The Impact of HIV on Economic Development

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Abstract

This paper estimates the impact of the HIV epidemic on the economic development taking place around the world. The focus is put on the World Bank measurements taken of various countries and other significant populations in 2003. Through these measurements, the annual growth rate is compared with the HIV prevalence rate in order to determine the impact. Even though the effect is only marginally significant, the data does show a slight negative effect on the economic growth around the world. These results suggest that as the pandemic increases in severity, the development of areas around the world will be adversely affected. However, when specific areas of interest, such as the African region and country income, are analyzed the results become more ambiguous.

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I. Introduction

Economic development is the development of economic wealth of countries or regions for the well-being of their inhabitants. Public policy normally endeavors to attain sustainable economic growth during the development of a country. However, economic growth and economic development are two different things. Economic growth is the increase in value of the goods and services produced by an economy. While economic development strives to provide a sustainable increase in the living standards of a community. This is commonly done through a number of advancements which include increased per capita income, education and health benefits.

Therefore, the growth of the economy does not necessarily increase the development since increasing the productivity of a region does not necessarily increase the standard of living in that region. However given that there is no empirical way to measure the standard of living in a community, economic growth becomes a good proxy variable.

Since HIV/AIDS was classified as an epidemic there have been fears that the disease could have a negative impact on economic growth. A number of studies have been done, however the results of these studies have varied from AIDS having no impact on economic growth to it having a significant impact. This study will analyze the 2003 world data to identify whether or not there is a global effect, or even sub-Saharan Africa effect, on economic growth. The impact HIV has on economic growth will be measured in conjunction with other variables that affect the economic growth of

a region, such as the gross fixed capital formation of the area and the change in the work force. As HIV is measured with these other variables, its impact on the change in the economy can be measured. Other variables will then be added to the model in order to determine if there is a change in the impact of HIV differs in specific scenarios.

II. Literary Review

According to UNAIDS/WHO 2006 report, there were approximately 36.2 million people living with HIV/AIDS in 2003. With 5.3 million more infections occurring in 2000, the epidemic does not appear to be slowing down (Piot, 2001). An estimated 70 percent of these infections are located in Africa. In many African countries, there are extensive HIV/AIDS cases that strongly affect their present economic and social conditions. "Before the AIDS epidemic, adults in their economically most productive years were dying at a rate of about five to six per thousand persons a year, or eight times the rate in industrial countries. In many African countries, particularly in urban areas, the baseline adult mortality rate has doubled or tripled, and AIDS is now the major cause of adult deaths" (Ainsworth, 1994, 203). Since AIDS has a high presence among productive adults, it will have a larger impact on African development than other diseases. Already it has been estimated that the life expectancy at birth is 49 years in the 7 African countries with prevalence rates over 20%. This is 13 years shorter than in the absence of AIDS (Gaigbe-Togbe, 2004). These demographics should have various impacts throughout the community.

There are five general areas that HIV/AIDS can affect the overall economy. These areas include individual households, private sectors, agriculture, health, and education.

The impact on the household is potentially the largest. The household is usually responsible for caring for their infected member while at the same time losing the income that the member would have earned. A study from Tanzania documented that "after the death of a prime-age male household head, 42.5 percent of households had dissolved (remaining members moved away) within one year after the death" (Negin, 2005, 272). Although these results are culturally unlikely to take place worldwide, the results indicate extreme stress in taking care of a household member in the African region.

The HIV/AIDS virus does not just affect the infected individual's immediate contacts, but could also impact the community around them. Dixon (2002) referenced a 1992 study that was done by Kambou (1992) to assess the impact on Cameroon's economy when there where changes in the labor force due to HIV/AIDS infections. The study concluded that the reduced availability of skilled labor would "reduce growth rates by about 50% and investment by 75%, that imports of food and other basic products would increase, and that exports of manufactured and other products would decline" (Dixon, 2002). Since more than 70 percent of Africa's population is working in the agriculture sector, HIV/AIDS will have a dramatic impact as the labor force also decreases.

The final two areas, education and health, can be affected both directly and indirectly. HIV/AID can affect the whole community indirectly by having fewer skilled teachers and health professionals to help the community. Furthermore, the health field will spend a great deal of money treating people, not just for AIDS but for others diseases contracted because of the virus such as tuberculosis. Also it could have a direct affect on education when children have to stay home to take care of a family member or provide

money for the household. Health can also be affected in this way, because as someone takes care of a person with a disease like tuberculosis, they are more likely to contract the disease.

All of these impacts can have a negative impact on the overall economy; however the empirical data is more ambiguous. Haacker (2004) suggests two shortcomings when observing the interpretations of empirical studies. First, it is hard to distinguish if the observed changes will reflect future changes since the economy is still adjusting to a new equilibrium after the shock of the presence of the virus. Second, both the dependent and independent variables have too much approximation error to be taken as fact. This case occurs since most of the HIV data, especially in Africa, was estimated from the blood tests of pregnant women who went to clinics. Therefore, the approximated prevalence rates may have a high variation of error, causing the growth data to be unreliable. Gaigbe-Togbe (2004) points out another reason for the unreliability of the empirical data to discern impacts from the virus. He observes that most affected countries in the world are also faced with drought, war and other problems. These problems could also have strong effects on the economic growth.

Alemu et al (2002) looked specifically at the impact of HIV on total factor productivity in order to infer the effects on economic performance. When Alemu et al (2002) looked at the countries with a prevalence rate of less than 1 percent; they found no threat to their economic performance. However, for most Southern African countries with high prevalence rates, HIV can have a large negative impact on factor productivity growth. Therefore, high HIV prevalence rates can have large, negative impacts on the economic performance of these countries through total factor productivity. Ouattara

(2004) partially refutes this by showing that the lack of using a health policy to stabilize the HIV infection rate leads to a decrease in the growth rate of the economy at any prevalence level.

The implication that HIV has a negative effect on the economy is further supported by the results of McDonald and Roberts (2006), who examine the impact estimates for the percentage change in income per capita when there is a 1% change in the HIV prevalence rate. In many cases "the HIV impacts are negative, with Africa recording an average reduction of 0.59% in income per capita for a 1% increase in HIV prevalence, while the World and Developing World sample indicate negative impacts of 0.05% and 0.08%" (McDonald and Roberts, 2006, 241). Even though there are some countries in which the impacts are insignificant, McDonald and Roberts (2006) generally show a negative HIV impact on economic development.

Bell et al (2004) not only concurs with McDonald and Roberts (2006) but attempts to show why there is some ambiguity in the earlier findings. Bell et al (2004) states that when earlier studies simply used the Solow growth model when applying empirical data to countries heavily afflicted by AIDS, the model yields the predictable result that the epidemic tends to reduce the aggregate rate of growth. At the same time, however, it will show as increase in the rate of growth of GDP per capita. In order to correct for this, Bell et al (2004) suggest using the overlapping generation framework since AIDS is an epidemic that primarily affects the young. This is shown through the difficulty infected men and women have when trying to provide for their children, which could possibly lead to a whole generation of undereducated and underproductive youth. When these youth reach adulthood, they could then find it difficult to provide for their

children, and so on. This cycle could prevent an otherwise successful economy from growing when strongly impacted by the AIDS epidemic. Since this downward spiral will not be felt immediately, estimates of the economic impact that AIDS has on a society can be deceptive if the study only looks at the reduction of labor in the short- to medium-run. These results signify that the ambiguity indicated in earlier studies occurred because all the consequences were not taken into account over a great enough period of time.

III. Methodology

This study looks at the affect that HIV has on economic development. In order to determine whether or not HIV has an affect on development, the annual percentage of GDP per capita growth in 2003 (GDPc) will be regressed against the gross fixed capital formation in 2003 (GFC), the percentage labor change between 2002 and 2003(LFperc), and the percentage of the population between 15 and 49 who has HIV (HIV) as shown in equation (1).

$$GDPc = \alpha_0 + \alpha_1 GFC + \alpha_2 LFperc + \alpha_3 HIV + \varepsilon_i \quad (1)$$

This model will indicate the growth in an area by measuring the annual percent change in the gross domestic product per capita. The major advantages to using GDP per capita as an indicator of standard of living are that it is measured frequently, widely and consistently. The technical definitions used within GDP are relatively consistent between countries, and so there can be confidence in its measurement in each country. Since economic development is typically measured by indicators of a change in the standard of living, this equation shows the impact that HIV will have on economic development.

The data is attained from all World Bank member economies and all other economies with populations of more than 30,000. Using the World Bank Indicator 2006 this data measures not only countries, but significant sized populations as well. The data is attained for the year 2003 in order to use the most up to date and complete information. Using this data, the impacts of HIV on economic growth can be assessed through the gross domestic product per capita.

Other factors that can affect the gross domestic product per capita are added to HIV on the right hand side. These include the total gross fixed capital formation for each region in that year as well as the change in the amount of people working in 2002 to 2003. The HIV prevalence rate between the ages of 15-49 is looked at because those are the years in which people generally are most productive in society adding to the economic impact of their community.

For World Bank purposes, the countries were divided among income groups according to 2004 gross national income (GNI) per capita, which was calculated using the World Bank Atlas method. The groups are: low income, $825 or lower; lower middle income, $826–3,255; upper middle income, $3,256–10,065; and high income, $10,066 or more.

IV. Empirical Results

An OLS regression of equation (1) is shown in Table 1. Using the information in Table 1, HIV has a marginally significant impact on growth at the 10% level. The gross fixed capital is also shown to have a significant affect on the economic growth, while the percent change in the labor force is insignificant. Intuitive reasoning would show that the

gross fixed capital of a region and the percentage of workers in the labor force should have a positive correlation with the gross domestic product per capita, while the HIV prevalence rate should have a negative correlation. The gross fixed capital does have a significant positive correlation with growth. The percentage of people in the labor force also follows the common thought process when compared to GDP per capita. However, this result is insignificant. One reason this might be the case is that this data is only looking at a snapshot change between 2002 and 2003 which might not show the significant shifts in the labor market with the economy. Furthermore, HIV empirically conforms to intuitive reasoning; however, the results are only marginally significant.

The validity of the model is tested for multicollinearity between the right-hand-side variables and whether or not there is heteroskedasticity in the model. Since the HIV prevalence rate is looking at people between the ages of 15 and 49, there is a chance that there might be some correlation between the proportion of people who are able to work and the percentage of people who have the virus. However, the correlation among the right-hand-side variables is not large enough to suggest that multicollinearity is a problem.

The Breusch-Pagan test is used to test for heteroskedasticity. If the Breusch-Pagan test results in a small enough p-value, some corrective measures should be used. Since this study is accepting HIV being marginally significant at a 10% level, the heteroskedasticity will be measured at the same significance level. Therefore a p-value of 5.6% reveals that the error terms exhibits non-constant variance. Consequently, the presence of heteroskedasticity needs to be corrected in this model. This is also shown in the starred columns in Table 1. The heteroskedastic-robust model decreases the

significance of the variables slightly; however HIV still has a negative impact on growth and is marginally significant at the 10% level.

Several variations of this model are also examined. A dummy variable is added to account for the African countries in Table 2. When this value is added, HIV is no longer significant. This result is a little unexpected since there is a higher prevalence rate in Africa then in many other places around the world. However, there are some explanations as to why the effect of HIV on a population is less even though there are more people infected. A possible explanation would be that Africa has many other shocks that effect development, such as civil wars and famines, which could lessen the impact of HIV on development.

Another variation on the model is included to differentiate by a country's income level. Dummy variables for low, medium, and high income countries were also analyzed. Table 2 also shows that the effect of HIV seems to have a greater negative impact on growth in the higher income countries. The income dummy variables have a significant HIV impact on the economic growth. However, when the African dummy variable is added to the equation in Table 2, formula 6, HIV has no significant impact on economic growth. The greater impact from HIV on high income countries rather than low income countries can also be explained. First, in many low income countries HIV is still a taboo disease. Therefore, the people in the countries where the disease is taboo are less likely to seek out medical help. The avoidance of diagnosing HIV in various low income countries implies that even though the rate of infection may be higher in some developing countries, the rate of treatment could be lower than the treatment rate in higher income countries. Another explanation is that more money is spent in higher income countries, not just on

treatments, but on research in order to attempt to find a cure. Treatments themselves cost more in high income countries, because low income countries, especially those with high estimated HIV prevalence rates, usually have their medications subsidized. The high income countries also spend more money on research and development since they have the medical capital needed in order to pursue testing to find a cure or improvements on the treatment drugs.

An interactive variable was also constructed in order to relate the percentage change in the labor force with the prevalence of HIV in Table 3. This variable will tell us if the percent of people working with HIV has an impact on the economic growth. The interactive term shows an insignificant relationship between the change in the labor force and the HIV infection rate.

V. Conclusion

Economic development is the development of economic wealth of countries or regions for the well-being of their inhabitants. This well-being usually referred to as the standard of living, can not be measured empirically. Therefore, the economic growth of an area is used instead. There are five general areas that HIV/AIDS can affect the overall economy as well as influence the standard of living in a region. These areas include individual households, private sectors, agriculture, health, and education. As HIV impacts these areas, it impacts the economic development of the region.

This study shows that HIV has a negative and marginally significant impact on economic growth. However, when the data is constrained to a certain area, the results become less accurate. In order to determine the impact of HIV on a smaller region, more

data needs to be analyzed. Also other factors that could potentially impact the development of a region should be analyzed.

Although this study appears to agree with the intuitive reasoning that HIV will have a negative relationship with growth, the results are still only marginally significant. The ambiguity found in the results of the impact of HIV on economic development might be attributed to the fact that HIV has intergenerational effects. HIV is a fairly new disease having just been classified in the 1980s. HIV is still culturally unacceptable in parts of the world and much of the data are estimates. However, with time and advancements in the knowledge of this disease becomes more common place in developing countries, a better estimate of the impact of the pandemic could be taken.

VI. Tables

Table 1

OLS Results					
Parameters	Parameter estimates	Se	t	se*	t*
Intercept	-1.49	1.40	-1.06	2.18	-0.68
GFC	0.23[a]	0.06	3.96	0.08	2.96
LFperc	-0.29	0.25	-1.15	0.25	-1.16
HIV	-0.11[c]	0.06	-1.79	0.07	-1.68
F-statistic	6.72			2.58	
Adjusted R^2	0.1135			0.0343	
B-P p-value	0.0560				

Notes: se – standard errors of the parameters
t – T-statistics of the parameters
* - after parameters are corrected for heteroskedasticity
B-P p-value – the significance level of the F-test of the error term
a, b, c – significant at the 1%, 5%, and 10% level respectively

Table 2

OLS Dummy Variable Results									
Parameters	2	3	4	5	6	2*	3*	4*	5*
Intercept	-1.24	-1.39	-0.09	-2.97[b]	-2.82[c]				
	(1.41)	(1.41)	(1.45)	(1.46)	(1.47)	(1.95)	(2.02)	(2.52)	(1.89)
	[-0.88]	[-0.99]	[-0.06]	[-2.03]	[-1.93]	[-0.64]	[0.69]	[-0.04]	[-1.57]
GFC	0.22[a]	0.23[a]	0.22[a]	0.22[a]	0.21[c]				
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.08)	(0.08)
	[3.77]	[3.92]	[3.95]	[3.89]	[3.70]	[3.14]	[3.29]	[2.75]	[2.75]
LFperc	-0.18	-0.21	-0.57[b]	-0.44	-0.41				
	(0.26)	(0.27)	(0.26)	(0.28)	(0.28)	(0.32)	(0.34)	(0.23)	(0.38)
	[-0.70]	[-0.79]	[-2.15]	[-1.57]	[-1.48]	[-0.56]	[-0.61]	[-2.48]	[-1.16]
HIV	-0.04	-0.10	-0.16[b]	-0.14[b]	-0.08				
	(0.08)	(0.06)	(0.06)	(0.06)	(0.08)	(0.08)	(0.06)	(0.07)	(0.06)
	[-0.56]	[-1.50]	[-2.55]	[-2.18]	[-1.03]	[-0.50]	[-1.67]	[-2.29]	[-2.33]
dAfr	-1.51				-1.68				
	(1.13)	-	-	-	(1.45)	(1.48)	-	-	-
	[-1.34]				[-1.16]	[-1.02]			
dLIC		-0.72		1.77	2.67[c]				
	-	(0.91)	-	(1.20)	(1.42)	-	(1.19)	-	(1.47)
		[-0.79]		[1.48]	[1.87]		[-0.61]		[0.83]
dlMIC				3.01[a]	3.01[a]				
	-	-	-	(1.14)	(1.14)	-	-	-	(0.89)
				[2.65]	[2.65]				[3.38]
duMIC				3.47[a]	3.50[a]				
	-	-	-	(1.24)	(1.23)	-	-	-	(0.89)
				[2.81]	[2.83]				[3.90]
dHIC			-2.81[a]						
	-	-	(1.00)	-	-	-	-	(0.83)	-
			[-2.82]					[-3.39]	
F-statistic	5.52	5.18	7.30	5.31	4.75	2.50	2.79	2.44	2.03
Adjusted R^2	0.1188	0.1110	0.1582	0.1617	0.1639	0.0427	0.0507	0.0413	0.0440
B-P p-value	0.0460	0.0292	0.0499	0.0665	0.1036				

Notes: () – standard errors of the parameters
[] – T-statistics of the parameters
* - after parameters are corrected for heteroskedasticity
B-P p-value – the significance level of the F-test of the error term
a, b, c – significant at the 1%, 5%, and 10% level respectively

Table 3

OLS Results					
Parameters	Parameter estimates	Se	t	se*	t*
Intercept	-1.35	1.43	-0.95	2.27	-0.59
GFC	0.22[a]	0.06	3.73	0.08	2.75
LFperc	-0.23	0.27	-0.87	0.24	-0.96
HIV	-0.10	0.07	-1.44	0.07	-1.42
LFHIV	-0.03	0.05	-0.59	0.05	-0.60
F-statistic	5.10			2.36	
Adjusted R^2	0.1090			0.0199	
B-P p-value	0.0982				

Notes: se – standard errors of the parameters
t – T-statistics of the parameters
* - after parameters are corrected for heteroskedasticity
B-P p-value – the significance level of the F-test of the error term
a, b, c – significant at the 1%, 5%, and 10% level respectively

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