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HIV-AIDS in the Caribbean: Economic Issues-Impact and Investment Response

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HIV/AIDS IN THE CARIBBEAN: Economic Issues-Impact and Investment Response

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HIV/AIDS IN THE CARIBBEAN:
Economic Issues- Impact and Investment Response

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Abstract

The paper presents updated information on the estimated impact of HIV/AIDS on the economies of the Caribbean. The author uses the output of a 1997 study on the economic impact of HIV/AIDS in Jamaica and Trinidad and Tobago as the starting point and updates the projections for these two countries based on some adjustments to some of the underlying assumptions in respect of the epidemiology of the disease. Estimates are also derived for St. Lucia.

Estimates of the economic losses associated with the incidence of the disease in these three countries are placed within the context of the present outlays on health as well as in the context of the development objectives of these island states. The study identifies four channels through which the HIV/AIDS epidemic can impact on the development process and makes the case that the epidemic has the potential to distort this process. The study ends by quantifying the level of resources that would be needed if the region is to adequately respond to the threat of this modern day plague.

INTRODUCTION

The information on the world experience of HIV/AIDS borders on the incredible. This is especially so for policy makers and even health workers in the Caribbean, where, for the English-speaking sub-region the population is less than 8 million and for the wider Caribbean it is just over 30 million. It is difficult for the people of this region to fully absorb and respond to the reality that since the early 1980s when the disease was first recorded in the region, the epidemic has claimed the lives of more than 16 million people world-wide and it is estimated that a further 34 million are presently infected (UNAIDS 2000). There is something unreal about the information. The message has probably begun to sink in, however, as we contemplate the rate at which the AIDS deaths have been taking place. According to the UNAIDS, whereas the epidemic claimed the lives of 1.5 million people in the 1980s, in the subsequent decade it claimed 15 million more lives, and it is expected to claim another 15 million lives in the first half of the present decade (UNAIDS 2000). On a global scale therefore, the rate of increase in deaths between the first and the second decade was 900 percent and the projected rate of increase for the present decade is at least an additional 100 percent. When we turn to the Caribbean we find that while just under 1,100 deaths were recorded in the first decade, by the end of the second decade another 7,000 deaths had occurred - an increase of 500 percent. Even if we make allowances for better recording of deaths in the second decade, the corresponding rates of increases in rates are mind-boggling.

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[1] A paper prepared and submitted to the WHO Working Group of the Commission on Macroeconomics and Health
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As we turn from AIDS deaths to HIV infection there is an equally alarming picture. *"In just 20 years, over 50 million people have been infected with HIV. Countless others have become more impoverished as a consequence: children have lost their parents, families have lost their property; communities have lost teachers, health workers, business and government leaders…and societies have lost untold potential contributions to their social, economic, political, cultural and spiritual life with the deaths of millions of young people in their most productive years*." [UNAIDS Draft Global HIV/AIDS Strategy Framework, Draft, Sept 2000 p. 3]

While data limitations make it difficult to make a similar statement about the Caribbean we do know that as far as AIDS cases are concerned, even with the under-reporting that is known to be taking place, the reported number of cases of infection is now close to 460,000 (Caribbean Task Force on HIV/AIDS 2000). Using a world population estimate of 6 billion, all of whom can be assumed to be at risk, the presumed prevalence worldwide would be 0.57 per cent. For the Caribbean, using a population estimate of 34 million, overall prevalence is estimated at 1.35 percent, almost two and a half times the world level.

As if the news so far were not bad enough, UNAIDS reminds us that the major impact of the pandemic is yet to come. *"While it is difficult to predict the future spread of the epidemic, the impact in terms of morbidity and mortality in the next decade is clear. In the absence of effective treatment and care, an additional 15 million people currently infected with HIV will develop AIDS and die in the next five years*." [UNAIDS, 2000]

This is the context in which we need to place our analysis of the economic impact of HIV/AIDS in this region. For while it is obvious that the epidemic will harm the productive capacity, and with it, the income and wealth creating potential, of the region, we seem to be in a race against time. We have reasonably good information about the rate at which the pandemic is developing. However, we do not yet have as equally robust information on the rate at which the epidemic is destroying the economic and development potential of the Caribbean. Yet, the timing, the scale and the quality of the region's response will most assuredly need to be informed by our knowledge of the projected economic impact of this disease.

In order to arrive at a functional understanding of the genesis of the economic impact it will be necessary to understand the specifics of the epidemiology of the disease in the Caribbean. This issue is addressed in the following section.

THE EPIDEMIOLOGY OF THE DISEASE IN THE REGION

According to the data in Table 1 below, at the end of 1999, the Caribbean registered the highest prevalence after Sub Saharan Africa. Studies by the Caribbean Epidemiology Centre (CAREC) and the University of the West Indies (UWI) suggest that the predominant mode of transmission of the virus is still via sexual contact, of which 63% can be classified as heterosexual and 12% due to homosexual, male-to-male contact (CAREC/UWI 1997). Further, the World Bank suggests than in excess of half the number of cases to date have been due to unprotected sex

between men and women (World Bank,2000). Moreover, strong social, cultural and legal discrimination against homosexual males has resulted in gross underestimations of the incidence. What is worrying from an economic perspective is that the disease appears to be impacting most heavily on young and middle-aged adults where it has become the leading cause of death among the 15 to 44 age group - the core of the productive labour force (Caribbean Task Force on HIV/AIDS 2000).

In Table 1 we present the ***adult*** prevalence estimates for the different regions of the world. The data show that the Caribbean ranks second to Sub-Saharan Africa with a rate of 1.96 percent. This compares to Latin America with a rate of 0.57 percent and the USA with a similar rate of 0.56 percent.

Table 1

ADULT HIV/AIDS PREVALENCE RATE BY REGION (DEC. 1999)

REGION	ADULT PREVALENCE RATE (*)	PERCENT OF HIV POSITIVE ADULTS WHO ARE WOMEN
Sub Saharan Africa	**8.0%**	**55%**
North Africa & Middle East	0.13%	20%
South & South East Asia	0.69%	30%
Latin America	0.57%	20%
CARIBBEAN	**1.96%**	**35%**
Eastern Europe & Central Asia	0.14%	20%
Western Europe	0.25%	20%
North America	0.56%	20%

*: the percentage of adults age 15-49 living with HIV in 1999 based on 1998 populations.
Source: UNAIDS 1999; 2000.

More detailed prevalence rates for the region are presented in Table 2. The Table reflects the data difficulties already alluded to in that they are not only three years out of date, but there are also serious gaps across the different countries.

Table 2:
Regional Prevalence and Incidence Rates

Country	HIV Prevalence Rate* (%, 1997)	HIV/AIDS Incidence Rate (Per 100,000 pop. 1996)
Antigua and Barbuda	…	204.9
Bahamas	3.77	1321.6
Barbados	2.89	498.1
Belize	1.89	173.5
Cuba	0.02	9.0
Dominica	…	207.6
Dominican Republic	1.89	51.5
Grenada	…	189.6
Guyana	2.13	171.8
Haiti	5.17	119.3
Jamaica	0.99	211.6
Montserrat	…	78.7
St Kitts and Nevis	…	145.0
St Lucia	…	94.0
St Vincent and the Grenadines	…	160.6
Suriname	1.17	46.8
Trinidad and Tobago	0.94	317.7
US Virgin Islands	…	242.7
United States of America	…	207.9

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* Adult rates (%) are derived from the number of total adults (15-49) living with HIV/AIDS at the end of 1997 divided by the 1997 adult population**.. Source**: UNAIDS Report on the Gobal HIV/AIDS epidemic, June 2000

This information is to be seen in conjunction with the results obtained from surveys among certain high risk groups. The table below details the prevalence among these groups in selected Caribbean Countries.

Table 3
HIV/AIDS Prevalence among Selected Population Groups in The Caribbean

Country	Study Population	Year of Study	% Testing HIV Positive
Trinidad and Tobago	Commercial Sex Workers	1998	13
Jamaica	Commercial Sex Workers	1994-5	11
Guyana	Commercial Sex Workers	1993	22
Port of Spain	STD Clinic Attendees	1991	13
San Fernando	STD Clinic Attendees	1996	6
St. Vincent and the Grenadines	STD Clinic Attendees	1995	2
Bahamas	STD Clinic Attendees	1995	7.2
Guyana	STD Clinic Attendees (men)	1995	21
Guyana	STD Clinic Attendees (women)	1995	6.6
Jamaica	STD Clinic Attendees (voluntary testing)	1998	7

Source: Caribbean Task Force on HIV/AIDS: HIV/AIDS in the Caribbean-Addressing the Challenges and Opportunities for Strengthening the National and Regional Response to the Epidemic.

Partly because of the extended period of economic adjustment, in some countries of the region commercial sex workers have become a more visible component of the service sector. The implications for the spread of HIV are being to be taken seriously. Since it is possible that some of these sex workers may be part of the cause of the derived demand for STD clinic services, from a prevalence point of view it is important that there is continuous monitoring of these workers and STD clinic attendees. Information on these groups is presented below.

Prevalence rates vary between the countries of the region and the populations that are most affected are also different. Moreover, prevalence is highest among commercial sex workers, STD clinic attendees and Tuberculosis patients. The groups at risk are changing as the greatest incidence of the epidemic has been shifting to young people who continue to have unprotected sex, as well as among men having sex with men. Statistics suggest that 70% of all cases in the region are among the 15-44 age group.

The evidence also shows increases in the absolute number of cases among women. Since 1995 the absolute number of cases among women increased by a factor of 1.7 and while there are generally more males affected, a disturbing finding is that in the 15-19 age group it is the adolescent girls that are especially vulnerable. This also partially explains the observed increases in the number of paediatric AIDS cases.

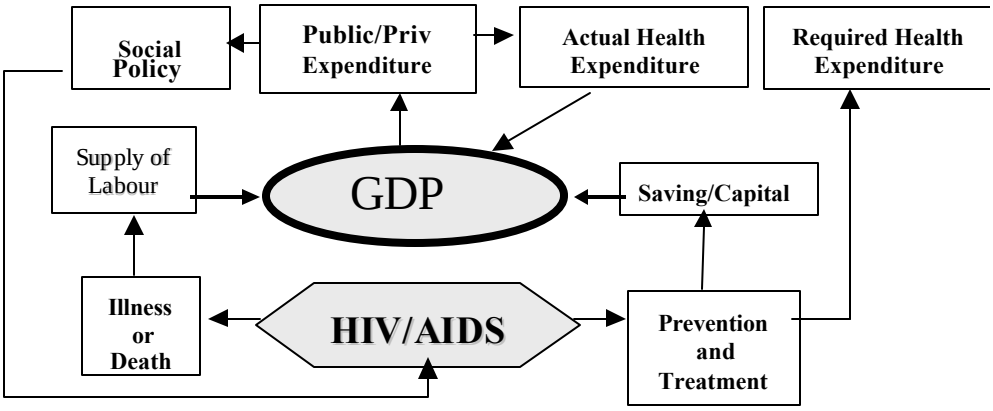
All the factors which influence prevalence of HIV/AIDS in the Caribbean are likely to generate specific economic burdens within the society. This is the subject of the next section.

ECONOMIC IMPACT OF THE EPIDEMIC

It is now generally well accepted that a twin directional relationship exists between HIV/AIDS and the Economic System. That is to say, HIV/AIDS impacts on the economic system and the economy in turn affects the epidemic. Figure I below maps out the relationship between HIV/AIDS and the Economic System. As the diagram shows, the epidemic has the potential to destabilise the economic system because it impacts on the foundation pillars on which the production of the society is built – the labour force and the accumulation of savings. What is more, the epidemic has the potential to keep the health financing system in a permanent state of disequilibrium. In short, it erodes productivity, consumes savings, increases expenditure and reduces income. The devastation does not end here though, for, with every increase in the rate of prevalence, the negative impact worsens.

Figure I

HIV/AIDS AND THE ECONOMIC SYSTEM



There are essentially ***four*** channels through which the HIV/AIDS epidemic could potentially exert economic impacts in the Caribbean. These are the (i) ***production;*** (ii) ***allocation;*** (iii) ***distribution***; and (iv) ***regeneration*** channels.

The Production Channel

This channel speaks to the mechanisms by which the disease impacts on the main factors of production – labour and capital – causing the production process to be less fruitful than it would otherwise have been. In extreme cases there would be a potential for the epidemic to impoverish countries with one possibility being the dismantling of the production process itself.

There are three development-related issues which arise in this context. The first relates to the **scale of production** in many on the countries, the second to desired **factor intensity of production**, and the third relates to the **industrial policy framework**.

In each case the HIV/AIDS epidemic seems to be pointing the economy in the "wrong" direction. In respect of production scale the prognosis is that production volumes across the region will decline making it more difficult to fulfil export orders and raising unit costs to the point of putting a number of arrangements in jeopardy. In respect of factor intensity, the argument is that with the absolute decline in the labour supply in a number of sectors the economies will become more and more capital intensive, making it harder to deal with unemployment objectives when the epidemic is brought under control. Finally, in the light of the expected dislocation of existing strategic sectors - tourism, for example – the instinct to survive the crisis will lead to policy support for sectors which may not in the longer term be in the best interest of particular countries, for example ones that maybe environmentally unfriendly.

In summary, the epidemic seems to have the potential to severely distort the developmental aspects of the region's production processes. For the present paper our information only allows us to focus on the direct quantitative impact of the epidemic on production.

The economic costs associated with HIV/AIDS would come from the production losses coming from repeated and prolonged illness that persons suffer as a result of the disease. HIV/AIDS would therefore impose significant costs on both households and the health systems. In an early Trinidad and Tobago study by Henry and Newton (1993), the estimated loss in GDP that would result if the epidemic continued in the manner in which it was growing, was between 1% and 3%. The more recent CAREC/UWI study found that the estimated loss to GDP would reach a level of 4.2% by the year 2005. In essence, these figures tell us that the epidemic is not only threatening to weaken the economic base of the society but is also succeeding in being a major challenge to both the delivery and financing sub systems of the health system. In these circumstances the need for more detailed economic investigations of this epidemic is compounded by the fact that these countries are small in terms of their geographical size, lack of robust infrastructure and experience high inward and outward migration rates. This is therefore a region with several doors of vulnerability.

The Allocation Channel

One the important functions of the economic system is to ensure that resources are allocated to the different lines of production in a way as to minimizes the cost of production to the society. Any epidemic which has the potential to cause shortages of critical resources and/or to skew the use of resources away from crucial lines of production, also holds the potential to impose heavy economic costs on the society under threat. In the case of HIV/AIDS the issue raised here concern the volume of the region's foreign exchange which will need to dedicated to dealing with the disease. To the extent that the therapeutic component of the response to the epidemic will require a reallocation of the region's foreign exchange away from alternative productive uses, there is a likelihood of production shortages and increasing costs in the now foreign-exchange-short sectors. In fact the exchange rate may itself be under pressure to adjust.

On another level, the case of HIV/AIDS the very fact that the age group 15-45 is the most affected suggests that there is the potential for the region's skilled labour force to be negatively affected. What is more, this negative impact may well deplete the labour force such that the countries may be taken below resource threshold levels, thereby making for an upsetting of factor combinations to the point of inefficiency as well as insufficiency.

The Distribution Channel

The development planners of the Caribbean are in general agreement that one of the main aims of development in the region has been to engender an environment wherein the output of goods and services in the society are equitably distributed The historical legacy of uneven distributions of income and wealth has remained one of the challenges to policy makers in the region . The emphasis on improving the education system as well as the attempts to reform the health system have all been predicated on the need to ensure that the weaker, more vulnerable members of our society are not left behind as the economies move forward (Trinidad and Tobago Budget Speech 2000; UNESCO 1999).

In the face of an epidemic like HIV/AIDS which has the potential to weaken the income-base while spurring higher expenditure requirements, it is eminently possible that the lowest income groups will find themselves even worse off once the disease takes root. Not only will their most promising income earners be plucked away but the young ones who should be replacing them will not live to become earners of income. Although the upper income groups will not be immune from the epidemic, their capacity to protect themselves will have the indirect result of widening the gap between the upper and lower income groups as the epidemic gains momentum.

One of the relevant issues here is the access to health care for HIV/AIDS patients themselves. The relatively expensive nature of required interventions raises this access question both at the level of the individual and at the level of the broader society. In a context where poverty levels are known to be significant and where governments are generally under severe fiscal constraints the care of patients from the lower income brackets has become an important social concern. One suggestion, yet to be adopted by any government in the region, is for the care of HIV/AIDS patients to be included, wholly or partly, within the proposed **basic packages** of health services which most of the governments are now considering as part of their health sector reform.
There is clearly a need for serious ongoing research on this issue.

The Regeneration Channel

In the face of normally expected increases in population and the usual rise in the expectations of the existing population the economic system is expected to combine its saving propensity with its technological development to ensure that the system keeps on a path of expansion and increasing sophistication. If the savings capacity and the human capital of the economy are compromised by the HIV/AIDS epidemic the ability of the economy to regenerate itself at a higher level will also be compromised. This is an important concern for the Caribbean given recent theoretical work coming out of the UWI which suggests that in its interdependence with the economic

system the health system has the potential for converting a downturn into downward spiral (Thomas 2000). What this means is that the economic managers of the region now have a vest interest in affording preferential treatment to the health system, taking all necessary steps to ensure that no health condition is allowed to reach the point of exerting a negative impact on the economy. The reality, however, is that the HIV/AIDS epidemic threatens to be just such a health condition.

General Comment

Perhaps one of the most disturbing implications of the potential of HIV/AIDS to disrupt the development process of the Caribbean lies in the fact that even as the economies of the region seek to stabilize themselves after prolonged structural adjustment, and even as they proceed with the restructuring necessary to fit themselves within the new global trading arrangements, they now find that they have to cope with a threat to the resource which holds the key to the generation of income and wealth in this region – the region's ***human capital***. The protection of this resource is therefore no longer a matter for Ministries of Health alone. Similarly, the prevention component of the region's response to HIV/AIDS will need to target those sectors of the economy which are not yet being ravaged by the epidemic to ensure that they do not fall prey to its lethally embracing clutches. In other words there is now an interesting symbiosis between Ministries of Health and Ministries of Planning and Development: the health of the population and the health of the economy are now to be seen as two sides of the same coin.

Based on the brief discussion of the different channels through which the economic impacts of the HIV/AIDS epidemic could be manifested, we now focus on the first of these impacts – ***the production impact.***

REVIEW OF METHODOLOGIES FOR ESTIMATING ECONOMIC IMPACT

The foregoing discussion suggests that the HIV/AIDS epidemic has the potential to negatively affect a number of key economic sectors as well as key systemic links, thereby distorting and disrupting the underlying economic fabric of these countries. It is the seriousness of this potential threat that has fueled the demand for quantification of the economic impact of the disease.

To date there have been at least two attempts to measure the economic impact of the HIV/AIDS pandemic in the Caribbean. Included among these are the Henry and Newton (1993) study for Trinidad and Tobago and the more recent CAREC/UWI study (1997) which estimated the macroeconomic impact of HIV/AIDS for Jamaica and Trinidad and Tobago.

Inherent in both studies is the recognition that the estimated GDP loss is driven by two key variables: the estimated ***number of cases*** in any given year and the ***average loss of income and output*** associated with the cases of HIV/AIDS. In the Henry and Newton (*HN*) study the estimated number of cases was derived as a simple extrapolation of the historical incidence trends based on available data at the time of the study. The CAREC/UWI (*CU*) study employed

a more elaborate method which involved the use of a mathematical model to arrive at the number of persons in the different risk groups likely to be infected with HIV.. This was a major difference between the two studies. With respect to the income loss estimates for Trinidad and Tobago, the *HN* study made use of available sectoral productivity and wage information. In this respect the *CU* study also used a more sophisticated approach – elaborating a complete econometric model of the economies in question. Although this more ambitious approach was not without its own limitations it probably holds more promise than the method used in the *HN* study.

Three Pillars of the CU Study

The *CU* study can be interpreted to rest on three main pillars: (i) a sexual behaviour survey; (ii) an econometric model (*CARIBAIDSMOD*) applied to each of the countries in the study; and (iii) a number of key assumptions linking the survey to the econometric model. The last pillar, the linking assumptions, is related to three factors: *the infection risk of different population groups*; *the treatment coverage of the infected population*; and *the unit costs of treatment of HIV/AIDS patients.*

The Sexual Behaviour Survey

The main objective of the sexual behaviour survey was to arrive at a projection of the number of persons infected with HIV/AIDS. The survey was based on a division of the population into three *Preference Groups*: homosexuals; heterosexuals; and bisexuals. The analysis then identified four types of P*artners* each associated with a different risk of contracting HIV: casual; regular; prostitute; and visiting. Finally, four factors describing the sexual *Practices* of the population were identified: the type and number of partners; the type of sexual contact; the frequency of sexual contact; and the safety of sexual contact. Using this *3 x 4 x 4* or *PPP* model it was possible to derive two probability values – one associated with sexual *Preference* and one associated jointly with the type of sexual *Partner* and sexual *Practices*. By applying the product of these probabilities to the gender groupings of the three preference groups, the CAREC/UWI team derived an estimate of the number of persons at risk of being infected. Once these estimates were derived, three infection projection scenarios were assumed in relation to persons at risk: a *high-infection* scenario (80 percent); a *median-infection* scenario (50 percent); and a *low-infection* scenario of (10 percent).

On the assumption that nothing was done to stem the existing trends in the epidemic, the prevalence rates for Trinidad and Tobago and Jamaica were estimated as follows:

Table 4: Estimated Prevalence Rates, CAREC/UWI, 1997

Country	HIGH	MEDIAN	LOW
Trinidad and Tobago	4.6%	2.9%	0.6%
Jamaica	5.1%	3.2%	0.6%

It is interesting to note that at the time of the CU study –1997 – the prevalence rates for Jamaica and Trinidad and Tobago were already close to **one** percent, compared with the low estimate for

2005 of **0.6** percent. This suggests that one of the adjustments that will have to be made in arriving at the new estimates is in the number of persons assumed to be infected with HIV/AIDS. No doubt the sexual behaviour survey itself can be improved by a more carefully defined sampling frame and making use of a much larger sample size. However, such modifications are unlikely to yield results that are qualitatively different from what was obtained through the *CU* study.

The Econometric Model

The econometric model used in the *CU* study is based on an adaptation of the economic model, *CARIBAIDSMOD Version 1,* developed by Cuddington (1993a; 1993b), Cuddington and Hancock (1994) and Cuddington, Hancock and Rogers (1994). Based on the results from the structural equations, there is no question that the econometric model itself can be modified to yield more robust results.[2] However, it is not clear whether the coefficients from the reduced form of the model will be significantly different from what was obtained using *CARIBAIDSMOD*. The model, which is fairly standard, with the main innovation being the inclusion of the HIV/AIDS component, comprises of five major blocks:

(a) Output;
(b) Labour Supply and Wages
(c) Employment
(d) Savings and Investment
(e) Cost of HIV

The output of the system is driven by the supply of labour and capital used in the different sectors. As we would expect, employment in each of the sectors of the economy is related to the real wage rate in the sector and the size of the labour force available for productive employment in that sector. It is therefore not surprising that an increase in the incidence of HIV/AIDS which would reduce the effective labour force, would impact negatively on the level of employment in the different sectors of the economy. Similarly, the model assumes that savings are proportional to income and that expenditure on HIV/AIDS is directly competitive with savings

The main results of the study are reproduced in Table 4 below

Table :5
Macro economic Impact on Key Variables for Trinidad & Tobago and Jamaica

Impact Variables	Trinidad & Tobago	Jamaica	Average
Gross Domestic Product	-4.2%	-6.4%	-5.3%
Savings	-10.3%	-23.5%	-16.9%
Investment	-15.6%	-17.4%	-16.5%
Employment in Agriculture	-3.5%	-5.2%	-4.4%
Employment in Manufacturing	-4.6%	-4.1%	-4.4%
Employment in Services	-6.7%	-8.2%	-7.5%
Labour Supply	-5.2%	-7.3%	-6.3%
HIV/AIDS Expenditure	+25.2%	+35.4%	+30.3%

[2] For example, some key coefficients were insignificant.

Source: CAREC/UWI. *Modelling and Projecting HIV and its Impact in the Caribbean: The Experience of Trinidad & Tobago and Jamaica*. 1997

The results are shown for the individual countries with an average computed in the last column. The Table shows the measured impact on four key macroeconomic quantities as well as on employment in three sectors. In all seven cases the impact is negative. This contrasts with the estimated impact on HIV/AIDS expenditure which increases significantly in both countries.

The information in the Table is not qualitatively surprising. The size of the GDP losses are nevertheless larger that were expected, given the previous HN study and given other international studies. . The difference between the results are no doubt due in part, to the difference in methodologies used. In particular the behavioural model seems to have biased the projected infection rate upward. However, we need to be cautious in dismissing the results since the behavioural model used is certainly capable of capturing incidence that will usually escape the surveillance net. It is noteworthy, for example, that the projected prevalence levels for 1999 is more than 5 times the official figures for those years. However, it is well known that in the developing countries the ratio of estimated to reported cases is sometimes higher than ten to one.(Over and Piot, 1993 in Disease Control Priorities in Developing Countries, Dean Jamison et all OUP,1993)

UPDATE AND EXTENSION THE GDP IMPACT OF HIV/AIDS

As already indicated, the CAREC/UWI estimates of the GDP impact of HIV/AIDS were based on a number of key assumptions, specifically relating to the derivation of the number of people at risk, the treatment coverage of persons infected with HIV/AIDS, and the unit cost of treatment of infected persons. The study also covered two countries – Jamaica and Trinidad and Tobago. The present paper will update the study using new estimates of treatment costs and will extend to study to cover St. Lucia, one of the countries of the Organization of Eastern Caribbean States (OECS).

Table 6: BASIC DATA FOR PROJECTION UPDATE
Year 2005

Country	*Population*	*% Pop > 15*	Adult HIV Prevalence,%	*Projected* Infections, CU Study	Projected Infections CTF
Jamaica	2,447,000	65	2.00	22,206	31,811
St. Lucia	142,000	63	0.70	983	688
Trinidad & Tobago	1,306,000	68	2.02	10,240	18,206

Notes:
1) Population level is assumed to constant over the projection period

2) Adult prevalence estimates are taken from World Bank/HEU cost estimation exercise, August 2000
3) Projected Infections from CAREC/UWI (CU) study based on prevalence rates derived from behavioural model
4) Caribbean Task Force (CTF) Projected Infections derived by applying estimates from World Bank/HEU cost estimation exercise

The planned update of the CU GDP loss estimates is carried out under two scenarios. In the first scenario adjustments are made in two of the three key assumptions mentioned earlier – the adult HIV/AIDS prevalence rate and the per capita cost of AIDS treatment. For the second scenario we add to the first an adjustment in the treatment coverage of AIDS patients. This second scenario brings the present estimates in line with the program cost estimates generated by the HEU for the Caribbean Task Force on HIV/AIDS.

The table below juxtaposes the two new scenarios with the original CAREC/UWI assumptions.

Table 7: Estimation Scenarios

STUDIES	**ASSUMPTIONS**		
	Coverage of Infected Persons, %	Adult Prevalence, %	Per capita Treatment Cost, $US
CAREC/UWI	100	0.9 – JA 0.9 – T&T	12,000
HEU *Scenario 1*	100	0.7 –SLU 2.00 – JA 2.05 – T&T	4,000
HEU/CTF *Scenario 2*	20	0.7 –SLU 2.00 – JA 2.05 – T&T	4,000

Finally, in the table below we present the new estimates on the GDP impact of HIV/AIDS, first extending the CAREC/UWI study to generate an estimate for St. Lucia and then updating the CAREC/UWI study under the assumptions for Scenario 1 and Scenario 2.

Table 8: GDP Impact Estimates – Alternative Scenarios

COUNTRY	CAREC/UWI BENCHMARK	SCENARIO 1	SCENARIO 2
Jamaica	6.2%	4.9%	3.2%
St Lucia	4.7%	2.1%	1.6%
Trinidad& Tobago	4.2%	5.6%	4.9%
Average	**5.0%**	**4.2%**	**3.2%**

The key in arriving at St. Lucia estimate for the present paper was the projection for infected cases. Since the survey data for St Lucia was not available for this exercise it was convenient to uplift the official St Lucia data for 1999 by the average of the difference between the Jamaica and Trinidad and Tobago actual and estimated figures for the same year. Using this average as

denominator and the official data as numerator we arrived at 1999 CAREC/UWI-type estimate. We then assumed that the number of cases would remain unchanged over the projection period, that is with the new cases being cancelled out by AIDS deaths. Interestingly enough the GDP impact estimate of 4.7% was in the range of the Jamaica and Trinidad and Tobago estimates.

The average of the CAREC/UWI estimates was 5.0% which is consistent with the assumption currently adopted by the Caribbean Task Force on HIV/AIDS. What is interesting is that on average the countries of the region are currently allocating between five and six percent of their national income to health services.

It is also noticeable that while for each Jamaica and St. Lucia the dramatic fall in treatment costs caused the share of GDP lost to be reduced, in the case of Trinidad and Tobago the opposite happened. The downward effect of the fall in treatment costs was more than compensated for by the upward impact of the significant increase in the number of infected individuals.

While we have not been able to replicate the sectoral impacts the expectation is that the impacts here will remain significant. Much of the current research aims to determine the specific impact of the disease on key sectors of the economy.

Details on all the computations are presented in the Appendix to this paper.

INVESTING IN THE RESPONSE TO HIV/AIDS

Rationale for a Holistic Response

The economic case for mounting an effective response to HIV/AIDS is a very compelling one. The fact is that the national product losses due to the epidemic have been estimated at an average of just over five (5) percent of the GDP by the year 2005 for two countries of the region – Jamaica, and Trinidad and Tobago. The importance of this finding is compounded by the fact that for each of these two countries this amounts to more than the quantum being used to provide health services for the entire nation. If this is the scale of the economic impact that will be experienced by the rest of the region then with an estimated income of US$ 40 billion the annual losses to the economies of the region are likely to reach a level of just over US$ 2 billion million per year.

This is the basis on which it has been argued that what now confronts the region is nothing short of a crippling attack on its development process and on the quality of life of the people of this part of the world.

Moreover, there is a range of factors which suggest that there is no reason to expect a spontaneous abatement in the epidemic. The disease itself is being mainly transmitted through various forms of sexual contact and the vast movements of persons within and into the region means that there are virtually infinite opportunities for infection. What this means is that once the epidemic has taken root in the society the economic system will become more and more dependent on the exogenous factors causing national income to increase. The GDP will itself

experience more and more significant losses, creating a larger and larger gap between the need for resources to respond and the availability of such resources. ***In this sense the initiation of an effective response must be seen in the light of what is in fact a race against time.*** If the start of an effective response is delayed there may simply not be enough resources within the region to carry out the activities that are necessary.

Comprehensiveness and Sustainability of the Response

Precisely because HIV/AIDS is both infectious and chronic the response will need to be both ***comprehensive*** and ***sustainable.*** It will need to be comprehensive in the sense that it will have to address all known sources of the disease and it will have to include a broader spectrum of sectors in the society. However, it will also need to be sustainable because the behaviour modification that will be necessary takes time. The Caribbean Task Force on HIV/AIDS has concluded that the region will need to respond with a holistic health plan that contains the elements of health promotion, HIV prevention as well as AIDS treatment and rehabilitation. Moreover, even as we see the need for expertise to be shared across the region such a plan must be adopted by each country and be incorporated into the country's National Health Plan, and by extension, into each country's national budgeting. This willingness to make domestic budgetary reallocations in favour of the HIV/AIDS program is in fact a major sustainability requirement. Moreover, it will have the effect of sending the message to the population that the country in question is in fact dealing with a genuine crisis.

The case for responding from a solid platform of prevention activities is well established. ***However, experience has shown that as necessary as prevention is, it will not be sufficient to reverse the deepening trend of this disease.*** The Caribbean Task Force on HIV/AIDS has taken the unambiguous stance that the care, support and treatment of HIV/AIDS are indispensable complements to HIV/AIDS prevention programmes. This position has been one of the major assumptions in the costing exercise.

Following the line taken by the Task Force, the program which the region will seek to put in place will contain six distinct elements:

i) Increasing the commitment of the governments to dealing with the disease;
ii) Prevention of the spread of the disease by seeking to influence the behaviour of specific population groups;
iii) Providing health care – diagnostic, preventive, palliative and therapeutic - for persons infected with HIV;
iv) Capacity building of the Ministries of Health and related institutions like specialized NGOs, charged with the responsibility for prevention and care activities;
v) Executing surveillance and monitoring, as well as the medical, economic and social research which enables policymakers to respond more effectively to the disease; and
vi) Improving the capacity of regional institutions to support the response of national agencies in dealing with the disease.

In preparation for the recent Caribbean Conference on HIV/AIDS in Barbados the Health Economics Unit (HEU) of the University of the West Indies and the World Bank used an accounting framework employed by the World Bank in Sub-Saharan Africa to arrive at an initial estimate of the cost of the annual response by each country of the region to the epidemic. The estimate was developed for twenty-four countries and the results are summarized in the Table below.

Table 9

COST STRUCTURE OF HIV/AIDS RESPONSE PROGRAM FOR THE CARIBBEAN

PROGRAM COMPONENT	Annual Cost $US mn.	Cost Share
Govt. Commitment	3.44	0.1%
Prevention	162.05	4.8%
Care	3122.57	92.6%
Palliative	*217.81*	***8.1%***
Home-based	*78.87*	***2.3%***
HAART	*2760.38*	***81.9%***
Capacity Building	9.81	0.3%
Research	37.88	1.1%
Regional Response	35.0	1.0%
TOTAL	**3370.75**	100%

The table shows the interesting result that while the prevention elements of the programme account for around ***five*** percent of the total cost, with other indirect elements accounting for about ***two*** percent, the treatment component accounts for about ***ninety-three*** percent. Quite apart from the heavy bias towards treatment the outstanding feature of the estimation exercise was the level of cost – US***$ 3.4 billion***.

When these estimates are considered on an individual country basis it becomes evident that for a number of countries the individual allocations were far in excess of their proven capacity to spend and that the programme elements would require a health system capability and a public sector management system which are simply not in place. It was therefore necessary to make a number of adjustments to reflect this reality.

Apart from the need to adjust the implicit spending capacity assumption, the assumptions made about the total cost of the anti-retroviral treatment included in the programme were later shown to be inconsistent with the known situation in some parts of Latin America, both in terms of the coverage of AIDS patients and in terms of the unit cost of the triple therapy treatment. While earlier data suggested that it was reasonable to use a figure of US$ 12,000 as the annual per capita cost of treatment a more realistic range today will be between US$ 2,000 and US$ 4,000.

When the new assumptions, taking actual experiences into consideration, were incorporated into the estimation model the result was a dramatic contraction of the "real" cost of the programme

for the twenty-four countries taken as a group. The low estimate was close to ***US$ 260 million*** and the high estimate was ***US$ 573 million***.

For the three countries in this study the program cost estimates are shown in the Table below. We also include the level of public health expenditure in order to put the program cost is better perspective. It should be noted that for most countries of the Caribbean public health expenditure is roughly one-half of national health expenditure.

Table 10
Annual Country Cost of HIV/AIDS Response
Low and High Cost Scenarios

Country	Low Cost, US$Mn	High Cost US$Mn	Public Health Expenditure, US$Mn,1999
Jamaica	25.47	45.02	162.5
St. Lucia	0.59	0.98	18.51
Trinidad & Tobago	13.94	24.64	158.75

The table shows that even with the high cost scenario for the HIV/AIDS program ranges between five and twenty-seven percent of public health expenditure. This would be between two and a half (2.5%) and thirteen and a half (13.5%) percent of national health expenditure.

One benefit of an exercise of this nature is that it enables each country to determine the size of the resource gap which it is likely to be experiencing. From a recent brief survey of AIDS programmes it has been estimated that none of the countries seems to be currently spending more than ***five*** percent of public health expenditure on these programmes. Applying this estimate to the three countries we show in the next table the programme resource gaps both in absolute and per capita terms as well as in terms of public health expenditure shares. The resource gap estimates are presented alongside the expected GDP loss associated with an uncontrolled HIV/AIDS epidemic.

In per capita terms the resource gap averages less than US$ 10 annually and as share of public health expenditure the gap averages just over 10 percent across the three countries with the Jamaica share being a high of 23 percent.

Table 11
GDP Impact and HIV/AIDS Program Cost Resource Gap, High Estimate

Country	Expected GDP loss, 2005 $USMn	Resource Gap US$Mn	Resource Gap per capita,$US	Resource Gap/ Public Health Expenditure
Jamaica	297.3	45.02	15.08	0.23
St. Lucia	23.23	0.06	0.39	.003
Trinidad & Tobago	379.0	16.7	12.79	.10
Average			9.42	0.11

In the context of the kind of crisis described in the early part of the paper these gap estimates seem to be well within the range of possibility. Certainly for the three countries discussed in this paper where per capita income ranges between US$ 1,750 (Jamaica) and US$ 4,520 (T&T) the per capita resource costs seem to be miniscule. The task is to muster the political will to mobilize the resources required and to identify the most appropriate mechanisms for the mobilization effort.

APPENDICES

1) Spreadsheet with updated GDP Impact Estimates

2) Excerpt from CAREC/UWI Study on Impact of HIV/AIDS.

APPENDIX 1

UPDATE AND EXTENSION OF CAREC/UWI ESTIMATES OF GDP IMPACT OF HIV/AIDS

	Trinidad and Tobago			**Jamaica**			**St. Lucia**	
ITEM		**GDP, $US**	**Comment**	**GDP, $US**	**Comment**	**GDP, $US million**	**Comment**	
			Assumed to grow at		Assumed to grow at		Assumed to grow at	
	2000	6,700,000,000	2.5% annually	5800000000	0.5% annually	410.70	2.5% annually	
	2001	6,867,500,000		5,829,000,000		420.97		
	2002	7,039,187,500		5,858,145,000		431.49		
	2003	7,215,167,188		5,887,435,725		442.28		
	2004	7,395,546,367		5,916,872,904		453.34		
	2005	7,580,435,026		5,946,457,268		464.67		
Original CU Impact est		***318,378,271***	**Applying the 4.2%** obtained in 1997 CAREC/UWI study	***380,573,265***	**Applying the 6. 4%** obtained in 1997 CAREC/UWI study	21.84 Implicit % GDP impact	Ratios of actual to estimated levels of infection	
Initial number of cases		10240		22206		**4.7** 983	TT =.39 JA = .68	
Implied per capita loss		31,092	$US	17,138	$US	22222	SLU =(.39+.68)/2 =.54	
Assumed treatment cost		12000	$US	12,000	$US	12,000	Est of per capita loss	
SCENARIO 1								
Adjusted cases of infection		18206	Adult population times prevalence rate,2.05%	31811	Adult population times prevalence rate, 2.0%	688	This assumes a prevale rate of 0.7% as oppose to the 0.9% in the	
Non-treatment loss		19,092	$US	5,138	$US	10,222	CU study	
New treatment cost assp.		4,000	$US	4,000	$US	4,000		
New per capita loss		**23,092**	$US	**9,138**	$US	**14,222**		
Adjusted Total GDP Loss at 100% coverage of cases		420,397,867	$US	290,698,713	$US	9,784,889	$US	
Adjusted GDP Impact		**5.5**		**4.9**		**2.1**		
SCENARIO 2								
CTF coverage 20%		3641		6362		138		
CTF Gdp loss,20%		362,139,819	$US	188,903,512.51	$US	7,583,288.89	$US	
Final adjusted GDP Impact		**4.8**		**3.2**		**1.6**		

APPENDIX 2

i) Modelling System for Assessing the Economic Impact of AIDS: CARIBAIDSMOD

A. Output Block

$$Y_{ag} = A\,L_{e,ag}^{a_1}\,K^{a_2} \qquad \text{Equation 5.1} \quad \textit{Output in Agriculture}$$

$$Y_{mg} = B\,L_{e,mg}^{b_1}\,K^{b_2} \qquad \text{Equation 5.2} \quad \textit{Output in Manufacturing}$$

$$Y_{sv} = C\,L_{e,sv}^{c_1}\,K^{c_2} \qquad \text{Equation 5.3} \quad \textit{Output in Services}$$

$$Y = Y_{ag} + Y_{mg} + Y_{sv} \qquad \text{Equation 5.4} \quad \textit{Total Output}$$

where subscripts Y_{ag}, Y_{mg} and Y_{sv} refer to agriculture, manufacturing and services, respectively; Y is the level of output in each sector; $L_{e,i}$ is the effective labour force in sector i; K is the capital stock.

Each of the production functions (Equations 5.1, 5.2 and 5. 3) is assumed to be based on a Cobb-Douglas technology. These functions have the interesting mathematical property of exhibiting varying returns to scale depending on the values assumed by the sum of the labour and capital coefficients. Total output in the model (Equation 5.4) is defined as the sum of output in the three sectors. In Caribbean type economies, both the agricultural and service sectors tend to be labour intensive while the manufacturing sector is characterised by capital-intensive processes.

B. Labour Supply and Wages

$$L_{s,ag} = L_{s,ag,m} + L_{s,ag,f} \qquad \textit{Equation 5.5 Labour Supply, Agric.}$$

$$L_{s,mg} = L_{s,mg,m} + L_{s,mg,f} \qquad \textit{Equation 5.6 Labour Supply, Manuf}$$

$$L_{s,sv} = L_{s,sv,m} + L_{s,sv,f} \qquad \textit{Equation 5.7 Labour Supply, Agriculture}$$

$$L_s = L_{s,ag} + L_{s,mg} + L_{s,sv} \qquad \text{Equation 5.8 Total Labour Supply}$$

$$L_{s,ag,m} = p_{ag,m} * L_m \qquad \textit{Equation 5.9 Male Labour, Agric}$$

$$L_{s,mg,m} = p_{mg,m} * L_m \qquad \textit{Equation 5.10 Male Labour, Manuf}$$

$$L_{s,sv,m} = p_{sv,m} * L_m \qquad \textit{Equation 5.11 Male Labour, Serv}$$

$$L_{s,ag,f} = p_{ag,f} * L_f \qquad \textit{Equation 5.12 Female Labour, Agric}$$

$$L_{s,mg,f} = p_{mg,f} * L_f \qquad \textit{Equation 5.13 Female Labour, Manuf}$$

$$L_{s,sv,f} = p_{sv,f} * L_f \qquad \textit{Equation 5.14 Male Labour, Serv}$$

Equation 5.15: Effective Labour Force in Agriculture

$$L_{e,ag} = \left[L_{s,ag,m} - f_{ag,m} * L_{s,ag,m} + L_{s,ag,f} - f_{ag,f} * L_{s,ag,f}\right]$$

Equation 5.16: Effective Labour Force in Manufacturing

$$L_{e,mg} = \left[L_{s,mg,m} - f_{mg,m} * L_{s,mg,m} + L_{s,mg,f} - f_{mg,f} * L_{s,mg,f}\right]$$

Equation 5.17: Effective Labour Force in Services

$$L_{e,sv} = \left[L_{s,sv,m} - f_{sv,m} * L_{s,sv,m} + L_{s,sv,f} - f_{sv,f} * L_{s,sv,f}\right]$$

Labour supply is represented by six definitional equations. Equations 5.5 - 5.7 represent the size of the labour force in agriculture *($L_{s,ag}$)*manufacturing *($L_{s,mg}$)* and services *($L_{s,sv}$)*, respectively. Six additional equations (Equations 5. 9 - 5. 14) are utilised to generate the gender component of the labour force for each sector. In these specifications, $p_{ag,m}$, $p_{mg,m}$ and $p_{sv,m}$ represent proportions of the male population that work in agriculture, manufacturing and services, respectively while $p_{ag,f}$, $p_{mg,f}$ and $p_{sv,f}$ represent proportions of the female population that work in agriculture, manufacturing and services, respectively.. Both the male and female proportions are assumed to sum to unity.[3] The total labour supply in the model (Equation 5.8) is calculated as the sum of the labour supply in each of the three sectors. Borrowing notions from Cuddington, the effective labour force is defined as the residual labour which is available for productive employment. This effective labour is determined by the difference between the total labour force and the fraction of the labour force which cannot work effectively because of HIV/AIDS-related illnesses. The parameters $f_{ag,m}$, $f_{ag,f}$, $f_{mg,m}$, $f_{mg,f}$, $f_{sv,m}$, $f_{sv,f}$ represent constant fractions of the male and female populations in each of the given sectors that succumb to the disease.

Given the Cobb-Douglas technology, wage levels in each of the sectors are assumed to be fixed in the short-run. Firms in each sector hire workers up to the point where the marginal product of labour is equal to the wage rate. The equations representing the determination of the wage levels in each sector are presented as follows:

$$w_{ag} = \frac{Y_{ag} * a_1}{L_{e,ag}} \qquad \textit{Equation 5.18, Wage rate, Agriculture}$$

[3] **This means that (a) $p_{ag,m} + p_{mg,m} + p_{sv,m} = 1$ (b) $p_{ag,f} + p_{mg,f} + p_{sv,f} = 1$.**

$$w_{mg} = \frac{Y_{mg} * b_1}{L_{e,mg}}$$ *Equation 5.19, Wage Rate Manufacturing*

$$w_{sv} = \frac{Y_{sv} * c_1}{L_{e,sv}}$$ *Equation 5.20, Wage Rate Services*

In these equations, declines in the size of the labour force and its relative productivity in each of the given sectors are expected to exert an upward influence on wage rates provided that the level of output and the labour coefficients in the various sectors remain fixed.

C. Employment

Employment in each of the respective sectors is affected by the wage rate paid in the sector and by the size of the labour force available for productive employment. Any increase in the incidence of AIDS reduces the size of the effective labour force and impacts negatively on the level of employment in the economy.

$Emp_{ag} = f(w_{ag}, L_{e,ag})$ *Equation 21 Employment in agriculture*

$Emp_{mg} = f(w_{mg}, L_{e,mg})$ *Equation 22 Employment in manufacturing*

$Emp_{sv} = f(w_{sv}, L_{e,sv})$ *Equation 23 Employment in Services*

Additionally, declines in the size of the effective labour force can drive up the wage rate in each sector. The total impact on employment depends on the strength of the impact of wages relative to that of the effective labour force.

D. Savings and Investment

The model assumes that workers in the domestic economy save a constant proportion of the income derived from production. In the absence of HIV/AIDS, savings is assumed to be proportional to income. Individuals who are stricken with the disease pay for medical treatment out of domestic savings. The savings rate is therefore expected to fall as the incidence of the disease rises and consequently as expenditures on HIV/AIDS related illnesses increase. Expenditure on AIDS-related illnesses in the model (E^{aids}) is therefore financed out of domestic savings and is expected to be inversely related to domestic savings.

The accumulation of capital in the domestic economy depends generally on the level of domestic savings as well as on foreign capital inflows (foreign direct investment or foreign Aid). In specifying the investment relationship in the model, it is assumed that foreign capital inflows are zero and that all investments are financed from domestic savings. An increase in the prevalence of HIV/AIDS is expected to slow capital accumulation as resources are re-allocated from domestic savings to finance AIDS-related illnesses.

$S_t = s_0 + s_1 Y_t - s_2 E_t^{Aids}$ *Equation 24 Domestic Savings*

$\Delta K_t = k_0 + k_1 S_t$ *Equation 25 Investment*

S_t - Domestic Savings
Y_t - Total Output/Income
E_t^{aids} - Expenditure on AIDS-related illnesses
K_t - Capital Formation

D. Cost of HIV/AIDS

Expenditure on AIDS-related illnesses is comprised of two components in the model - Direct and Indirect Expenditure (Cost). In our modelling design, the indirect expenditure on AIDS is assumed to be an exogenous variable in the model. Direct expenditure on AIDS is determined by three major cost categories - (i) *the cost of Drugs*, (ii) *the cost of HIV and other related tests* and (iii) *the cost of hospitalisation*.

$E^{Aids} = E^{Daids} + E^{idaids}$	Equation 26	*Expenditure on HIV/AIDS*
$E^{Daids} = E^{Drg} + E^{Hosp} + E^{test}$	Equation 27	*Direct Cost of HIV/AIDS*
$E^{Drg} = Drgc*D_1*\{(f_1*L^M)+(f_2*L^F)\}$	Equation 28	*Cost of Drugs*
$E^{hosp} = Hospc*D_2*\{(f_1*L^M)+(f_2*L^F)\}$	Equation 29	*Cost of Hospitalisation*
$E^{Test} = Testc*D_1*\{(f_1*L^M)+(f_2*L^F)\}$	Equation 30	Cost of AIDS-related illnesses

Drgc - Average Drug Cost per patient per month
Hospc - Cost of Hospitilization per patient
Testc - Cost for HIV test per patient
f1 - fraction of Male labour force with AIDS
f2 - fraction of female labour force with AIDS
D1 - Number of months in the year

(ii). ESTIMATION RESULTS FOR CARIBAIDSMOD

The model as designed is a block recursive system with groups of simultaneous and recursive blocks. The modelling system consists of eight (8) behavioural equations, eighteen (18) definitional equations and four (4) institutional equations. In order to estimate the system, it was necessary to convert the system to logarithmic form to permit linearisation of the output equations. The behavioural equations were estimated by two-stage least squares, a limited information systems estimator which provides consistent parametric estimates in a simultaneous equation system environment.

With respect to the Output Block, the estimation results indicate that the effective labour force is a significant determinant of output levels in the agricultural, manufacturing and services sectors of Trinidad and Tobago and Jamaica, respectively. The capital stock variable was, however, only a significant determinant of output levels in the Trinidad and Tobago specification. In the equations for agriculture, manufacturing and services in Jamaica, the capital stock variable was not statistically significant.

The coefficients of the double-log specification of savings (Savings and Investment Block) indicate the responsiveness of domestic savings to changes in income and to the level of expenditure on HIV/AIDS related illnesses. In the Trinidad and Tobago specification, the coefficient on the level of domestic savings is insignificant and indicates that domestic savings is not responsive to changes in income. The opposite result was obtained for Jamaica. In this case, domestic savings are highly responsive to changes in income. The coefficient for expenditure on HIV/AIDS, the second argument in the equation, was highly significant in both specifications but carried the wrong sign. The positive sign on this coefficient seems to suggest that as expenditures increase, the level of domestic savings does not fall but rises to accommodate the increased expenditure on AIDS related illnesses.

The overall fit of the Investment equation was generally unsatisfactory in both the specifications for Trinidad and Tobago and Jamaica. In these equations, domestic savings were not significant determinants of investment levels. Moreover, only 20% of the variation in investment was explained by the domestic savings variable. This variable also carried the wrong sign in the investment equation for Jamaica.

The final group of behavioural equations is contained in the employment block. Contrary to expectations, the effective labour force (i.e labour force without AIDS related illnesses) was not a

significant determinant of employment levels in the manufacturing and agricultural sectors of Jamaica. Employment in service related industries was influenced, however, by the size of the effective labour force in both Jamaica specifications. Wages did not appear to affect employment levels in any of the three sectors and had the wrong sign in the regression equations for manufacturing and agriculture.

The employment equations in the Trinidad and Tobago model fitted much better than those in the model for Jamaica. Both wages and the effective labour force were significant determinants of the level of employment in manufacturing and services. For agriculture, although the wage rate was significant, it carried the wrong sign. The effective labour force had no significant impact on employment levels in agriculture.

Despite the attempts to correct for auto correlation in the various equations, the Durbin Watson test statistic indicated that this was a serious problem in both the models for Trinidad and Tobago and Jamaica (Tables A2.1 and A2.2).

These initial estimates of the parameters in the model are very preliminary in nature and signal a host of econometric problems. The problems of serial correlation and possible mis-specification of some of the behavioural system are in need of further investigation.

Table A2.1: Trinidad and Tobago Regression Result (Independent Variable)

Dependent Variable	Independent Variables													
	Constant	L^s_{ag}	L^s_{mg}	L^s_{sv}	K	Y	E^{Aids}	S	W_{ag}	W_{mg}	W_{sv}	R^2	DW	F
Y_{ag}	-1.207 (4.1554)	0-2346 (2.033)	-	-	0.7655 (6.632)	-	-	-	-	-	-	0.528	1.502	-
Y_{mg}	0.9317 (20.069)	-	0.777 (2.2791)	-	0.8229 (10.5909)	-	-	-	-	-	-	0.789	0.857	-
Y_{sv}	0.8499 (12.3127)	-	0.2759 (2.999)	-	0.7240 (7.8723)	-	-	-	-	-	-	0.5769	0.6304	-
Sav	-17.716 (-4.515)	-	-	-	-	0.053 (0.182)	2.015 (6.748)	-	-	-	-	0.2065	2.187	-
∂K_E	-1.310 (-1.646)	-	-	-	-	-	-	0.1532 (1.649)	-	-	-	0.206	2.187	-
Emp_{ag}	5.705 (6.527)	0.0286 (0.037)	-	-	-	-	-	-	-1.659 (-3.876)	-	-	0.669	2.168	-
Emp_{mg}	-11.816 (-8.882)	-	1.272 (14.158)	-	-	-	-	-	-	5.275 (9.146)	-	0.925	1.003	-
Emp_{ag}	-6.072 (-4.461)	-	-	1.143 (13.88)	-	-	-	-	-	-	3.015 (3.935)	0.946	1.621	-

(iii) Dynamic Simulation Results of CARIBAIDSMOD

The overall adequacy of both models was judged by a set of dynamic simulations. The results obtained from the simulations were compared with the actual historical values in order to assess the overall performance of the models. Tables 5.3 and 5.4 presents summary statistical measures based on the Theil Inequality Coefficient and its various decompositions (*UB* - Bias Decomposition, *UV* - Variance Decomposition, and *UC* - Covariance Decomposition).

The output equations registered good simulation performances in both the Trinidad and Tobago, and Jamaican models. In these cases, the small values of the U coefficient reinforce the lack of any significant deviations between the actual and simulated values.

The simulation results for savings and investment were generally poor in both models. The Theil U coefficients of 0.575 and 0.886 were recorded for domestic savings in Trinidad and Jamaica, respectively, while U coefficients of 0.966 and 0.957 were registered for investment in Trinidad and Tobago and Jamaica, respectively.

The dynamic simulations for employment were quite satisfactory for Jamaica when compared with Trinidad and Tobago, although the bias decomposition measure was relatively large in both models. The equations for services and manufacturing, however, recorded better simulations than those for agriculture in both models. Similar results were obtained for expenditures on AIDS related illnesses, total employment and overall output. All in all, based on the summary statistical measures, the Jamaican model appears to have outperformed its Trinidad and Tobago counterpart.

The model has generated modest results, and has not been as well behaved as would be required by purists. It is important to recognise that the data from which it has been derived relate to a relatively short series, within which the nature of the spread of the disease was undergoing a metamorphosis as the Caribbean moved from being a Type I area to become a Type II. This happened in the mid to late 1980s, even before a pattern could emerge under the Type I categorisation. In other words, the data are mixture of a structural pattern that now applies to the Region as a Type II area and the change effect of the Type I pattern that the Region was at the very beginning.

This issue has to be taken into account as the model is applied to the development of projections and in preparing new interventions to stem the spread of the disease. There is need for continuing work in this

area, but policy-makers would be well advised to make bold interventions against a disease which threatens to be the major cause of death for most countries, afflicting mainly the economically productive labour force.

Table A3.1: Summary Measures of the Dynamic Simulations, Trinidad and Tobago

	Theil U	UB	UV	UC
Y_{ag}	0.011	0.000	0.051	0.949
Y_{mg}	0.005	0.000	0.247	0.753
Y_{sv}	0.006	0.000	0.019	0.981
S	0.575	0.999	0.000	0.001
∂K_t	0.966	0.998	0.002	0.000
Emp_{ag}	0.157	0.997	0.002	0.001
Emp_{mg}	0.993	0.999	0.000	0.001
Emp_{sv}	0.242	0.998	0.002	0.000
W_{ag}	0.620	0.997	0.000	0.002
W_{mg}	0.699	0.999	0.000	0.001
W_{sv}	0.568	0.999	0.000	0.001
E^{Aids}	0.308	0.999	0.000	0.001
Emp	0.274	0.999	0.000	0.001
GDP	0.428	0.999	0.000	0.001

$u\beta + uv + uc = 1$

Table A3.2: Summary Measures of the Dynamic Simulations, Jamaica

	Theil U	UB	UV	UC
Y_{ag}	0.016	0.002	0.181	0.817
Y_{mg}	0.008	0.007	0.160	0.833
Y_{sv}	0.008	0.006	0.177	0.817
S	0.886	0.999	0.001	0.000
∂K_t	0.957	0.965	0.028	0.007
Emp_{ag}	0.024	0.967	0.028	0.005
Emp_{mg}	0.077	0.992	0.002	0.006
Emp_{sv}	0.003	0.271	0.025	0.704
W_{ag}	0.041	0.843	0.084	0.073
W_{mg}	0.032	0.936	0.037	0.027
W_{sv}	0.016	0.721	0.160	0.119
E^{Aids}	0.310	0.999	0.001	0.000
Emp	0.425	0.999	0.001	0.000
GDP	0.442	0.999	0.001	0.000

$u\beta + uv + uc = 1$

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