.16			
Cultural fractionalisation			0.84			
			0.70			
Log of non-AIDS DALYs per capita				-0.56	-0.64 *	-0.79 *
				0.41	*0.34*	*0.41*
Latin America and the Caribbean					1.13 **	
					0.43	
East, South and South-East Asia					0.36	
					0.32	
Eastern Europe and Central Asia					2.44 ***	
					0.40	
Southern Africa mega epidemics					0.03	0.05
					0.42	*0.44*
Constant	-3.82 ***	-2.84 **	-1.21	-1.27	0.78	2.12
	1.16	*1.29*	*1.64*	*1.59*	*1.51*	*1.77*
R^2	0.59	0.62	0.69	0.68	0.78	0.70
F-statistic	18.03 ***	16.83 ***	10.55 ***	17.71 ***	71.13 ***	13.87 ***
Observations (N)	55	55	53	55	55	36

*Note: Robust standard errors are in italics below the coefficients; *,**,*** stand for significance at the 10%,5% and 1% level respectively.*

The non-AIDS DALYs have a negative coefficient but do not achieve significance in Regression 4. On adding this variable, the coefficient of the state legitimacy dummy decreases substantially. This may be the reflection of legitimate states doing a better job of subverting health crises than non-legitimate states.

Regression 5 adds the regional dummy variables and represents the best model of MTCTP coverage. The R^2 of 0.78 is very high. The regional dummies reveal that even once the other explanatory variables are controlled for, countries in Latin America and the Caribbean and Eastern Europe and Central Asia seem to be much more successful in rolling out ARVs for MTCTP than countries in other regions of the world.

The proportion of HIV positive people in urban areas, the GDP per capita, the share of GDP spent on health and state legitimacy were significant in previous regressions, but are no longer significant in Regression 5. Compared to HAART coverage, it is plausible that the concentration of people in need of MTCTP and health care professionals in urban areas matters less because MTCTP is easier to administer. Because MTCTP is also much cheaper to administer than HAART it is plausible that the share of the resources a society commits to health care is less consequential.

PEPFAR money makes a significant and sizable contribution to MTCTP coverage. Global Fund money is not revealed to have an impact on MTCTP coverage. Possible explanations for this are the selection bias mentioned earlier; the fact that MTCTP is cheaper and easier to administer than HAART and countries would have been able to introduce it without outside assistance; or that the Global Fund prefers committing money to interventions other than MTCTP.

The adult HIV prevalence rate and the percentage of births attended by skilled health personnel are associated with significantly higher levels of MTCTP coverage. Furthermore, the incident of other health crises measured by the non-AIDS DALYs negatively impacts on MTCTP coverage. Even though this variable is only significant at the 10% level, its large negative coefficient indicates that the opportunity costs in terms of health of committing one dollar to MTCTP matters substantially.

Regression 6 tests the robustness of the model applied to countries in sub-Saharan Africa. All variables maintain their signs. The adult HIV prevalence is no longer significant. The effects of births attended by skilled personnel, PEPFAR dollars and the non-AIDS DALYs remain significant, even though the births attended by skilled personnel only achieves significance at the 10% level. The model can explain much of the variation in MTCTP coverage across countries in sub-Saharan Africa.

7. Conclusion

Regression analysis can establish that variables are statistically correlated; in combination with theoretical links between variables it can also provide some support for arguments posing causal connections between the dependent and independent variables. The regressions presented here provide support for the hypothesis that, holding other things equal, a high HIV prevalence rate positively impacts on ARV coverage, probably because AIDS is more likely to be a national priority in high prevalence countries. HAART coverage is also higher in countries that experience a concentration of the epidemic in urban areas. This is probably because it is easier to target people in need of HAART if they are in close proximity to the majority of health professionals.

Neither GDP *per capita* nor the share of GDP spent on health are revealed to have an effect on MTCTP coverage. The regression analysis also does not indicate a positive effect of GDP *per capita* on HAART coverage. A society's willingness to commit resources to health over other uses as measured by the share of GDP spent on health, however, is associated with higher levels of HAART coverage. This is an important result since we are dealing with a variable that government has some control over and can hope to affect in the short-run. It has to be noted though that the effect of these economic variables on ARV coverage was estimated in the absence of a variable that captures the price of ARVs in different countries. If price data were available, including a price variable in the analysis would increase the strength of conclusions regarding the effect of the economic variables on ARV coverage.

MTCTP coverage is positively affected by the percentage of births attended by qualified health personnel. It is negatively affected by the incidence of other health crises as measured by the non-AIDS related DALYs.

On average, countries in Latin America and the Caribbean achieve higher HAART and MTCTP coverage. Countries in Eastern Europe and Central Asia achieve lower HAART coverage and substantially higher MTCTP coverage than other countries even once a host of explanatory variables are controlled for. The fact that countries in this region are very successful in rolling out ARVs for MTCTP indicates that they have a good health infrastructure in place. These countries' failure to roll out HAART may thus potentially be the result of a political choice rather than a lack of capacity. A more focused comparative study of the determinants of HAART coverage in Latin America and the Caribbean on the on hand, and Eastern Europe and Central Asia on the other hand, is likely to reveal valuable insights into the role played by political will in rolling out ARVs and to what extent this political will is shaped by the context in which government officials make decisions.

The positive coefficients of the PEPFAR and Global Fund variables are highly topical. On April 2 of 2008, the United States House of Representatives passed a bill that commits another 50 billion dollars to the fight against AIDS over the next five years. More than the current 15 PEPFAR focus countries will be targeted in this initiative. The results of the regression analysis imply that this aid money is likely to go a long way in achieving greater ARV coverage in the developing world.

References

AIDS Accountability International. (2007). "Relative Response: Ranking Country Responses to HIV and AIDS", AIDS Accountability International, Stockholm, Sweden (unpublished draft).

AIDS Program Effort Index (API). (2003). *"Level of effort in the national response to AIDS: The AIDS Program Effort Index 2003 Round"*, POLICY Project, Washington. Available on the web: http://www.policyproject.com/pubs/monographs/API2003.pdf.

Barnett, T. and Whiteside, A. (2002). "*AIDS in the 21st Century: Disease and Globalisation*", New York: Palgrave MacMillan.

Bor, J. (2007) "The Political Economy of AIDS Leadership in Developing Countries: An Exploratory Analysis", in *Social Science and Medicine*, 64: 1585-1599.

Chin, J. (2007). "*The AIDS Pandemic: The Collision of Epidemiology with Political Correctness*", Radcliffe Publishing, Oxford.

Dal Poz , M., Yohannes, K., Dräger, S. & Kunjumen, T. (2006). *"Counting health workers: definitions, data, methods and global results"*, Department of Human Resources for Health Evidence and Information for Policy, World Health Organization, Geneva.

Englebert, P. (2000). "Solving the myth of the African Dummy", in *World Development*, 28(10): 1821-1835.

Fearon, J. (2003). "Ethnic Structure and Cultural Diversity by Country", in *Journal of Economic Growth*, 8:195-222.

Ford, N. *et al*. (2007). "Sustaining access to antiretroviral therapy in the less-developed world: lessons from Brazil and Thailand", in *AIDS*, 21(suppl 4), pp.S21-S29.

Global Fund. (2007). "*Partners in Impact: Results Report*", December 2007. The Global Fund, Geneva. Available on the web: http://80.80.227.97/en/files/about/replenishment/oslo/Progress%20Report.pdf

Hahn, J. & Hausman, J. (2005). "Instrumental Variable Estimation with Valid and Invalid Instruments", Unpublished paper, Cambridge, MA, July.

Hosseinipour, M., Kazembe, P., Sanne, I. & van der Horst, C. (2002). "Challenges in delivering antiretroviral treatment in resource poor countries", in *AIDS,* 16(suppl4): 177–187

Iliffe, J. (2006). "*The African AIDS Epidemic: A History*", James Currey and Double Storey, Cape Town.

Jackson, J.B. *et al.* (2003). "Intrapartum and neonatal single-dose nevirapine compared with zidovudine for prevention of mother-to-child transmission of HIV-1 in Kampala, Uganda: 18-month follow-up of the HIVNET 012 randomised trial." in *Lancet*, 362:859–68.

Levi, G. & Vitoria, M. (2002). "Fighting against AIDS: the Brazilian experience", in *AIDS*, 16:2373–2383

Lieberman, E. (2007). "Ethnic Politics, Risk, and Policy-Making: A Cross-National Statistical Analysis of Government Responses to HIV/AIDS", forthcoming in *Comparative Political Studies.*

Mauchline, K. (2008). Official Government Justifications and Public ARV Provision: A Comparison of Brazil, Thailand and South Africa, CSSR Working Paper no.214, April 2008. Available on the web: http://www.commerce.uct.ac.za/Research_Units/CSSR/Working%20Papers/papers/km214.pdf.

Nattrass, N. and Geffen, N. (2005). "The Impact of Reduced Drug Prices on the Cost-Effectiveness of HAART in South Africa", in *African Journal of AIDS Research*, 4, 1, pp. 65-78.

Nattrass, N. (2006). "What Determines Cross-Country Access to Antiretroviral Treatment?", in *Development Policy Review*, 24 (3): 321-337

Nattrass, N. (2007). "Mortal *Combat: AIDS Denialism and the Fight for Antiretrovirals in South Africa"*, University of KwaZulu Natal Press.

Oliveira-Cruz, V., Kowalski, J. & McPake, B. (2004). "Viewpoint: The Brazilian HIV/AIDS 'success story' – can others do it?", in *Tropical Medicine and International Health*, 9(2):292–297

Parker, R. (2000). "A Summary Discussion of the Development of HIV/AIDS Policy in Brazil", *Urban Health and Development Bulletin* 3(2). Medical Research Council of South Africa. Available on the web: www.mrc.ac.za/ubanbulletin/june2000.

Rodrik, D. (2000). "Institutions for high-quality growth: What they are and how to acquire them", Working Paper 7540, National Bureau of Economic Research, Cambridge.

Sen, A. (1999). "*Development as Freedom"*, Anchor Books, New York.

Smith, D. (2003). "*The Penguin Atlas of War and Peace"*, Penguin Books, Harmondsworth.

UNAIDS (2006). "*Report on the global AIDS epidemic*". Available on the web: http://www.unaids.org/en/KnowledgeCentre/HIVData/GlobalReport/Default.asp

World Health Organisation. (2007). "*Towards Universal Access: Scaling up Priority HIV/AIDS Interventions in the Health Sector. Progress Report, April 2007*" Available on the web:
http://www.who.int/hiv/mediacentre/univeral_access_progress_report_en.pdf

World Health Organisation. (2008). "Health information systems and statistics". Available on the web: http://www.who.int/healthinfo/boddaly/en/