Modelling and Projection HIV/AIDS and its Economic Impact in Trinidad & Tobago

by

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Presented at the Annual Review Seminar, Research Department,
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For Discussion purposes only (Not for Quotation)

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The first case of HIV/AIDS in the Caribbean was reported in Jamaica in 1982. Since that time, the epidemic has spread rather quickly throughout the Caribbean region. At the end of 1996, a total of 9,978 cases of AIDS was reported to CAREC by nineteen of its member countries. Trinidad and Tobago, the Bahamas and Jamaica have reported the largest number of cases since the onset of the disease. In its recent report entitled "Confronting AIDS: Public Priorities in a Global Epidemic", the UN has reported that an estimated 6 million people have died of AIDS worldwide and that another 30 million more have contracted the disease. Ninety per cent of the infections have occured in developing countries and AIDS if left unchecked is likely to become the leading cause of death by the year 2020.

Acquired Immunodeficiency syndrome (AIDS) is caused by by the Human Immunodeficoiency Virus (HIV) which binds itself to the CD4+T-cells and macrophages. The CD4+T-cells are responsible for secreting a special chemical which helps other cells function effectively while the macophages prime the immune system to recognize the invading virus. The AIDS virus systematically destroys the CD4+ T-cells so that the host becomes susceptible to opportunistic infectins and other illnesses which typically result in death. The disease is spread through contact with bodily fluids with the main transmission modes being sexual intercourse, blood transfusions and vertical transmision (parent to sibling).

In many of the member countries of CAREC member countries, the under-reporting of AIDS cases has been a problem and the number of HIV infections represent only a small percentage of the true figures. Several attempts have been made in the Caribbean to project the incidence and prevalence of the disease.

Between 1991 and November 1993, CAREC, in collaboration with AIDSTECH/Family Health International, developed projections of the impact of the AIDS epidemic for a hypothetical Eastern Caribbean country using a model called "Caribea". Demographic and epidemiological data from 1982 to 1992 were gathered and analysed to produce a global understanding of the AIDS epidemic, using the Demproj3 model.[1] Newton et al (1992) and Newton, Farley, and Gayle (1993) have also attempted to develop projections of AIDS using the backcalculation method.

This paper has two main objectives. The first is to present an alternative behavioural model for projecting the incidence of HIV while the second is to analyse the impact of HIV/AIDS on the macroeconomy.

The paper is divided into four sections. Section 1 discusses the various approaches to the measurement of the incidence and prevalence of HIV/AIDS while Section 2 utilises the behavioural model of Schmitz and Castillo-Chavez (1994) to develop preliminary projections for HIV in Trinidad and Tobago and Jamaica. Section 3 develops a simple macro-econmic model in the tradition of the Cowles Commission approach to analyse the impact of HIV/AIDS on the macroeconomy. In section 4, a summary and conclusion is presented.

Section 1: A Review of Methods for Estimating the Incidence and Prevalence of HIV/AIDS.

The measurement of the incidence and prevalence of HIV/AIDS, however, poses unique problems to researchers which are quite different from other infectious diseases. Several methods and approaches have surfaced in the literature for estimating the incidence and prevalence of AIDS and HIV[2]. The more common among these emphasize four broad categories of factors, namely: Epidemiological, Demographic, Sociocultural/Behavioural and Economic. This review excludes the demographic literature.

[1] Demproj3, developed by the Futures Group, is a demographic model that incorporates demographic and epidemiological variables to derive projections of the incidence and prevalence of HIV/AIDS.
[2] It is useful to note in the context of this study that incidence refers to the number of new HIV/AIDS infections in a specified population in a given period of time. Prevalence refers to the number of HIV-positive people in a population at a particular point in time.

The epidemiological approach is concerned with factors surrounding the incubation period of the disease and the design of methods and measures to prevent and control the spread of epidemics in populations. Much of the mathematical modelling in this area utilises standard probability distributions. These models generally focus on the nature of the disease and on those factors such as population growth, age, sex and other factors which affect the incubation period. The most popular technique which has surfaced in this area for modelling incidence is that of back-calculation (see Brookmeyer [1991], Rosenberg and Gail [1991], Day et *al.* [1988, 1995], Aalen, Farewell and De Angelis [1994] and Newton, Farley and Gayle [1996]).

Since the most prevalent mode of transmission of the disease involves *sexual contact*, it seems only natural that models that address this should concern themselves with the important factors which determine such contacts. Sexual behavior is itself complicated and depends on a host of factors. The spread of the disease is influenced, to some extent, by sexual interaction between those who have the disease and those who do not. Indeed, the number of sexual partners is a critical element which affects the spread of the disease and hence its distribution in the population at large.

One of the most useful modelling methodologies for examining the socio-cultural and behavioural factors is the network modelling framework of Schmitz and Castillo-Chavez (1992). The basis of this model is the design of a procedure to examine the mixing patterns of the population. The model looks at the non-random interaction of a target population that cannot be sampled appropriately. The model assumes that the population consists of I distinct groups. In the present study, we assume that these groups consist of homosexuals, heterosexuals and bi-sexuals. Each of these ith groups consist of high risk and low risk individuals. Each ith group is assumed to have T_i individuals who in turn have an average number of C_i partners per person per unit of time.

The social sexual contact within and between the groups is modeled by an IxJ contact matrix of probabilities $P(t)$ where each $P_{ij}(t)$ is the probability that a partner selected by a sexually active individual at time t in group i is a member of group j. Busenberg and Castillo-Chavez (1989, 1991) have developed a representation theorem which specifies the given probabilities as follows:

$$P_{ij} = \overline{P}_j\left[\frac{Q_i Q_j}{V} + \phi_{ij}\right] for 1 \le i, j \le I$$

where

$$\overline{P}_j = \frac{C_j T_j}{\sum_{k=1}^{I} C_k T_k} for 1 \le j \le I$$

$$Q_i = 1 - \sum_{k=1}^{I} \overline{P}_k \phi_{ik} \; for 1 \le i \le I$$

$$V = \sum_{k=1}^{I} \overline{P}_k Q_k$$

The expression P_{ij} therefore captures random or proportionate mixing between the various groups. The IxI matrix ϕ is a measure of mutual preference or affinity for sexual partners between pairs of groups.

One can also specify a preferred mixing matrix as follows:

$$P_{ij} = h_i \delta_{ij} + (1 - h_i) \frac{(1 - h_j)\overline{P}_j}{\sum_{k=1}^{I} (1 - h_k)\overline{P}_k}$$

In this matrix the h_is are the proportion of group contacts reserved for within group mixing while the term δ_{ij}s are the partnerships that do not follow reserved mixing but rather those that follow random or proportionate mixing.

One of the interesting dimensions of the Schmitz-Castillo Chavez model is that it allows one to examine the nature of sexual contacts and hence mixing strategies in the population. This model can also be expanded to incorporate further sub-divisions of the main groups by gender, race, ethnicity through extension of the size of the mixture matrix.

Within recent years, more detailed analyses of the mixing patterns have also surfaced in the works of Gupta et al (1988), Garnett and Anderson (1993), Jaquez et al. (1988) and Williams and Anderson (1994). In sum then, any attempt to estimate incidence and prevalence of the disease requires a modelling design that places emphasis on the sexual contact and behavioural patterns in the society.

The discussion of the socio-behavioural factors already adverted to the economic issues. HIV/AIDS is a terminal disease and the examination of its economic implications relate solely to costs, therefore, since there are no benefits to be derived. One can classify these costs into three broad categories[3]:- **Direct Costs, Indirect Costs and Intangibles.** The direct costs basically refer to the costs involved in managing the disease. These costs are measurable and are associated with personal medical care costs which the individual or the society may bear and the non-personal costs which are largely borne by the society. These costs can be further disaggregated into those which relate to **Prevention, Testing, Treatment and Care, Administration** (i.e Advertising, etc.) and **Scientific Research.** The indirect costs relate generally to the opportunity costs of forgone earnings incurred due to production loss caused by morbidity (sickness), disability and premature mortality. The third category, intangible costs refer to those social costs (such as psychological burden, ostracism, and the loss in quality of life) which are not easily expressed in monetary terms.

The other economic factor is the assessment of the costs to the economy of the loss of output and productivity that is incurred through the reduction in the labour force and in the effective participation of workers. As indicated above, the debate here is between the human capital approach and the macro-economic approach. The latter approach has been adopted for this study for its completeness in following through the effect on the national economy on the other variables impacted by all contributors to the national income through savings, investment, the multiplier, etc.

[3] **See Wiggers, C. and E. Bergsma (1992) "The Costs of HIV in the Netherlands in 1988: A Preliminary Estimate" in Jager and Ruitenberg (eds): *AIDS Impact Assessment: Modelling and Scenario Analysis*, Amsterdam: Elsevier Science Publishers.**

Section 2: Projecting HIV in Trinidad and Tobago and Jamaica

The expected number of persons that are likely to be at risk from HIV/AIDS were derived from a framework which combined the modelling methods of Schmiltz and Castillo-Chavez (1994) with that of Bos and Bulatao (1992). This approach incorporates assumptions of the social, cultural, and behavioural patterns that influence the spread of the disease in the population. The hybrid behavioural model adopted in our study divides all adults in the population into three risk groups namely, homosexuals (hom), heterosexuals (het) and bi-Sexuals (bi). The probability of transmission of HIV among these groups is affected by four major factors, namely, (i) the type and number of sexual partners, (ii) the type of sexual contact, (iii) the frequency of sexual contact and (iv) the safety of sexual contact.

In our analysis, it is assumed that the sexual contacts of these various groups take place with the following four types of partners, namely (i) casual partners (cpt), (ii) regular partners (rpt), (iii) prostitutes (ppt) and (iv) visiting partners (vpt). Relationships with casual partners and prostitutes are assumed to more risky than relationships with a regular or visiting partner. In addition, risky behaviour is also affected by the types of sexual practices adopted with each of the respective partners. Our analysis assumes the following ten types of sexual practices or contacts:

(1) Vaginal Sex with a condom (T1)
(2) Vaginal Sex without a condom with ejaculation (T2)
(3) Vaginal Sex without a condom without ejaculation (T3)
(4) Anal intercourse with a condom (T4)
(5) Anal intercourse without a condom with ejaculation (T5)
(6) Anal intercourse without a condom without ejaculation (T6)
(7) Oral-Genital Sex with a condom (T7)
(8) Oral-Genital Sex without a condom with ejaculation (T8)
(9) Oral-Genital Sex without a condom without ejaculation (T9)
(10) Oral Sex (T10)

All contacts which do not involve the use of a condom and which are associated with ejaculation are given high risk probabilities with respect to the transmission of the disease. In our framework, therefore, T2, T5, T6 and T8 are accorded the the highest risk probabilities while T7 and T10 are associated with lower risk.

2.1 Methodology for Estimating Persons at Risk to HIV/AIDS

Estimates of the persons at risk to HIV/AIDS were derived in four related stages. First, the adult population in each country was classified by sexual orientation and gender. Second, risk probabilities were assigned to each group based on the sexual orientation of the group. Third, contact probabilities were then determined from the mixing matrix based on the type of partner, the frequency of intercourse and the safety of sexual practices. Finally, the contact probabilities were utilised to weight the various sub-groups of the populations in order to derive estimates of the expected number of persons at risk to HIV/AIDS.

Classification of Population by Sexual Orientation (Stage: 1)

The adult populations of both Jamaica and Trinidad and Tobago, respectively were subdivided into the following major groups, namely, (a) homosexual males, (b) heterosexual males (c) bi-sexual males (d) homosexuals females (e) heterosexuals females and (f) bi-sexual females. Since there are no official figures which give an accurate representation of the distribution of these groups in the adult population in the Caribbean, crude estimates were developed using data obtained from CAREC.

$$P_{males,i} = P_{m.hom.i} + P_{m.het.i} + P_{m.bi.i}$$

$$P_{females,i} = P_{f.hom.i} + P_{f.het.i} + P_{f.bi.i}$$

$$P_{total,i} = P_{males,i} + P_{females,i}$$

where $P_{males,i}$ - *Male Population in country i*

$P_{m.hom.i}$ - *Homosexual Male Population in country i*

$P_{m.het.i}$ - *Heterosexual Male Population in country i*

$P_{m.bi.i}$ - *Bi-sexual Male Population in country i*

$P_{females,i}$ - *Female Population in country i*

$P_{f.hom.i}$ - *Homosexual Female Population in country i*

$P_{f.het.i}$ - *Heterosexual Female Population in country i*

$P_{f.bi.i}$ - *Bi-sexual Female Population in country i*

Homosexual-, heterosexual- and bisexual males were estimated at 3%, 96% and 1%, respectively of the adult male population in both Trinidad and Tobago and Jamaica. Homosexual-, heterosexual- and bisexual females were estimated at 2%, 97% and 1%, respectively of the female adult population in both Trinidad and Tobago and Jamaica. Table 4.1 provides the relevant estimates of the various groups over the period 1981-2005.

Risk Probabilities associated with Population Groups (Stage: 2)

In the second stage of the analysis, risk probabilities were assigned to the various sub-groups of the population. The initial estimates of the number of persons at risk were then determined by weighting each of the groups by a subjective risk factor. This subjective risk factor is based on the probability that the group engages in risky sexual behaviour. At this juncture, it is important to state that bisexuals and homosexuals were assumed to have higher probabilities of engaging in riskier sexual behaviour than heterosexuals. As regards the gender subgroups, the analysis assumed that there was a greater likelihood of contracting the disease from men[4] than from women. The equations which follow were utilised to derive the initial estimates for men and women who were at risk to HIV/AIDS.

$$R_{males,i} = \delta_{m.hom.i} P_{m.hom.i} + \delta_{m.het.i} P_{m.het.i} + \delta_{m.bi.i} P_{m.bi.i}$$

$$R_{females,i} = \delta_{f.hom.i} P_{f.hom.i} + \delta_{f.het.i} P_{f.het.i} + \delta_{f.bi.i} P_{f.bi.i}$$

where $R_{males,i}$ - *Initial Estimate of Males at Risk to HIV/AIDS*

$R_{females,i}$ - *Initial Estimate of Females at Risk to HIV/AIDS*

$P_{m.hom.i}$ - *Homosexual Male Population in country i*

$P_{m.het.i}$ - *Heterosexual Male Population in country i*

$P_{m.bi.i}$ - *Bi-sexual Male Population in country i*

$P_{f.hom.i}$ - *Homosexual Female Population in country i*

$P_{f.het.i}$ - *Heterosexual Female Population in country i*

$P_{f.bi.i}$ - *Bi-sexual Female Population in country i*

[4] Men in the Caribbean generally tend to be more promiscuous than women and are likely to have more risky sexual encounters

$\delta_{m,\,hom,\,i}$ - *Risk factor for Homosexual Male Population in country i*

$\delta_{m,\,het,\,i}$ - *Risk factor for Heterosexual Male Population in country iI*

$\delta_{m,\,bi,\,i}$ - *Risk factor for Bi-sexual Male Population in country i*

$\delta_{f,\,hom,\,i}$ - *Risk factor for Homosexual Female Population in country i*

$\delta_{f,\,het,\,i}$ - *Risk factor for Heterosexual Female Population in country iI*

$\delta_{f,\,bi,\,i}$ - *Risk factor for Bi-sexual Female Population in country i*

In Table 4.2 the assumed risk probabilities for each of the groups in the adult population are outlined.

Contact Risk Probabilities (Stage 3)

In the third stage, a mixing matrix of contact probabilities is utilised to determine the level of risk of the population based on the type of partner and the safety of sexual contact or intercourse. The mixing strategy adopted is a modification of the Schmitz-Castillo-Chavez framework in which each of the sub-groups of the population (i.e. homosexual males, homosexual females, heterosexual males, heterosexual females, bi-sexual males and bi-sexual females) are engaged in a process of random or proportionate mixing. Tables 4.2 – 4.8 summarise the contact risk probabilities for the male and females groups in both Trinidad and Tobago and Jamaica, respectively. These probabilities measure the likelihood of transmission through sexual contact with varying types of partners. In Table 4.3, the risk probabilities associated with vaginal intercourse (T1,T2 and T3) are assumed to be zero for homosexual men since there is no vaginal contact in sexual intercourse between homosexual men. Anal intercourse with casual partners, regular partners and prostitutes without the use of a condom (T5 and T6) was assigned relatively high risk probabilities of 0.90, 0.80 and 0.95, respectively. Homosexual vaginal contact amongst regular female partners was assumed to carry smaller risk.

Estimates of Persons at Risk to HIV/AIDS (Stage 4)

In the final stage of our analysis, the contact risk probabilities were utilised to weigh the various population subgroups in order to derive the expected number of persons at risk among homosexual males, homosexual females, bi-sexual males, bi-sexual females, heterosexual males and heterosexual females. The equations for determining the likely number of males and females at risk to HIV/AIDS are indicated as follows:-

$$N_{males,\,i} = \delta_{m,\,hom,\,i} P_{m,\,hom,\,i} v_{m,hom,\,i,j,ti} + \delta_{m,\,het,\,i} P_{m,\,het,\,i} v_{m,het,\,i,j,ti} + \delta_{m,\,bi,\,i} P_{m,\,bi,\,i} v_{m,bi,\,i,j,ti}$$

$$N_{females,\,i} = \delta_{f,\,hom,\,i} P_{f,\,hom,\,i} v_{f,hom,\,i,j,ti} + \delta_{f,\,het,\,i} P_{f,\,het,\,i} v_{f,het,\,i,j,ti} + \delta_{f,\,bi,\,i} P_{f,\,bi,\,i} v_{m,bi,\,i,j,ti}$$

where

$N_{males,\,i}$ - *Estimates of Males at risk to HIV/AIDS in country i*

$N_{females,\,i}$ - *Estimates of Females at risk to HIV/AIDS in country i*

$v_{m,hom,\,i,j,ti}$ - *contact probabilities for male homosexuals in country i with partner j and sexual practice ti*

$v_{m,het,\,i,j,ti}$ - *contact probabilities for male heterosexuals in country i with partner j and sexual practice ti*

$v_{m,bi,\,i,j,\,ti}$ - *contact probabilities for male bi-sexuals in country i with partner j and sexual practice ti*

$v_{f,hom,\,i,j,ti}$ - *contact probabilities for female homosexuals in country i with partner j and sexual practice ti*

$v_{f,het,\,i,j,ti}$ - *contact probabilities for female heterosexuals in country i with partner j and sexual practice ti*

$v_{f,bi,\,i,j,\,ti}$ - *contact probabilities for female bi-sexuals in country i with partner j and sexual practice ti*

Table 4.1a

Estimates of Adult Population by Sexual Preference: Trinidad & Tobago

/'000 Persons/

Date	THOMMALE	THETMALE	TBISMALE	THOMFMAL	THETFMAL	TBISFMAL
1981	10833	346663	3611	7218	350068	3609
1982	11050	353587	3683	7361	357001	3680
1983	11276	360838	3759	7511	364297	3756
1984	11575	370413	3858	7722	374525	3861
1985	11625	372013	3875	7803	378442	3901
1986	12040	385276	4013	7766	376646	3883
1987	12499	399957	4166	7663	371641	3831
1988	12569	402207	4190	7613	369230	3806
1989	12653	404909	4218	7578	367553	3789
1990	12937	413988	4312	7577	367509	3789
1991	13066	418125	4355	7622	369691	3811
1992	12402	396872	4134	8099	392783	4049
1993	12458	398672	4153	8153	395426	4076
1994	12469	399020	4156.	8184	396906	4092
1995	12554	401740	4185	8262	400708	4131
1996	12660	405115	4220	8312	403153	4156
1997	12913	413217	4304	8529	413634	4264
1998	13236	423548	4412	8870	430180	4435
1999	13831	442607	4610	9224	447387	4612
2000	14316	458098	4772	9547.	463046	4774
2001	14673	469551	4891	9910	480641	4955
2002	15187	485985	5062	10198	494580	5099
2003	15870	507855	5290	10626	515352	5313
2004	16267	520551	5422	11476	556580	5738
2005	16527	528880	5509	12394	601107	6197

Thommale - Homosexual Males in Population
Thetmale - Heterosexual Males in Population
Tbismale - Bi-sexual Males in Population
Thomfmal - Homosexual Females in Population
Thetfmal - Heterosexual Females in Population
Tbisfmal - Bi-sexual Females in Population

Table 4.1b

Estimates of Adult Population by Sexual Preference: Jamaica

/'000 Persons/

YEAR	JHOMMALE	JHETMALE	JBISMALE	JHOMFMAL	JHETFMAL	JBISFMAL
1981	34130	1092168	11377	7585	367848	3792
1982	34682	1109808	11561	7807	378638	3903
1983	35249	1127952	11750	7967	386376	3983
1984	35816	1146096	11939	8190	397223	4095
1985	36398	1164744	12133	8276	401378	4138
1986	36808	1177848	12269	8237	399473	4118
1987	37154	1188936	12385	8127	394165	4064
1988	37454	1198512	12485	8074	391608	4037
1989	37769	1208592	12590	8038	389829	4019
1990	38115	1219680	12705	8037	389782	4018
1991	38493	1231776	12831	8084	392097	4042
1992	38887	1244376	12962	8589	416588	4295
1993	39296	1257480	13099	8647	419391	4324
1994	39720	1271038	13240	8680	420961	4340
1995	40131	1284192	13377	8763	424994	4381
1996	40682	1301832	13561	8816	427586	4408
1997	41496	1327869	13832	9045	438703	4523
1998	42533	1361065	14178	9407	456251	4704
1999	44447	1422313	14816	9784	474501	4892
2000	46003	1472094	15334	10126	491109	5063
2001	47153	1508897	15718	10511	509771	5255
2002	48803	1561708	16268	10816	524555	5408
2003	51000	1631985	17000	11270	546586	5635
2004	52275	1672785	17425	12171	590313	6086
2005	53111	1699549	17704	13145	637538	6573

Jhommale - Homosexual Males in Population
Jhetmale - Heterosexual Males in Population
Jbismale - Bi-sexual Males in Population
Jhomfmal - Homosexual Females in Population
Jhetfmal - Heterosexual Females in Population
Jbisfmal - Bi-sexual Females in Population

Table 4.2 Risk Probabilities Associated with Sexual Orientation

POPULATION	TRINIDAD AND TOBAGO	JAMAICA
Males		
Homosexuals	0.75	0.75
Bi-sexuals	0.70	0.70
Heterosexuals	0.65	0.65
Females		
Homosexuals	0.65	0.65
Bi-sexuals	0.60	0.60
Heterosexuals	0.55	0.55

Table 4.3 Risk Probabilities for Sexual Activity of Homosexual Males
Trinidad and Tobago and Jamaica (By type of Partner and Safety of Contact)

	TRINIDAD AND TOBAGO				JAMAICA			
	Casual	*Regular*	*Prostitute*	*Visiting*	*Casual*	*Regular*	*Prostitute*	*Visiting*
T1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T4	0.60	0.45	0.65	0.55	0.60	0.45	0.65	0.55
T5	0.90	0.80	0.95	0.85	0.90	0.80	0.95	0.85
T6	0.80	0.65	0.85	0.70	0.80	0.65	0.85	0.70
T7	0.30	0.20	0.35	0.25	0.30	0.20	0.35	0.25
T8	0.70	0.60	0.75	0.65	0.70	0.60	0.75	0.65
T9	0.65	0.55	0.70	0.60	0.65	0.55	0.70	0.60
T10	0.03	0.01	0.05	0.02	0.03	0.01	0.05	0.02

Table 4.4 Risk Probabilities for Sexual Activity of Homosexual Females
Trinidad and Tobago and Jamaica (By type of Partner and Safety of Contact)

	TRINIDAD AND TOBAGO				JAMAICA			
	Casual	*Regular*	*Prostitute*	*Visiting*	*Casual*	*Regular*	*Prostitute*	*Visiting*
T1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T7	0.20	0.10	0.25	0.15	0.20	0.10	0.25	0.15
T8	0.60	0.35	0.65	0.55	0.60	0.35	0.65	0.55
T9	0.55	0.40	0.60	0.50	0.55	0.40	0.60	0.50
T10	0.03	0.01	0.05	0.02	0.03	0.01	0.05	0.02

Table 4.5 Risk Probabilities for Sexual Activity of Bisexual Males
Trinidad and Tobago and Jamaica (By type of Partner and Safety of Contact)

	TRINIDAD AND TOBAGO				JAMAICA			
	Casual	*Regular*	*Prostitute*	*Visiting*	*Casual*	*Regular*	*Prostitute*	*Visiting*
T1	0.40	0.30	0.45	0.35	0.40	0.30	0.45	0.35
T2	0.90	0.80	0.95	0.85	0.90	0.80	0.95	0.85
T3	0.85	0.75	0.90	0.80	0.85	0.75	0.90	0.80
T4	0.60	0.45	0.65	0.55	0.60	0.45	0.65	0.55
T5	0.90	0.80	0.95	0.85	0.90	0.80	0.95	0.85
T6	0.80	0.65	0.85	0.70	0.80	0.65	0.85	0.70
T7	0.30	0.20	0.35	0.25	0.30	0.20	0.35	0.25
T8	0.70	0.60	0.75	0.65	0.70	0.60	0.75	0.65
T9	0.65	0.55	0.70	0.60	0.65	0.55	0.70	0.60
T10	0.03	0.01	0.05	0.02	0.03	0.01	0.05	0.02

Table 4.6 Risk Probabilities for Sexual Activity of Bisexual Females
Trinidad and Tobago and Jamaica (By type of Partner and Safety of Contact)

	TRINIDAD AND TOBAGO				JAMAICA			
	Casual	*Regular*	*Prostitute*	*Visiting*	*Casual*	*Regular*	*Prostitute*	*Visiting*
T1	0.40	0.30	0.45	0.35	0.40	0.30	0.45	0.35
T2	0.90	0.80	0.95	0.85	0.90	0.80	0.95	0.85
T3	0.85	0.75	0.90	0.80	0.85	0.75	0.90	0.80
T4	0.60	0.45	0.65	0.55	0.60	0.45	0.65	0.55
T5	0.90	0.80	0.95	0.85	0.90	0.80	0.95	0.85
T6	0.80	0.65	0.85	0.70	0.80	0.65	0.85	0.70
T7	0.30	0.20	0.35	0.25	0.30	0.20	0.35	0.25
T8	0.70	0.60	0.75	0.65	0.70	0.60	0.75	0.65
T9	0.65	0.55	0.70	0.60	0.65	0.55	0.70	0.60
T10	0.03	0.01	0.05	0.02	0.03	0.01	0.05	0.02

Table 4.7 Risk Probabilities for Sexual Activity of Heterosexual Males
Trinidad and Tobago and Jamaica (By type of Partner and Safety of Contact)

	TRINIDAD AND TOBAGO				JAMAICA			
	Casual	*Regular*	*Prostitute*	*Visiting*	*Casual*	*Regular*	*Prostitute*	*Visiting*
T1	0.40	0.30	0.45	0.35	0.40	0.30	0.45	0.35
T2	0.90	0.80	0.95	0.85	0.90	0.80	0.95	0.85
T3	0.85	0.75	0.90	0.80	0.85	0.75	0.90	0.80
T4	0.60	0.45	0.65	0.55	0.60	0.45	0.65	0.55
T5	0.90	0.80	0.95	0.85	0.90	0.80	0.95	0.85
T6	0.80	0.65	0.85	0.70	0.80	0.65	0.85	0.70
T7	0.30	0.20	0.35	0.25	0.30	0.20	0.35	0.25
T8	0.70	0.60	0.75	0.65	0.70	0.60	0.75	0.65
T9	0.65	0.55	0.70	0.60	0.65	0.55	0.70	0.60
T10	0.03	0.01	0.05	0.02	0.03	0.01	0.05	0.02

Table 4.8 Risk Probabilities for Sexual Activity of Heterosexual Females
Trinidad and Tobago and Jamaica (By type of Partner and Safety of Contact)

	TRINIDAD AND TOBAGO				JAMAICA			
	Casual	*Regular*	*Prostitute*	*Visiting*	*Casual*	*Regular*	*Prostitute*	*Visiting*
T1	0.40	0.30	0.45	0.35	0.40	0.30	0.45	0.35
T2	0.90	0.80	0.95	0.85	0.90	0.80	0.95	0.85
T3	0.85	0.75	0.90	0.80	0.85	0.75	0.90	0.80
T4	0.60	0.45	0.65	0.55	0.60	0.45	0.65	0.55
T5	0.90	0.80	0.95	0.85	0.90	0.80	0.95	0.85
T6	0.80	0.65	0.85	0.70	0.80	0.65	0.85	0.70
T7	0.30	0.20	0.35	0.25	0.30	0.20	0.35	0.25
T8	0.70	0.60	0.75	0.65	0.70	0.60	0.75	0.65
T9	0.65	0.55	0.70	0.60	0.65	0.55	0.70	0.60
T10	0.03	0.01	0.05	0.02	0.03	0.01	0.05	0.02

As regards the sexual activity of homosexual females, several additional assumptions were made in assigning the risk probabilities. Since there is no insertion in intercourse among homosexual females, the associated risk probabilities for vaginal and anal intercourse were set to zero. Risk probabilities were only assigned to oral-genital sexual contact. For oral-genital intercourse without a condom (T8), relatively moderate risk probabilities of 0.60, 0.65 and 0.55 were assigned for intercourse with casual, prostitute and visiting partners. In the case of oral-genital intercourse with a regular partner, a risk level of 0.35 was assigned to the likelihood of HIV transmission.

Tables 4.5 and 4.6 present the risk probabilities for bisexual- males and females, respectively. Since these group engage in the full range of sexual activity, risk probabilities were assigned to all the forms of sexual contact (i.e. vaginal, anal and oral-genital sex). In respect of bisexual males, high risk probabilities were assigned to the most risky forms of sexual interaction. For anal intercourse without a condom with ejaculation, risk probabilities of 0.90, 0.95 and 0.85 were assigned for contact with casual, prostitute and visiting partners, respectively.

In the case of vaginal intercourse without use of a condom, risk probabilities of 0.90, 0.95 and 0.85 were assumed for sexual intercourse with casual, prostitute and visiting partners, respectively. Relatively lower risk probabilities were assigned to the various forms of sexual contact with regular partners. As regards the sexual activity of bisexual females, equivalent risk probabilities were assumed for the various forms of sexual contact.

Tables 4.7 and 4.8 present risk probabilities for the sexual contacts of heterosexual men and women, respectively. Relatively higher risk probabilities were assigned to intercourse without the use of condom while lower risk probabilities were assigned to safe-sex practices. The values assigned for the various forms of sexual intercourse were assumed to be no different from those adopted for bisexual males and females. The general assumption being made here is that the activity of heterosexuals poses the same risk for transmission as that for bisexuals.

2.2 Discussion of Number of Persons at Risk

Estimates of the number of males and females, respectively who are at risk to contracting HIV in Trinidad and Tobago and Jamaica were computed using the socio-behavioural model. Based on the existing sexual preferences and practices, 45,643 males and 38,285 females will be at risk to HIV by the year 2000 in Trinidad & Tobago. The number of males and females at risk is projected to increase to 52,696 and 49,701, respectively by the year 2005. Altogether , 102,397 persons are likely to be at risk of contracting the disease. This represents 9 percent of the country's adult population and 5.8% of the overall population. Similar estimates for males and females were also derived for Jamaica and are contained in tables 4.11 and 4.12 respectively. In the case of Jamaica, 169,351 males and 52,713 females are estimated to be at risk by the year 2005. This represents some 9% of the adult population in that country.

When the data are disaggregated by risk group, the number of bisexuals and homosexuals that are at risk to HIV are projected to be substantially lower than the number of heterosexuals. This is simply because the number of bisexuals and homosexual males and females are assumed to comprise relatively smaller proportions of the total population in Trinidad and Tobago.

2.3 Projections on the Incidence of HIV

The projections of HIV incidence in both Jamaica and Trinidad and Tobago are subdivided into three scenarios (low, median and high case). In the low and high case scenarios, 10% and 80%, respectively of the persons at risk are expected to be HIV positive. In the median case scenario, only one half of the number of persons at risk (50%) are expected to develop HIV.

In Trinidad and Tobago, the low case projections indicate that 5,270 males (0.5% of the adult population) are expected to be HIV positive by the year 2005. The high and median case estimates suggest that 42,157 and 26,348 males, respectively are expected to be HIV positive by the year 2005, if no intervention occurs. In the worst case scenario, 4% of the adult population will contract HIV by the year 2005 in Trinidad and Tobago.

For Jamaica, the low-case scenario suggests that 16,935 males are expected to be HIV positive in the year 2005. In the high case (worst case) scenario, 5.5% of the population or 135,481 males are expected to contract the HIV virus by the year 2005.

Projections of HIV incidence among females in Trinidad and Tobago display similar patterns to their male counterparts. In the low, median and high case scenarios, 4.970, 24,850 and 39,761 females, respectively are expected to contract the HIV virus by the year 2005. The number of females that are expected to be HIV positive in the high case scenario comprise 3.4% of the adult population. This number is marginally lower than that estimated for males.

With respect to the projections of HIV incidence among females in Jamaica, the figures reveal comparatively lower estimates when compared to that of males. In the low, median and high case scenarios, 5,271, 26,356 and 42,170 females are expected to contract the HIV virus by the year 2005. These figures comprise 0.2%, 1.1% and 1.7%, respectively of the total population of Jamaica. In the high case scenario, the estimate of HIV incidence among males is over three times the number projected for females.

Tables 4.13 and 4.14 provide summary data for overall HIV incidence among adults in Trinidad and Tobago and Jamaica respectively for all three scenarios. In the worst case scenario, 81,917 and 177,651 persons are expected to contract HIV in Trinidad and Tobago and Jamaica respectively, by the year 2005.

For Trinidad & Tobago, the projections for the overall HIV incidence represent 0.9% of the adult population in the low case scenario and 4.4% and 7% respectively in the median and high case scenarios. In terms of the overall population, these figures represent 0.6%, 2.9% and 4.6% over the three scenarios.

In the case of Jamaica, incidence projections represent 0.9%, 4.6% and 7.4% of the adult population in the low, median and high case scenarios respectively and 0.6%, 3.2% and 5.1% of the overall population over the three scenarios.

Table 4.13 Adult HIV Incidence projections for Trinidad & Tobago (1997-2005)

YEAR	Total Adult Population at Risk	Projected HIV Cases		
		Low scenario	Median scenario	High scenario
1997	75371	7537	37686	60297
1998	77769	7777	38885	62215
1999	81091	8109	40545	64873
2000	83928	8393	41964	67143
2001	86524	8652	43262	69219
2002	89315	8931	44657	71452
2003	93211	9321	46606	74569
2004	97885	9789	48943	78308
2005	102397	10240	51198	81917

Table 4.14 Adult HIV Incidence projections for Jamaica (1997-2005)

YEAR	Total Adult Population at Risk	Projected HIV Cases		
		Low scenario	Median scenario	High scenario
1997	168588	16859	84294	134870
1998	173346	17335	86673	138677
1999	180958	18096	90479	144767
2000	187292	18729	93646	149834
2001	192502	19250	96251	154002
2002	198987	19899	99493	159189
2003	207811	20781	103906	166249
2004	215492	21549	107746	172394
2005	222064	22206	111032	177651

Fig 1 HIV Incidence Projections for Trinidad and Tobago and Jamaica (1997-2005) High Scenario Case

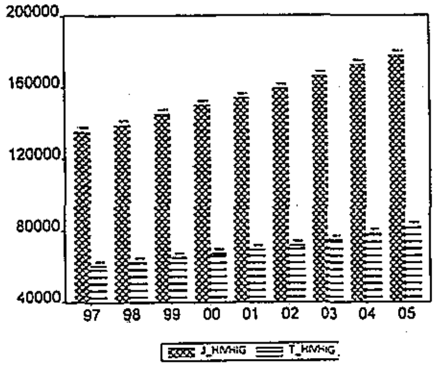
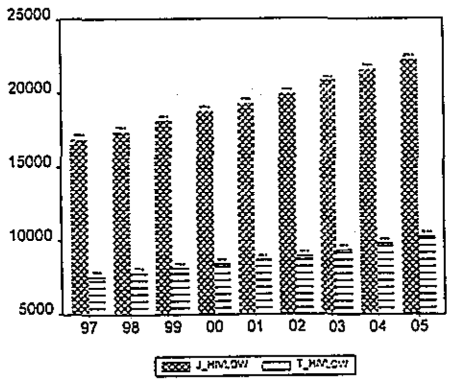


Fig 2 HIV Incidence Projections for Trinidad and Tobago and Jamaica (1997-2005) Low Scenario Case



Section 4: The Macroeconomic impact of HIV/AIDS

Specification of CARIBAIDSMOD

The framework adopted in our approach for modelling the economic impact of HIV/AIDS on Caribbean-type economies is based on a modification of the economic model developed by Cuddington (1993a, 1993b), Cuddington and Hancock (1994) and Cuddington, Hancock and Rogers (1994). This model (known as CARIBAIDSMOD Version 1) consists of the following five major blocks:

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

MODELLING SYSTEM FOR ASSESSING THE ECONOMIC IMPACT OF AIDS: CARIBAIDSMOD

A. Output Block

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

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

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

$$Y = Y_{ag} + Y_{mg} + Y_{sv}$$ Equation 5.4 *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

$L_{s,ag} = L_{s,ag,m} + L_{s,ag,f}$	*Equation 5.5 Labour Supply, Agric.*
$L_{s,mg} = L_{s,mg,m} + L_{s,mg,f}$	*Equation 5.6 Labour Supply, Manuf*
$L_{s,sv} = L_{s,sv,m} + L_{s,sv,f}$	*Equation 5.7 Labour Supply, Agriculture*
$L_s = L_{s,ag} + L_{s,mg} + L_{s,sv}$	Equation 5.8 Total Labour Supply
$L_{s,ag,m} = p_{ag,m} * L_m$	*Equation 5.9 Male Labour, Agric*
$L_{s,mg,m} = p_{mg,m} * L_m$	*Equation 5.10 Male Labour, Manuf*
$L_{s,sv,m} = p_{sv,m} * L_m$	*Equation 5.11 Male Labour, Serv*
$L_{s,ag,f} = p_{ag,f} * L_f$	*Equation 5.12 Female Labour, Agric*
$L_{s,mg,f} = p_{mg,f} * L_f$	*Equation 5.13 Female Labour, Manuf*
$L_{s,sv,f} = p_{sv,f} * L_f$	*Equation 5.14 Male Labour, Serv*

Equation 5.15: Effective Labour Force in Agriculture

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

Equation 5.16: Effective Labour Force in Manufacturing

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

Equation 5.17: Effective Labour Force in Services

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

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.[5] 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:

$\omega_{ag} = \dfrac{Y_{ag} * a_1}{L_{e,ag}}$	*Equation 5.18, Wage rate, Agriculture*
$\omega_{mg} = \dfrac{Y_{mg} * b_1}{L_{e,mg}}$	*Equation 5.19, Wage Rate Manufacturing*
$\omega_{sv} = \dfrac{Y_{sv} * c_1}{L_{e,sv}}$	*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.

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

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.

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

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

$Emp_{sr} = f(\omega_{sr}, L_{e,sr})$ *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

4.1 OUTPUT OF CARIBAIDSMOD[6]

The macroeconomic impact of HIV is confined here to the effects on savings, investment, employment in the sectors, labour supply, HIV expenditure and GDP (Gross Domestic Product). The proportion of adults that are projected to succomb to the disease will initially adversely affect the labour supply, particularly the more labour intensive sectors (Agriculture and Services). In addition, as the supply of labour falls, wage rates are expected to increase as employers compete for limited labour (and particularly those that are skilled). The impact on savings and investment is seen via the expected increase in expenditure associated with increased incidence of HIV among the adult population. This threatens to divert funds away from productive saving, which will in turn affect the levels of investment that can be achieved. Given that investment in capital and labour are identified as the major determinants of the levels of output from the various sectors, it is evident that HIV/AIDS will have a negative impact on the level of growth.

Table 5.1 presents the results of the macro economic impact of HIV in Trinidad and Tobago and Jamaica, respectively, based on the adult projections. It must be noted that these impact measures are based only on the low case scenario projections. The fraction of persons that are likely to contract the disease was increased on a sustained basis by 20% over the period 1997 – 2005. This exogenous shock to the system was meant to capture the increase in the incidence of HIV cases in both Jamaica and Trinidad and Tobago. Contractions in the major macroeconomic variables were evident from the simulations. Gross Domestic Product in Jamaica and Trinidad and Tobago declined on average by 6.4 and 4.2 percent, respectively. The level of investment was also severely affected as incomes had to be redirected from the production of goods and services to finance expenditures on HIV. Indeed, expenditures on HIV- related illnesses rose by 25.3% and 35.4% respectively in Trinidad and Tobago and Jamaica.

[6] See Camara et al. for details on the model.

Table 5.1 Macro economic Impact on Key Variables for Jamaica and Trinidad and Tobago (based on low case scenario projections)

Impact Variables	Trinidad & Tobago	Jamaica
Gross Domestic Product	-4.2%	-6.4%
Savings	-10.3%	-23.5%
Investment	-15.6%	-17.4%
Employment in Agriculture	-3.5%	-5.2%
Employment in Manufacturing	-4.6%	-4.1%
Employment in Services	-6.7%	-8.2%
Labour Supply	-5.2%	-7.3%
HIV/AIDS Expenditure	+25.3%	+35.4%

Although there were declines in employment, the model simulations demonstrate that employment in the service sector categories were more affected by rising incidence of the disease than employment in either agriculture or services. The model simulation results also indicate that the macroeconomic consequences of the disease were more severe in Jamaica than in Trinidad and Tobago. In particular the negative impact on savings in Jamaica needs to be given special attention. The results of the simulations, when examined over a 15-20 year horizon indicate that the level of domestic savings in Jamaica was inadequate to finance the expenditures on HIV.

The preliminary results of the model demonstrate that the rising incidence of HIV cases, if left unchecked, will lead to negative growth (fall in the level of GDP) and a substantial decline in the level of domestic savings.

Section 4 Summary and Conclusions

In terms of the outcome of the study, a few general points are worth mentioning:-

1. It is clear both from the projections and the existing data that although the first case of AIDS was diagnosed in 1982, cases of HIV would have existed in Trinidad and Tobago and Jamaica as early as the mid 1970s.

2. The projected impact of HIV and by extension AIDS, if left unattended will have a significant impact on both the adult population as well as that of young children, the latter case, while not specifically included in the model, will significantly impact on HIV/AIDS expenditure at both the individual as well as the institutional level.

3. The impact of the increase incidence on the macro economy is also a cause for concern, particularly as HIV threatens to erode the economic base of many Caribbean countries via its impact on the labour force and its impact on the capacity to sustain adequate levels of saving to create new investment opportunities that are essential for growth.

4. Finally, given that a number of programmes have been initiated since the inception of HIV/AIDS, it is also clear that levels of awareness and behavior would have improved over the last decade or so. Also, in so far as these initiatives are continuing it is essential that the model be continuously tested within the context of the changing economic and social environment.

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CUMULATIVE AIDS CASES BY COUNTRY, AGE GROUP AND GENDER
REPORTING PERIOD: JANUARY, 1982 TO DECEMBER, 1996

			AGE GROUP									GENDER		
COUNTRY	CASES	DEATHS	0 - 4	5 - 14	15 - 19	20 - 24	25 - 34	35 - 44	45 - 54	Over 55	UNKN.	MALE	FEMALE	UNKN.
Anguilla	4	4	0	0	0	0	2	0	0	0	2	1	2	1
Antigua	79	64	4	0	3	5	30	10	7	8	12	56	14	9
Bahamas	2476	1654	164	18	19	159	856	705	321	214	20	1509	966	1
Barbados	762	637	36	4	18	58	259	203	112	70	2	583	179	0
Belize	113	108	2	0	1	10	23	7	2	3	65	30	18	65
Bermuda	383	293	1	2	0	11	116	167	60	20	6	296	87	0
Cayman Islands	22	18	1	0	0	2	9	4	4	2	0	13	9	0
Dominica	88	70	4	1	1	6	33	29	7	7	0	69	19	0
Grenada	95	67	6	0	2	12	35	23	5	8	4	65	26	4
Guyana	697	193	18	5	17	115	316	118	49	7	52	470	225	2
Jamaica	2058	1146	141	16	38	131	679	565	258	146	84	1267	778	13
Montserrat	2	0	0	0	0	0	0	1	0	0	1	0	·1	1
St Kitts & Nevis	59	32	1	0	0	0	12	10	3	1	32	38	21	0
Saint Lucia	90	74	6	1	2	3	21	34	12	7	4	54	36	0
St. Vincent & Gren.	98	94	5	0	4	8	36	29	10	4	2	66	32	0
Suriname	215	182	7	0	5	12	82	46	39	23	1	151	64	0
Trinidad & Tobago	2492	1584	158	19	65	267	837	629	321	160	36	1753	728	11
Turks & Caicos Is	42	30	0	0	2	2	14	8	9	7	0	29	13	0
British Virgin Is. U.K.	12	7	1	1	0	0	4	4	0	2	0	7	5	0
Total	9787	6257	555	67	177	801	3364	2592	1219	689	323	6457	3223	107

Data Source: Quarterly AIDS Surveillance Reports submitted to CAREC's Epidemiology Division by its member countries 14-10-97 1