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A RESERVES POOL MODEL FOR CARICOM

BY

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INTRODUCTION

In previous papers [Nicholls (1991, 1993)] a detailed assessment was made of the integration attempt in CARICOM as it related to trade. Indeed the main emphasis of the regional movement was on the promotion of integration through the mechanism of intra-regional trade liberalization. On hindsight, the expectation of major benefits from this approach has not been realized. This anticipation of net benefits reflected, in large measure, the Vinerian orthodoxy which assumed that once a customs union was formed (by tariff elimination between member states and the administering of a common external tariff) then, *ipso facto*, a chain of events would be set in motion which caused the partner country to increase its exports to the regional market. This increased exportation in turn boosted the revenues, reserves and income of the partner country while the increased importation of cheaper goods to the home country gave its citizens increased choice and an improvement in welfare.

These inferences are indeed more justifiable in the context of a developed country economy where the existence of

a relatively sophisticated monetary architecture guarantees the necessary linkages needed to bolster the benefits from trade integration. The same cannot be automatically inferred for CARICOM where the monetary and financial linkages needed for promoting trade integration are quite limited. Incidentally, the traditional customs union literature which provided the theoretical reference frame for integration in many less developed countries ignored the important contribution of monetary and financial policy. The developmental approach to customs union theorizing attempted to correct this by stressing the importance of other factors, particularly foreign exchange savings (i.e one aspect of monetary policy) in the integration process of less developed countries.

The latter approach provides the rationale for an examination of foreign exchange pooling as a viable strategy in the advancement of Caribbean integration and in the promotion of exchange rate stability. The pooling of reserves, however, raises several important questions. Why should reserves be pooled in CARICOM?; How much reserves should be contributed to a common pool?; What effect is pooling likely to have on the stability of the exchange rate of individual member states and how is it likely to affect the individual economies?; and finally, who should be in charge of managing the reserves of the pool? The remaining sections of the chapter attempt to shed some light on these critical

matters.

Section 1 of the paper essentially deals with the question of why reserves should be pooled in CARICOM by exploring the gains and costs which can result from pooling. The theoretical rationales for and against reserves pooling are presented drawing from contributions of Dodsworth (1975), Landell-Mills (1989) and Ben-Bassat et al. (1992). Section 2 discusses the question of how much reserves should be contributed to the pool and examines the benefits which accrue to member states under varying pooling configurations. In section 3, a small macroeconometric model is constructed to analyze the impact that pooling has on the economies of three of the more important territories. This analysis is conducted by simulating how the exchange rate and other key macrovariables behave in an unpooled as compared to a pool state. The final section, section 4, looks at the institutional framework which is needed if a strategy based on pooling is to confer benefits on the member states of CARICOM.

SECTION 1: RESERVES POOLING - RATIONALE AND THEORY

Benefits and Costs of Reserves Pooling

Recently, the CARICOM Heads of Government have agreed on a two-tiered approach to monetary union. This approach sets the stage for the evolution of a Caribbean Monetary Authority (CMA) with power to issue a common currency. Concrete monetary union in CARICOM, however, not only involves the creation of a CMA and common currency but must consider, in addition, the management of the reserves which are at the disposal of the CMA. On this latter score, the report of the Central Bank Governors (1992) is particularly silent. The issue of a reserve fund for CARICOM is, however, not an entirely new idea and was given some active consideration in the decade of the 1970s by Thomas (1973), the World Bank (1975), Worrell (1976a,b), Bennett (1979a,b) and Dodsworth (1978). No concerted follow-up was made since one member state of CARICOM (Trinidad and Tobago), amassed a large quantity of reserves (on account of a hike in oil prices), and was able to advance loans and aid to less fortunate members, obviating the reserve constraint of other member states.

By the mid-1980s, however, the situation changed drastically as commodity prices collapsed exposing the fragile base of Caribbean economies. The pooling of reserves is a key

strategy which, had it been adopted, may have provided Caribbean member states with a source of funds to continue with their developmental objectives.

In a broad sense, the reserves of a country consist of its official holdings of gold and the convertible currency of other member states. The IMF defines reserves as "the resources that are available to the monetary authorities for the purpose of meeting balance of payments deficits". This definition, includes SDRs and the reserve position in the fund. Jager (1979) however questioned the inclusion of the latter arguing that they fail to satisfy the very definition of reserves. In this chapter the IMF definition will be utilized although a greater weight will be placed on the convertible currency of other states[1]. The pooling of reserves refers simply to the amalgamation of the reserve holdings of a set of co-operating entities.

Countries hold reserves for reasons that arise out of their economic circumstances and policy priorities. These circumstances and priorities include imbalances of a financial, cyclical and seasonal nature; intervention in exchange markets; the smoothing of current consumption and the provision of a buffer to cushion the economy against future exigencies [Landell-Mills (1989)]. The opportunity to pool reserves under the umbrella of a monetary union can confer

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[1] In Caribbean economies the US dollar is the major reserve currency.

several benefits on the member states of CARICOM.

Firstly, by belonging to a reserve pool each member state can buy itself unconditional access to the reserves of other member states during its time of need [Medhora (1992)]. Secondly, pooling may afford member states the possibility of a reduction in their reserve variability thereby granting them protection against unforeseen variation in the volume of and/or prices of their major hard currency earners. This issue, incidentally, is only truly beneficial if the variability in reserves of the entire pool is smaller than the variability in the reserves of the individual member countries. Thirdly, reserve pooling allows an increase in the bargaining strength of individual member countries especially as regards negotiations with multilateral institutions like the IMF and World Bank. Typically in such negotiations developing countries with limited reserves are forced into a weak bargaining position. Fourthly, the existence of a strong regional reserve fund can give a position of strength to regional currencies by lessening the risk of frequent exchange rate depreciations. This leads in the final analysis to fuller convertibility of the respective member currencies. Finally, reserve pooling also confers indirect benefits by fostering an environment in which member states can pool knowledge, information and exchange technology. This can cultivate a better understanding of differences and serve to

enhance co-operative efforts between member states [Wadhva (1969)].

It would, of course, be inadequate to focus only on the perceived benefits of pooling since contributing to a regional reserve fund also carries with it certain inherent costs. These opportunity costs involve the loss of income which results if the reserves were deployed in alternative uses. For countries in the Caribbean, reserves have several alternative uses. For a start, they can be monetized and utilized by individual member governments to finance infra-structural development and investment in the economy. Alternatively, they can be utilized for debt repayment or in the case of excess reserves invested on the international market in short-term, liquid instruments.

Several well-meaning skeptics in the Caribbean suggest that the pooling of reserves is an uninteresting proposition since arrangements with similar effects (e.g clearing-houses) have been attempted with limited overall success. It is useful to point out, though, that the clearing house arrangement which was undertaken in CARICOM (CMCF) occurred in the context of a pseudo-exchange rate union which delivered no fixed commitment, on the part of participating members, to discipline defaulters. However, a reserves pooling arrangement under the umbrella of an independent monetary authority with well-defined operational rules can bring benefits to the member countries of CARICOM.

Theory of Reserves Pooling

The Dodsworth Model applied to CARICOM

In order to analyse the possible contribution of reserves pooling to economic integration, this section draws on the framework of Dodsworth (1975, 1978) and Dodsworth and Diamond (1980). This framework is in actuality a modification of the theory of Clubs developed earlier by Buchanan (1965) and Ng (1975). The model of Dodsworth assumes that members of a regional group are faced in each time period (t) with a choice regarding the financing of payments. Payments D_t can either be financed from current receipts, C_t, if $D_t < C_t$, or from a reserve pool, R, if $D_t > C_t$. The size of the reserve fund reflects the dispersion of D_t above C_t as well as a risk factor, W, which is the probability that illiquidity will arise after a number of time periods, n.

$$W = Pr\left[\sum_{t=1}^{n} D > \left(\sum_{t=1}^{n} C_t + R\right)\right] \qquad (7.1)$$

If the time horizon, n, is arbitrarily fixed at unity, then a trade off curve, reflecting the distribution of payments D_t around receipts C_t, may be drawn between reserves held and the risk factor W. These payments reflect for CARICOM countries, recurrent fiscal expenditure especially on principal and debt

payments. Receipts are derived primarily from exportation of one or two major products (e.e Oil, Bauxite and Alumina).

Consider the case therefore of any two CARICOM member countries. If the distribution of $\{D_t - C_t\}$ is assumed to be symmetric then trade-off curves which cut the W axis at a probability value of 0.5 can be constructed for both member countries as illustrated in figure 7.1[2]. . Initial trade-off curves for these member countries are represented by C1 and C2 and indicate the level of reserves which correspond to a given level of risk. The risk preferences of the two member countries are denoted by the preference curves a(i) and b(i) which indicate the level of risk aversion of the two member states. Figures 7.1a and 7.1b summarize the effects of reserves pooling on risk aversion.

Before a situation of pooling is instituted, country 1 and country 2 are at positions V1 and V2 which correspond to initial reserve holdings of R1 and R2. Suppose that a pooling arrangement is concluded such that the pooled trade-off curve is given by OP. Once a decision is taken as to the relative contributions of the two countries to the central pool, new effective trade off curves, CP1 and CP2, can be defined which indicate the division of costs between the two countries. Desired positions under the pooling arrangement are indicated

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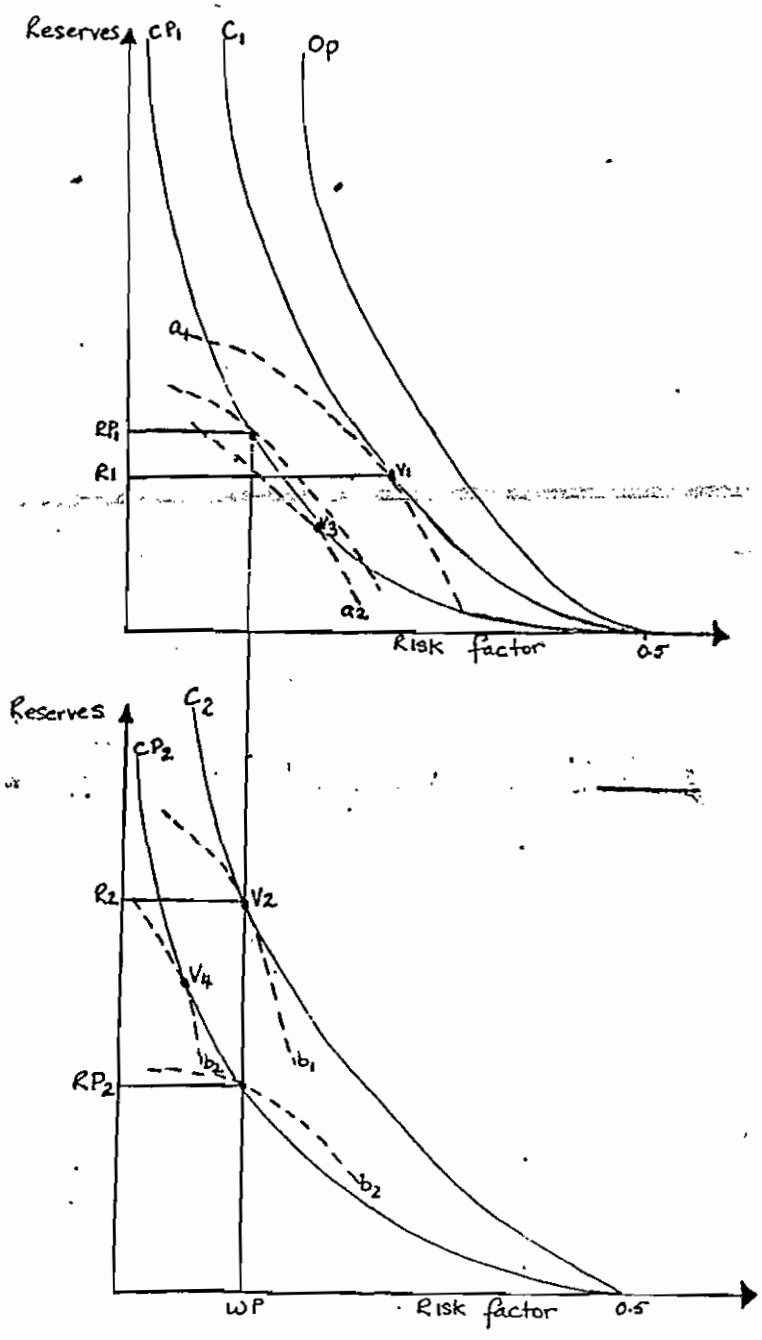
[2] These trade off curves are assumed to be identical for each member state although in practice this nicety will scarcely arise.

by V3 and V4 and lie on preference curves b2 and b3 for

FIGURE 7.1

Trade-Off Curves Under Reserves Pooling



Source: Dodsworth (1978, p. 280)

countries 1 and 2, respectively. These positions, however, are not likely to be compatible, except by mere coincidence, and countries are expected to settle on a common risk factor if the pooling arrangement is to be instituted. Such a compromise is illustrated in Figure 7.1b in which consensus is reached on a risk factor, wp. This common risk factor implies reserves holdings of RP1+RP2 and a movement from a1 to a2 for country 1 and b1 to b2 for country 2.

Several interesting and relevant conclusions can be gleaned from an analysis of the Dodsworth model. Firstly, benefits from the reserve pooling arrangement depend not only on reserve economies but also on the differences in the preferences (risk aversion) of member countries. The larger the differences in desired risk factors in a situation of pooling the more inferior will the pooled state (a2) & (b2) be to the unpooled state, (a1) & (b1). Secondly, the savings in reserves will be affected by the choice of the common risk factor. If a conservative scheme is adopted that requires no member state' risk factor to be increased, then the reserve saving element will be reduced and if there are wide differences between factors may even be negative. This situation is more likely if a wide divergence in risk adversity is combined with greater correlation between member's usage patterns (i.e similarity in seasonal and cyclical reserve behaviour). Thirdly, the size of the reserve saving will be affected by the cost-sharing scheme. Cost

sharing schemes should be inclined towards requiring the more risk averse members of the group to contribute more than a proportionate share to the common fund.

The model of Dodsworth provides a useful reference frame for analyzing reserve pooling in CARICOM but has some inherent limitations. The analysis focuses almost exclusively on the variability of payments and the risk of illiquidity. These are, however, not the only factors which affect the demand for reserves in the member states of CARICOM although they do play a significant role[3]. Furthermore, the Dodsworth model assumes implicitly that future deficits/surpluses of member states will be unaffected by the existence of the regional reserve pool. This may introduce a problem of moral hazard in which some member countries who are granted unlimited access to the reserve fund adopt a profligate approach in their spending patterns. This signals the need for operating rules which employ some credit rationing devices to force likely "abusers" to exercise a more disciplined stance in their foreign and domestic expenditure decisions.

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[3] Attempts have been made in other empirical studies to analyze the main determinants of reserve demand. See Bahmani-Oskooee (1985) for a useful survey.

SECTION 2: RESERVES POOLING AND THE RISK OF ILLIQUIDITY

Potential for Reserves Pooling

The pooling of reserves offers member states in CARICOM the potential to derive two sources of gain. The first of these is access to increased reserve holdings while the second is a possible reduction in reserve variability. Dodsworth (1978) and Medhora (1992a,b) utilized a notion of coverage which incorporates these two sources of gain. This concept of coverage is defined as the ratio of reserve holdings to their variability. For a single country, coverage in a situation without pooling is :-

$$C_i^u = \frac{R_i}{Varb(R_i)} = \frac{R_i}{\sigma} \qquad (7.2)$$

where R_i is reserve holdings in each member state and Varb(R_i) is the variability of reserves proxied by their standard deviation. Suppose that the N member states of CARICOM decide to pool a proportion of their reserves by establishing a reserves fund. Let R_i (i=1 to N) be random variables which represent foreign exchange earnings of the various member states. R_i is assumed to have mean, μ_i and variance, σ^2_i. The reserve fund, R^p_N, can be expressed as a linear combination of

the R_is as follows:-

$$R_n^p = \sum_{i=1}^{N} \phi_i R_i \qquad (7.3)$$

where ϕ_is $(0<\phi_i<1)$ are parameters which denote the proportion of reserves that will be committed to the fund. The mean of the reserve fund can be written as follows[4]:-

$$\mu_{R^p} = E\left[\sum_{i=1}^{N} \phi_i R_i\right] = \sum_{i=1}^{N} \phi_i E(R_i) = \sum_{i=1}^{N} \phi_i \mu_i \qquad (7.4)$$

while the standard deviation of the pool of reserves is:-

$$\sigma_{R^p} = \sum_{i=1}^{N} \phi_i^2 \sigma_i^2 + 2 \sum_{i} \sum_{j} \phi_i \phi_j \rho_{ij} \sigma_i \sigma_j \qquad (7.5)$$

where

$$\rho_{ij} = \frac{Cov(R_i, R_j)}{\sigma_i \sigma_j} \qquad (7.6)$$

If the R_is are independent so that the Cov $(R_i, R_j)=0.0$, $(i \neq j)$, the standard deviation of the reserve fund is simply $\sum \phi^2_i \sigma^2_i$. In any given period the coverage that is available to a member

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[4] See Hogg and Craig (1978) and Hogg and Klugman (1983) for details on these derivations.

state of CARICOM under partial reserve pooling can be defined as follows:-

$$C_i^p = \frac{\phi_i R_i + (1-\phi_i) R_i + \sum_{j(i\neq j)} \phi_j R_j}{Varb\left[\phi_i R_i + (1-\phi_i) R_i + \sum_{j(i\neq j)} \phi_j R_j\right]} \qquad (7.7)$$

The numerator in the above expression represents the reserves which each member state has at its disposal. This consists of the contribution to the reserve pool, $\phi_i R_i$, plus reserves in hand, $(1-\phi_i)R_i$, plus the sum of the contributions of the remaining member states, $\sum \phi_j R_j$. The formulation in equation 7.7 reduces to the following expression:-

$$C_i^p = \frac{R_i + \sum_{j(i\neq j)} \phi_j R_j}{Varb\left[R_i + \sum_{j(i\neq j)} \phi_j R_j\right]} \qquad (7.8)$$

If reserve pooling is to afford any gains to member states then $C^p_i > C^u_i$. The necessary conditions for this to occur are (1) $\{\sum \phi_j R_j\} > 0.0$ and (2) $Varb[R_i + \sum \phi_j R_j] < Varb[R_i]$. Coverage under reserve pooling, therefore, will be higher than that in the autonomous state if the variability of the pool is lower than the variability of the reserves of each member state separately, or if the increased access to reserves outweighs the higher variability of the pool. It should be emphasized at this juncture that in this formulation each country has

unrestricted access to the resources of the pool[5]. As a result the drawing of reserves from the pool by any single member country will reduce the coverage that any other member of the pool will have at its disposal.

The pattern of reserve holdings and their variability in each member state of CARICOM is indicated in Table 7.1. The first column displays average reserve holdings for each member state while the second and third columns display the standard deviation of reserve holdings and the coefficient of variation, respectively. This coefficient is a statistical measure of the degree of variability of reserve holdings. Reserves variation are analysed for the sub-periods 1975-1985 and 1986-1991 and the whole period 1975-1991. For the overall period 1975-1991, the results indicate wide dispersion in the mean reserve holdings of the various member states. For instance, the mean reserve holdings of Trinidad and Tobago were almost three times that of the combined earnings of the other member states. Moreover, the coefficient of variation reveals that Guyana, Belize, Dominica, St. Lucia and Trinidad and Tobago had comparatively higher levels of variability than the other member states of CARICOM over the period 1975-1991. When the data is disaggregated into sub-periods an interesting contrast emerges in respect of reserve variability. Reserve

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[5] The equation for C^{P}_{i} represents a member's full access to the fund and assumes that no two countries can draw reserves from the pool simultaneously.

Table 7.1 Mean Reserves Holdings and Variability in CARICOM

1975-1991	MEAN $US	STD DEV.	COEFVAR
ANTIGUA/BARBUDA	16.17	9.78	0.605
BARBADOS	93.86	42.44	0.452
BAHAMAS	114.42	52.83	0.462
BELIZE	22.40	20.79	0.928
DOMINICA	6.99	5.91	0.845
GRENADA	13.43	5.40	0.402
GUYANA	25.34	33.42	1.319
JAMAICA	100.61	44.20	0.439
ST KITTS/NEVIS	7.18	5.22	0.727
ST. LUCIA	17.83	14.78	0.829
ST. VINCENT	12.96	8.42	0.650
TRINIDAD AND TOBAGO	1241.02	1009.15	0.813
AVERAGE	139.35	104.36	0.71
1975-1985			
ANTIGUA/BARBUDA	9.54	3.66	0.384
BARBADOS	78.71	43.51	0.553
BAHAMAS	87.33	41.90	0.480
BELIZE	9.00	3.29	0.366
DOMINICA	3.31	2.70	0.816
GRENADA	10.39	3.74	0.360
GUYANA	22.40	26.63	1.189
JAMAICA	82.82	39.74	0.480
ST KITTS/NEVIS	3.79	1.54	0.406
ST. LUCIA	7.87	2.82	0.358
ST. VINCENT	7.32	3.39	0.463
TRINIDAD AND TOBAGO	1777.26	850.44	0.479
AVERAGE	174.98	85.28	0.53
1986-1991			
ANTIGUA/BARBUDA	28.33	2.28	0.080
BARBADOS	121.62	23.46	0.193
BAHAMAS	164.10	29.05	0.177
BELIZE	46.97	15.53	0.331
DOMINICA	13.74	3.54	0.258
GRENADA	19.01	2.78	0.146
GUYANA	30.73	45.86	1.492
JAMAICA	133.22	33.47	0.251
ST KITTS/NEVIS	13.39	3.23	0.241
ST. LUCIA	36.09	8.10	0.224
ST. VINCENT	23.29	2.40	0.103
TRINIDAD AND TOBAGO	257.90	140.95	0.547
AVERAGE	74.03	25.89	0.34

holdings displayed much greater variability in the first sub-period compared to the second for most countries of CARICOM with the exception of Trinidad and Tobago and Guyana.

Coverage ratios for the members states of CARICOM were calculated based on the expressions for C^p_i and C^u_i and are reported in Table 7.2. The first column displays the coverage ratios (C^u_i) that each member state would have enjoyed had it not belonged to the reserve pool. The remaining columns show coverage ratios under varying pooling configurations. During the first sub-period, 1975-1985, Antigua and Barbuda, Belize, Grenada and St. Lucia would have enjoyed lower coverage under pooling than they would have experienced autonomously. These results demonstrate than even increased access to pooled reserves would have been insufficient to compensate these countries for accepting the higher variability of other countries in the pool. However, the majority of countries would have experienced higher ratios if reserves were pooled than if they were left under autonomous control. For the second sub-period, 1986-1991, despite the fact that reserves holdings of most member states displayed relatively little variability, there were still gains to be made from pooling on account of the increased access to additional reserves. Only two countries, Antigua and Barbuda and St. Lucia displayed coverage ratios under pooling than were lower than in the unpooled state. For the entire period 1975-1991, all countries with the exception of Grenada would have benefitted

from a reserve pooling scheme. In examining coverage ratios under pooling an attempt was also made to discern the extent to which coverage ratios differed under a full pooling arrangement as compared to a partial pooling scheme. The results, based on the pooling formula utilized, indicate that a full pool delivers lower reserves gains and coverage for the majority of countries than a partial pooling arrangement. This is not to suggest, however, that a full pool is not beneficial since it does afford countries the potential to realize increased coverage.

To understand the beneficial impact of pooling one needs only ascertain the level of reserves each country would have had to hold in an autonomous state to enjoy the level of coverage afforded by a pooling of reserves. Following Medhora (1992a), this level of reserves can be computed as follows:-

$$R_i^* = C_i^P Varb(R_i) \qquad (7.9)$$

R_i^* is the hypothetical level of reserves that each member state would have to hold to enjoy the pooled level of coverage, C_i^P. Table 7.3 presents reserve savings computed if a 10% partial pooling scheme had been adopted in CARICOM. In the sub-period, 1975-1985, the reserve gain, as a percentage of unpooled reserves, ranges from 1.87% in Trinidad to 256% gain Guyana. The large percentage gain figure for Guyana is not surprising since this country had, throughout the period,

Table 7.2 Coverage Ratios Under Varying Pooling Configurations in CARICOM

1975-1991	COVERAGE (no pool)	COVERAGE 10%	COVERAGE 50%	COVERAGE 70%
ANTIGUA/BARBUDA	1.65315	2.14396	1.87923	1.86115
BARBADOS	2.16567	2.69552	1.96163	1.89686
BAHAMAS	2.21116	3.33074	2.02441	1.92299
BELIZE	1.07778	2.28213	1.89517	1.86797
DOMINICA	1.18470	1.97073	1.86125	1.85348
GRENADA	2.48650	2.01030	1.86575	1.85541
GUYANA	0.75813	2.17011	1.89278	1.86719
JAMAICA	2.27616	3.01879	1.99020	1.90870
ST KITTS/NEVIS	1.37500	1.97564	1.86169	1.85367
ST. LUCIA	1.20581	2.19606	1.88514	1.86368
ST. VINCENT	1.53922	2.07805	1.87257	1.85831
TRINIDAD AND TOBAGO	1.22976	1.28699	1.52635	1.65208
1975-1985				
ANTIGUA/BARBUDA	2.60931	2.58876	2.47690	2.46888
BARBADOS	1.80932	2.66188	2.50776	2.48298
BAHAMAS	2.08401	3.04090	2.55608	2.50363
BELIZE	2.73235	2.52025	2.46944	2.46569
DOMINICA	1.22902	2.47567	2.46439	2.46352
GRENADA	2.77795	2.51143	2.46849	2.46528
GUYANA	0.84114	2.99938	2.52594	2.48990
JAMAICA	2.08384	3.02998	2.55200	2.50179
ST KITTS/NEVIS	2.45873	2.50184	2.46723	2.46473
ST. LUCIA	2.79168	2.53540	2.47096	2.46634
ST. VINCENT	2.19574	2.54091	2.47169	2.46665
TRINIDAD AND TOBAGO	2.08981	2.12898	2.28186	2.35572
1986-1991				
ANTIGUA/BARBUDA	12.41822	6.45008	5.43949	5.36142
BARBADOS	5.18335	10.51115	6.45238	5.78765
BAHAMAS	5.64908	7.68914	6.21088	5.71502
BELIZE	3.02462	4.85877	5.30273	5.30612
DOMINICA	3.88354	5.72658	5.36043	5.32758
GRENADA	6.83166	7.07524	5.48356	5.37954
GUYANA	0.67010	2.22744	4.68294	5.03708
JAMAICA	3.98000	5.93055	5.92252	5.59872
ST KITTS/NEVIS	4.03050	5.34635	5.31183	5.30658
ST. LUCIA	4.45630	5.42168	5.33823	5.31878
ST. VINCENT	9.69400	5.99693	5.38792	5.33929
TRINIDAD AND TOBAGO	1.82975	2.24221	3.74522	4.40933

a very low level of reserves coupled with the highest level of own-reserve variability among the member states. Belonging to the pool therefore would have conferred on Guyana the double benefit of increased access to reserves plus a lower level of variability. Dominica, like Guyana, would also have experienced a large gain (101.9%) while Barbados and the Bahamas would have experienced relatively moderate gains of 47.15% and 45.90%, respectively. Trinidad and St. Kitts would have gained the least from the partial pooling arrangement. In respect of the losses from pooling, these are relatively small ranging from -0.68% in Antigua/Barbuda to 9.6% in Grenada. A similar pattern emerges when the entire period 1977-1991 is considered except that only one country, Grenada, experiences a loss from pooling.

Two important points emerge from the pooling analysis presented above. Firstly, countries that are likely to gain the most are those which display relatively low level of own reserves availability coupled with high levels of variability. Secondly, pooling will not deliver equal reserve gains to all the member states. There is likely to be some asymmetry in the distribution of gains but most countries in CARICOM would derive benefits.

Table 7.3 Reserves Gains and Losses Under Pooling in CARICOM

1975-1991	MEAN ACTRES. $USmn	POTRES. $USmn	GAIN/LOSS $USmn
ANTIGUA/BARBUDA	16.17	20.97	4.80
BARBADOS	93.86	114.40	20.54
BAHAMAS	114.42	175.96	61.54
BELIZE	22.40	47.45	25.05
DOMINICA	6.99	11.65	4.66
GRENADA	13.43	10.86	-2.57
GUYANA	25.34	72.53	47.19
JAMAICA	100.61	133.43	32.82
ST KITTS/NEVIS	7.18	10.31	3.13
ST. LUCIA	17.83	32.46	14.63
ST. VINCENT	12.96	17.50	4.54
TRINIDAD AND TOBAGO	1241.02	1298.77	57.75
1975-1985			
ANTIGUA/BARBUDA	9.54	9.47	-0.07
BARBADOS	78.71	115.82	37.11
BAHAMAS	87.33	127.41	40.08
BELIZE	9.00	8.29	-0.71
DOMINICA	3.31	6.68	3.37
GRENADA	10.39	9.39	-1.00
GUYANA	22.40	79.87	57.47
JAMAICA	82.82	120.41	37.59
ST KITTS/NEVIS	3.79	3.85	0.06
ST. LUCIA	7.87	7.15	-0.72
ST. VINCENT	7.32	8.61	1.29
TRINIDAD AND TOBAGO	1777.26	1810.57	33.31
1986-1991			
ANTIGUA/BARBUDA	28.33	14.71	-13.62
BARBADOS	121.62	246.59	124.97
BAHAMAS	164.10	223.37	59.27
BELIZE	46.97	75.46	28.49
DOMINICA	13.74	20.27	6.53
GRENADA	19.01	19.67	0.66
GUYANA	30.73	102.15	71.42
JAMAICA	133.22	198.50	65.28
ST KITTS/NEVIS	13.39	17.27	3.88
ST. LUCIA	36.09	43.92	7.83
ST. VINCENT	23.29	14.39	-8.90
TRINIDAD AND TOBAGO	257.90	316.04	58.14

ACTRES - Actual Reserves
POTRES - Potential Reserves

Risk of Illiquidity

An evaluation of risk is critical to the success of a reserves pooling strategy in CARICOM since recent experiences have indicated that large payment imbalances are more likely to be continuing features of the economies. There is, consequently, a strong likelihood that claims on the reserve pool can be frequent and substantial for the more depressed economies which are unable to access funds from the multilateral institutions. It is useful, therefore, to attempt an evaluation of the risk of illiquidity for various member territories.

Consider, therefore, a reserve pool in CARICOM which is comprised of some proportion of the foreign exchange earnings of the individual member states of CARICOM. The risk of illiquidity of the pool or the probability that the payment deficits of countries will exhaust the holdings of the pool can be expressed as follows for each member state:-

$$Pr\left[\tilde{D}_i > R_N^p\right] = \int_{R_N^p}^{\infty} p\left(\tilde{D}_i\right) d\left(\tilde{D}_i\right) \qquad (7.10)$$

or for all member states collectively as :-

$$Pr\left[D_N^p > R_N^p\right] = \int_{R_N^p}^{\infty} p\left(D_N^p\right) d\left(D_N^p\right) \qquad (7.11)$$

where $D_N^P = \sum\{D_i - C_i\} = \sum D_i$ and $p(D_N^P)$ and $p(D_i)$ are probability density functions. The calculation of the risk of illiquidity hinges, therefore, on appropriate specifications of the probability density functions. For instance, if $p(D_i)$ is Gaussian then

$$Pr\left[\tilde{D}_1 > R_N^P\right] = \int_{R_N^P}^{\infty} \frac{1}{\sigma\sqrt{(2\pi)}} e^{-\frac{1}{2}\left(\frac{\tilde{D}_1 - \mu}{\sigma}\right)^2} d(\tilde{D}_1) \qquad (7.12)$$

or alternatively,

$$Pr\left[\tilde{D}_1 > R_N^P\right] = 1 - Pr\left[\tilde{D}_1 < R_N^P\right] \qquad (7.13)$$

where

$$Pr\left[\tilde{D}_1 \leq R_N^P\right] = \int_{-\infty}^{R_N^P} \frac{1}{\sigma\sqrt{(2\pi)}} e^{-\frac{1}{2}\left(\frac{\tilde{D}_1 - \mu}{\sigma}\right)^2} d(\tilde{D}_1) \qquad (7.14)$$

A transformation to standard normal form can be utilized to enable computations of the risk of illiquidity for each member territory. Recourse to the Central Limit theorem would suggest for equation 7.14 the following inequality:-

$$Pr\left[\hat{D}_1 \leq \hat{R}_N^P\right] = 1 - \alpha \qquad (7.15)$$

where

$$\hat{D}_1 = \frac{\tilde{D}_1 - \mu}{\sigma} \quad , \quad \hat{R}_N^P = \frac{R_N^P - \mu}{\sigma} \qquad (7.16)$$

This inequality indicates at a given probability level, the size of the reserve fund that the regional monetary authority must have on hand to meet the net deficit of each member state.

Thus the probability of insolvency can indeed be calculated for each member state of CARICOM for given values of D_i and R_N^0. Whereas the normal density may be an appropriate characterization of insolvency for some member states in CARICOM it may provide an inadequate representation for other members whose payment deficits exhibit more probability mass in the tails. For these countries density functions which allow for longer tails and a greater degree of skewness may be more appropriate. The choice of an appropriate representation of the density must however involve an examination of the empirical moments of the main sources of payment imbalances which arise in the member states. Empirical moments utilizing these data are reported in Table 7.4. A cursory look at the data indicates relatively small skewness coefficients for most of the member states of CARICOM with the exception of St. Kitts, St. Lucia, and St. Vincent. External payments outstanding for these countries display a greater degree of asymmetry with coefficients of 1.33, 1.21 and 3.56 respectively. The coefficients of kurtosis which give a measure peakedness of the data are relatively small for most countries with the exception of St. Vincent where the value of the kurtosis coefficient is 14.24, indicating a

greater degree of leptokurtosis. Nevertheless, the empirical moments suggest that the normal distribution may be a relatively good approximation of risk for most of the CARICOM member states with the exception of St. Kitts, St. Lucia and St. Vincent.

Table 7.5 presents results of the risk of illiquidity among the various member territories of CARICOM based on the standard normal form. In calculating these probabilities, it was assumed that R^p_N represents the total reserves of all CARICOM countries. Data on External Debt and Reserves were converted to standard normal form and utilized to compute the probability expression in equation 7.15 for each year over the period 1971-1991. The risk of illiquidity was estimated by simply subtracting these probabilities from unity and averaging across various time periods. The results reveal marked differences in the risk of illiquidity between the various member states of CARICOM during different phases of the integration effort. If a pooling strategy were adopted in the first decade of the integration movement (1973-1991), then the risk of illiquidity would have been substantially higher for Jamaica and Guyana than for most of the other territories. These countries had estimated risk probabilities of 0.83 and

TABLE 7.4

EMPIRICAL MOMENTS FOR EXTERNAL DEBT DATA
OF CARICOM MEMBER COUNTRIES

COUNTRY	MEAN	STD DEV.	SKEWNESS	KURTOSIS
BARBADOS	307.48	265.83	0.261	-1.703
BELIZE	72.66	57.41	0.136	-1.508
DOMINICA	32.48	31.62	0.696	-1.047
GRENADA	0.04	0.03	0.758	-0.633
GUYANA	975.71	648.51	0.190	-1.529
JAMAICA	2748.10	1403.52	0.222	-1.772
ST. KITTS	12.71	12.69	1.335	0.965
ST. LUCIA	22.52	24.39	1.214	0.269
ST. VINCENT	0.03	0.05	3.563	14.424
TRINIDAD	1052.25	818.81	0.259	-1.432

0.74, respectively compared for instance to values of 0.597 and 0.657 for St. Lucia and Barbados respectively. For the period 1984-1991 the risk probabilities are much higher for all the member states while the deviation between the risk estimates is relatively minor. This is indicative of an increase in payment difficulties in all the member territories. The risk probabilities for the overall period 1973-1991 suggest that the larger territories with sizable external debt pose a greater risk of making the reserve pool insolvent.

TABLE 7.5

RISK OF ILLIQUIDITY IN CARICOM
(NORMAL DISTRIBUTION)

COUNTRY	AVG PROB. (73-83)	AVG PROB. (84-91)	AVG PROB. (73-91)
BARBADOS	0.65670	0.93111	0.77224
BELIZE	0.68381	0.94183	0.79245
DOMINICA	0.62442	0.90905	0.74426
GRENADA	-	-	-
GUYANA	0.74164	0.96521	0.83577
JAMAICA	0.83043	0.98759	0.89660
ST. KITTS	0.60678	0.89744	0.72916
ST. LUCIA	0.59760	0.89104	0.72115
ST. VINCENT	-	-	-
TRINIDAD	0.69327	0.94620	0.79976

These member countries in any pooling arrangement may therefore be required to make proportionately larger reserve contributions to the regional fund.

SECTION 3: RESERVES POOLING AND THE MACROECONOMY

Specification of the Prototype Model

In the previous sections the possible advantages of a

reserve fund for CARICOM were outlined. However the critical role that the reserve pool would play in the determination of the individual exchange rates needs to be amplified. A prototype econometric model is developed for CARICOM to provide some analysis of the important feedback relationships between access to additional coverage through pooling and the behaviour of exchange rates in three member states. The model also explicitly considers the effects of reserves pooling on major macroeconomic variables in the economies of the various member territories. The simplicity of the prototype was dictated by a desire to focus on the effects of pooling on the more general macroeconomic indicators. For ease of exposition, the model is divided into the following four blocks.

(A) **Reserves Block.**
(B) **Trade Block.**
(C) **Budgetary Block.**
(D) **Prices, Consumption and National Product Block**

The full structure of the model is outlined in Table 7.6.

(A) Reserves Block

This sector[6] is the most important block in the model and consists of five equations - three behavioural, two institutional and one definitional.

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[6] The subscripts i and j are utilized to refer to the three member states, {i=(1,2,3)}; j=i-1}, considered in this model.

(7.17) $LDRES_t(i) = f[LMPORT_t(i), LMS_t(i), LSRES_t(i), LRSVAR_t(i)];$

(7.18) $LSRES_t(i) = f\ [LXPORT_t(i), LDRES_t(i), LSRES_{t-1}(i)];$

(7.19) $LRSPOL_t(i) = \delta_i * LSRES_t(i) + \sum \delta_j * LSRES_t(j);$

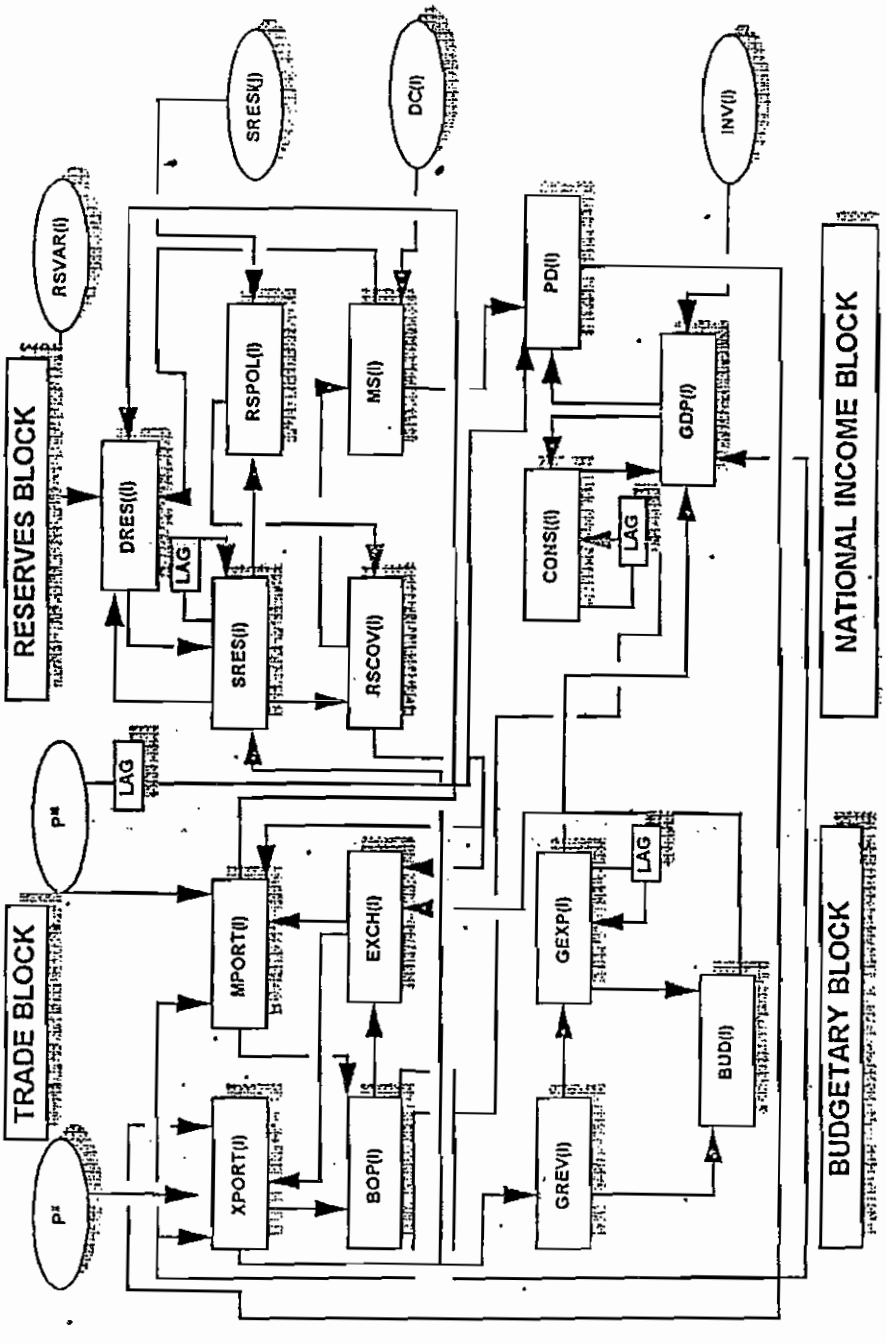
(7.20) $LRSCOV_t(i) = (1-\delta_i) * LSRES_t(i) + \gamma * LRSPOL_t(j);$

(7.21) $LMS_t(i) = LDC_t(i) + LRSCOV_t(i);$

LDRES - Demand for Reserves;
LSRES - Supply of Reserves;
LRSPOL - Pooled Reserves;
LRSCOV - Available Reserves for Coverage;
LMS(i) - Money Supply;
LMPORT - Demand for Imports;
LXPORT - Supply of Exports;
LRSVAR - Variability of Reserves;

Equation 7.17 of the block reflects the major determinants of the demand for reserves in each member state of CARICOM. This demand is assumed to depend on the level of imports, the money supply which represents aggregate purchasing power of consumers in the member states, the supply of foreign exchange reserves and the variability of reserves. The arguments of the reserve demand equation are all expected to carry positive signs. Increases in the level of imports, the supply of money and the supply of foreign exchange respectively are expected to result in an increased demand for international reserves. Similarly an increase in the variability of international reserves is also likely to stimulate increased demand. The second behavioural equation (Equation 7.18) of the reserves block is concerned with the determination of the supply of reserves. In small Caribbean countries the supply of reserves is ultimately determined by the export earning capability of the economy and also by the existing reserves demand. Other studies Beenstock (1988) also suggest inflows of aid as

FIGURE 7.2 Block Diagram of the Pooling Model



important sources of foreign exchange but these are omitted in our specification since aid flows are usually random and sporadic and cannot be effectively relied upon as a bona fide source of foreign exchange. Both exports and the demand for reserves are expected to exert a positive influence on the supply of reserves.

The next two equations (Equations 7.19 and 7.20) in the block are institutional and determine reserves cover and the reserves pool. Equation 7.19 represents each member country's access to resources from the reserves pool. Available drawings from the reserve pool are the sum of the particular member country's contribution plus the contributions of a proportion of reserves of the other member states. The parameters δ_i and δ_j can be viewed as key policy levers which are at the disposal of the individual Central Banks of the member states. For instance in this model, Trinidad Jamaica and Barbados contribute 10% of their foreign exchange reserves to the pool, (i.e $\delta_i=\delta_j=0.1$). A situation in which member states contribute varying percentages depending on their level of risk aversion can also be accommodated in the model. Equation 7.20 determines the level of reserves which is available for coverage in each of the member states of CARICOM. This cover is equivalent to the portion of the member states reserves that is not committed to the pool plus some fraction of pooled reserves.

The amount that any member state can draw from the pool

in any specific year, γ*RESPOL(j), is determined by the Regional Monetary Authority. The parameter γ can be made to function as a policy parameter which a Regional Monetary Authority can utilize in a discretionary manner to provide additional coverage for a member state if the need arises. It is therefore possible in this model to compare simulation effects when γ=0.0 or when $\gamma \in [0.1,..,1.0]$. The final equation of the currency and reserves block (equation 7.21) specifies the money supply as the sum of domestic credit and the domestic currency equivalent of foreign reserves. This identity assumes that foreign reserves are in large measure monopolized by the individual Central Banks of the respective member states and serves to increase the broad money supply.

(2). Trade Block

The trade block contains three behavioural equations which determine exports, imports and the nominal bilateral exchange rate respectively and one definitional equation which specifies the overall trade balance.

$$(7.22)\quad LXPORT_t(i) = f[LGDP_t(i),\{(LEXCH_t(i)*LPX_t(i))/LPD_t(i)\}]$$

$$(7.23)\quad LMPORT_t(i) = f[LGDP_t(i),\{(LEXCH_t(i)*LPM_t(i)/LPD_t(i)\} LRSCOV_t(i)]$$

$$(7.24)\quad LEXCH_t(i) = f[LRSCOV_t(i),LBUD_t(i),LBOP_t(i)]$$

$$(7.25)\quad LBOP_t(i) = LXPORT_t(i) - LMPORT_t(i)$$

LEXCH - Nominal Exchange Rate;
LGDP - Gross Domestic Product;
LPD - Domestic Prices;
LRSCOV - Available Reserves for Coverage;

LBUD - Budgetary Deficit/Surplus;
LBOP - Balance of Payments;
LXPORT - Supply of Exports;
LRSVAR - Variability of Reserves;
LPM - Import Prices;
LPX - Export Prices;

The supply of exports in each member state (equation 7.22) is determined by national product, and the relative price of exports weighted by the exchange rate. It is assumed that increases in national product and the relative price of export exert a positive influence on the supply of exports. A depreciation in the nominal bilateral exchange rate (defined as domestic currency units to foreign currency units) would also boost the value of exports expressed in domestic currency terms.

The specification for the demand for imports (equation 7.23) is quite similar to that for the supply of exports, except for the inclusion of reserves cover as an additional argument in the function and the replacement of export prices by import prices (i.e LPX by LPM). The demand for imports is assumed to be negatively related to the relative price of imports weighted by the exchange rate. Thus as the price of the imported commodity rises the value imported is reduced as consumers in the member states lower their demand. The availability of an ample supply of foreign exchange (reserves cover) exerts a positive influence on the value of imports as it provides consumers in the member states with a sufficient quantity of reserves to purchase imports. A depreciation in

the nominal bilateral exchange rate of the given member state is expected to raise the cost of imports thereby lowering the amount purchased.

Equation 7.24 of the trade block is one of the key equations in the model since it captures the main influences on the bilateral nominal exchange rate of each member state. This rate is determined by three important variables, namely (1) the reserves cover (2) the fiscal position (3) the balance of trade situation of the member state. An increase in available reserves for coverage will place the Central Bank of each member state in a stronger position to defend the nominal exchange rate and in a regime of floating rates should lead either to an appreciation of the rate or to no change in the nominal parity. A deficit in governments fiscal operations will cause a depreciation in the nominal rate especially if the government is unable to raise adequate financing from either the domestic economy or multilateral sources. In like manner, a deficit on the external account directly affects domestic reserve accumulation and places a severe strain on the members states's ability to maintain the existing parity. To the extent, however, that the member state is able to draw reserves from the common pool this should mitigate the negative impact that a conjuncture of deficits on the trade and fiscal accounts would have on the nominal bilateral exchange rate. The trade block is closed by an identity which specifies the trade balance as the difference between the

value of exports and imports.

(3) Budgetary Block

The budgetary operations of each member state is determined by two behavioural equations which capture the influences on governments' revenues and expenditures, respectively while an identity determines the overall fiscal position of the member state. In Caribbean economies, the majority of governments' revenues are earned from exports and this is reflected in equation 7.26 of the fiscal block. Current government expenditure (equation 7.27) is related to its lagged value and to government revenue. The lagged value reflects the stickiness of current expenditure commitments while revenue reflects the government's budget constraint on expenditure. The government budget balance is the excess of revenue over expenditure.

(7.26) $LGREV_t(i) = f[LXPORT_t(i)];$

(7.27) $LGEXP_t(i) = f[LGEXP_{t-1}(i), LGREV_t(i)];$

(7.28) $LBUDJ_t(i) = LGREV_t(i) - LGEXP_t(i);$

LBUD - Budgetary Deficit/Surplus;
LXPORT - Receipts from Exports;
LGREV - Government Revenue;
LGEXP - Government Expenditure;

(4) Prices, Consumption and National Income Block

The final sector of the model contains relationships for

prices, consumption and government expenditure. Consumption is determined by income (proxied by GDP) and lagged consumption expenditure. Both these arguments are expected to be positively signed. Domestic prices is specified as a hybrid relation reflecting the influence of demand-pull and cost-push factors. The main demand pull influences originate from the money supply and income (proxied by GDP), increases in which are expected to lead to a rise in domestic prices. The cost push influence emanates from import prices, increases in which are translated into higher domestic prices. The final argument in the prices equation captures the influence of past price trends on the current rate of inflation. All the arguments of the prices function are expected to exert a positive influence on the rate of inflation. The model is closed by the standard national income identity which specifies expenditure on the Gross Domestic Product as the sum of consumption, investment and government expenditures plus the balance of payments.

$$(7.29) \quad LCONS_t(i) = f[LGDP_t(i), LCONS_{t-1}(i)]$$
$$(7.30) \quad LPD_t(i) = f[LPM_t(i), LPD_{t-1}(i), LMS_t(i), LGDP_t(i)]$$
$$(7.31) \quad LGDP_t(i) = LCONS_t(i)+LINV_t(i)+LGEXP_t(i)+LBOP_t(i);$$

LCONS - Private Consumption;
LGDP - Gross Domestic Product;
LPD - Domestic Prices;
LPM - Import Prices;
LMS - Money Supply;
LINV - Investment Expenditure;
LGEXP - Government Expenditure;
LBOP - Balance of Payments;

Identification, Estimation and Simulation of the Model

Model Identification

The equations of the model are specified in log-linear form for each of the three member territories of CARICOM. The overall model is a small simultaneous equation system consisting of 15 equations, 9 of which are behavioural, 4 are definitional and 2 are institutional. The model contains 15 endogeneous variables and 11 predetermined variables[7]. A block diagram of the system is presented in Figure 7.2. Before proceeding with the estimation of the system it is necessary to guage whether or not the system as constructed is identifiable. This issue of identification is important since it determines whether the estimation method can recover the structural parameters from the reduced form. Identification of the system was determined by the order condition. This condition requires that the number of exogenous excluded from the equation be at least as large as the number of endogenous variables included in the equation. Although the condition is only a necessary condition, it proved more appropriate in the context of our model[8]. The results from this exercise

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[7] These predetermined variables consist of lagged endogeneous and exogenous variables.

[8] The rank condition provides a necessary and sufficient condition for identification but is computationally more

indicate that all the behavioural equations of the system were over-identified. Next, a decision had to be made as to whether the parameters of the system were to be estimated by a full-information or limited information systems estimator[9]. In the specific case of this model it was decided to utilize, two stage least squares (2SLS), a limited information systems estimator which provides consistent single equation parameter estimates in a simultaneous equations environment[10].

Model Estimation

The nine behavioural equations in each of the country models were estimated by 2SLS and are reported in Table 7.7. Additional tests (Ljung-Box) were performed on the residuals of the estimated equations which carried lagged endogeneous terms to verify that they were white noise series and contained no serial correlation. The results for each country are grouped together in their respective blocks to allow for easy comparisons.

The estimation results for the reserve demand equations were mixed for the three models under consideration. In

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[9] For the estimation of systems the full information estimators (FISEs) are more efficient since they exploit more of the available information in the system. However while the FISEs such as 3SLS or FIML would have been more appropriate these methods could introduce large specifications errors. [Theil (1971), p.528]

[10] For a discussion of simultaneous equation systems see Theil(1971), Greene (1993) or Davidson (1993).

Barbados, import demand and the supply of foreign exchange reserves were the only significant variables, although the import demand variable was incorrectly signed. In the Jamaica model, the supply of foreign exchange reserves had the predominant effect while in the case of Trinidad and Tobago, import demand, the supply of foreign exchange reserves and the variability of reserves were the only significant arguments. The reserve variability term was wrongly signed in all the reserves demand equations.

All apriori expectations of the signs for the independent variables were realized in the reserves supply equations. Moreover, export supply and reserve demand were significant at the 5% level for all the member states. However, the lagged reserve supply term was only significant in the Trinidad model.

In the foreign trade block, the results for the export supply equations generally verified the importance of national income and the relative price of exports in the determination of the supply of exports. For Jamaica and Trinidad, these arguments were significant and carried the correct signs whereas in the case of Barbados only the national income variable was significant. The export prices (weighted by the exchange rate) term was not significant in the Barbados model and carried the wrong sign. National income and import prices (weighted by the exchange rate), in the demand for imports equations, were correctly signed and significant for all

countries. However, the third argument in the equation, namely, available reserves for coverage only had a significant impact in the Barbados model.

In respect of the determination of the nominal bilateral exchange rates of the various member states, the balance of payments as well as the reserves cover variable were significant determinants for all three CARICOM territories. The budgetary balance was only significant in the models for Jamaica and Trinidad and Tobago. Since the exchange rate is defined for each country as the domestic equivalent of foreign currency, an increase in the bilateral rate represents a depreciation whereas a decrease in the rate represents an appreciation. Based on this interpretation it was expected that the balance of payments, budgetary and reserves cover variables would all be negatively signed. The results from TSLS estimation demonstrate that persistent deficits on either the balance of payments or governments budgetary position cause an increase in the nominal bilateral exchange rate expressed in domestic currency units (i.e a devaluation or depreciation). Additionally, an increase in available reserves for coverage resulted in a fall in the nominal bilateral exchange rate (i.e an appreciation or revaluation) confirming that a supply of ample reserves can prevent sustained depreciations or devaluations in the nominal rates of the various member states of CARICOM.

In terms of the government block, the results for the

revenue equation substantiate the importance of exports in the determination of government revenues in all three member states. In fact, each independent variable for this specified equation was significant and correctly signed. The significance of the revenue term in the equation for current government expenditure verifies the influence of the government budget constraint on spending.

For the final block, national income and lagged private consumption were significant determinants of current private consumption for the three countries under consideration. The estimates for the final behavioural equation, domestic prices, yielded mixed results. Although the national income variable was insignificant in all three countries, the results highlighted the importance of the money supply, prices lagged one-period, and import prices in the determination of current inflation levels. All in all, the estimation results were generally satisfactory for all the member states, although the equation fits were generally better for Trinidad and Tobago and Jamaica, than for Barbados.

Model Simulation

The adequacy of the model cannot be judged only by estimation, since in a simultaneous setting one is also interested in how the variables interact in a complete system. In order to determine the performance and adequacy of the

entire model, the system was simulated over the period 1965-1991. The results of the simulations were compared with the actual historical values using graphical and statistical procedures. The graphical results are presented in Figures 7.3, 7.4 and 7.5 and indicate the extent to which the models are replicating the turning points for the various endogenous variables. In almost all cases the simulated series are reproducing the peaks and troughs in the original data. The main exceptions in all the country models are the simulations for the Balance of Payments and the Government Budget. For these variables the models do not adequately replicate the oscillations in the actual data and tend to underestimate the original values in most time periods. The statistical methods employ the Correlation Coefficient Squared (CCS) as well as Theil's Inequality Coefficient (U) together with its Bias (UB), Variance (UV), and Covariance (UC) decompositions. The results are contained in Tables 7.8 and 7.9. These results reinforce the goodness of fit of the graphical comparisons for most of the endogeneous variables. The Correlation Coefficient Squared (CCS) which measures the degree of correlation between the actual and simulated series was, however, under 50% for the Balance of Payments and Budgetary variables, respectively. The Theil U results were also relatively large for these variables with

Figure 7.3 Dynamic Simulation Results: Barbados Model

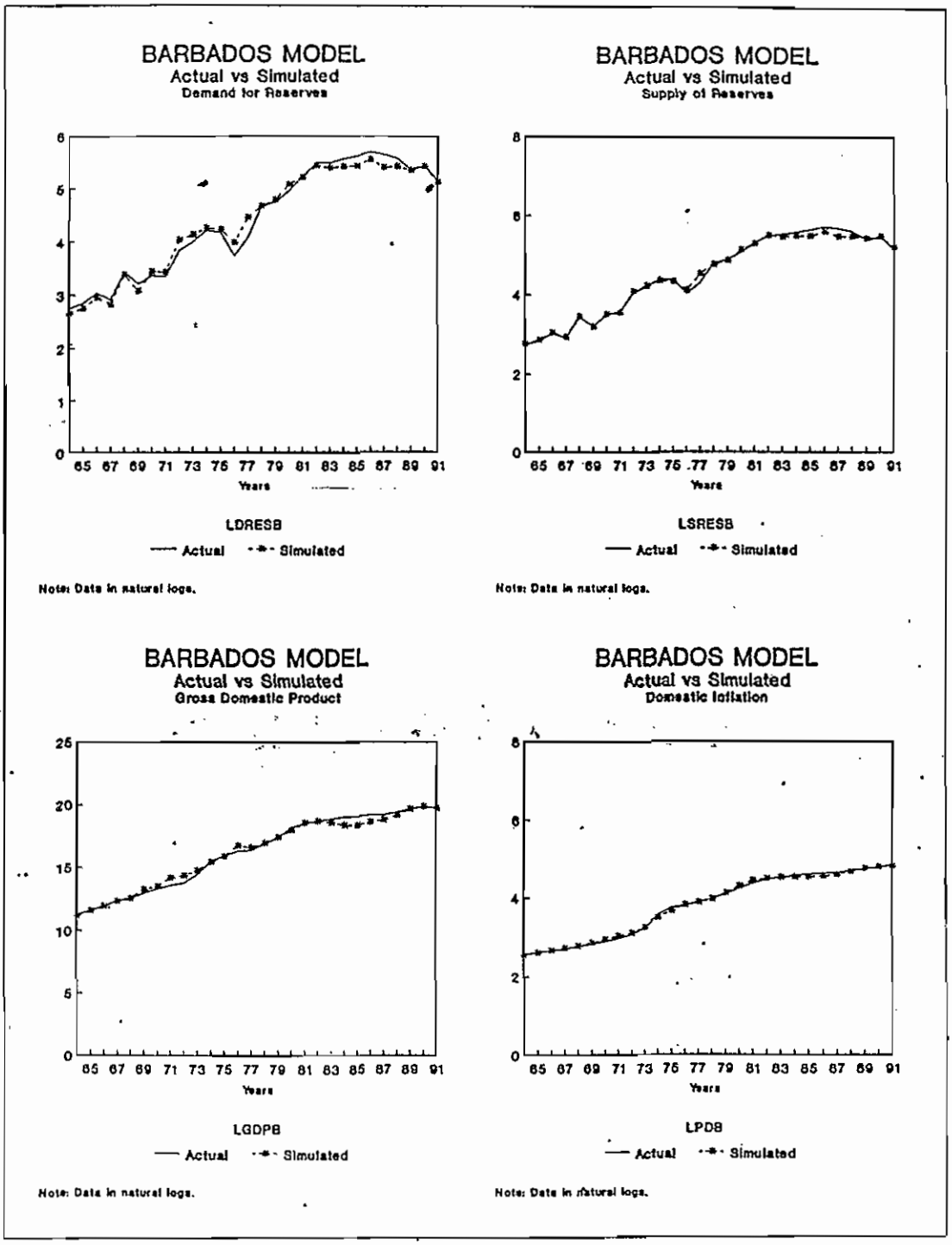
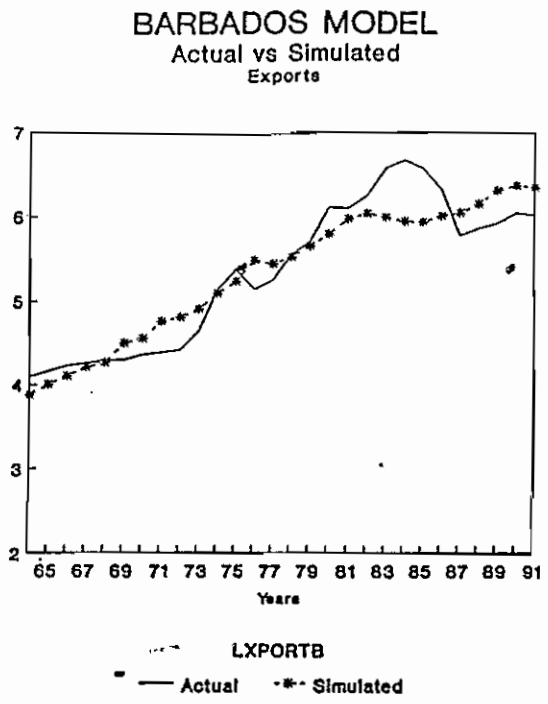
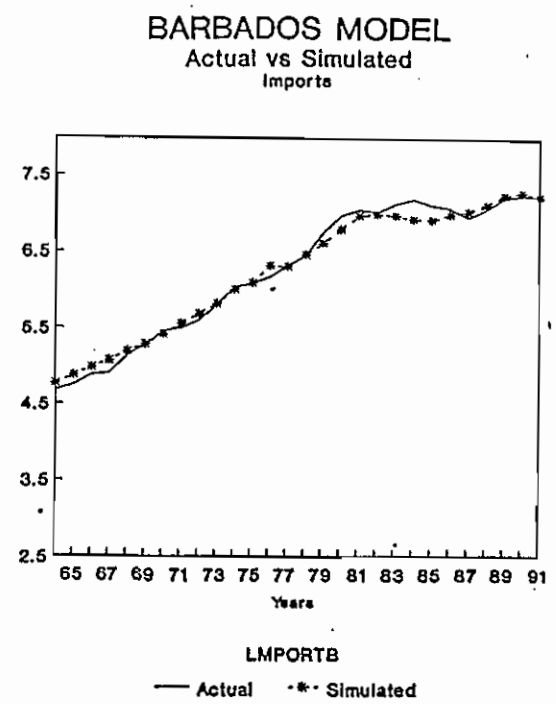


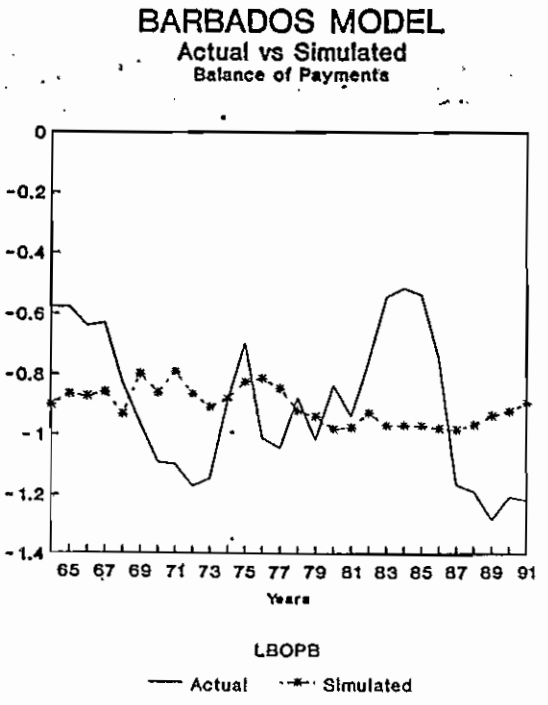
Figure 7.3(Cont'd) Dynamic Simulation Results: Barbados Model



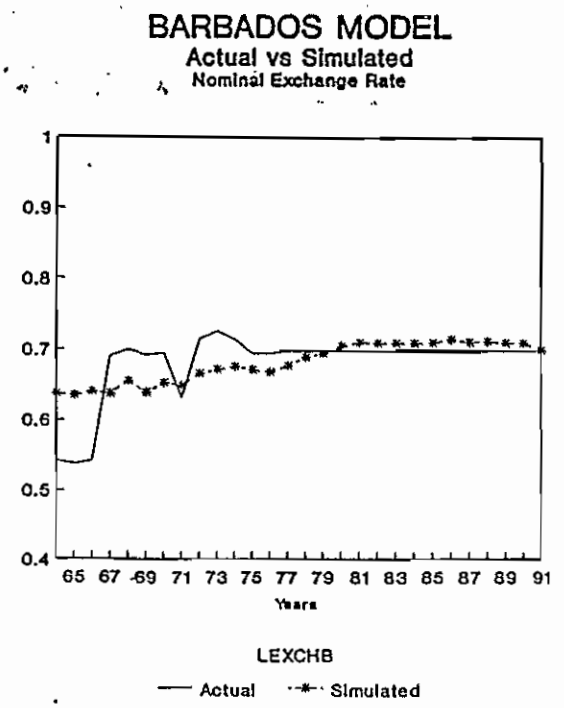
Note: Data in natural logs.



Note: Data in natural logs.

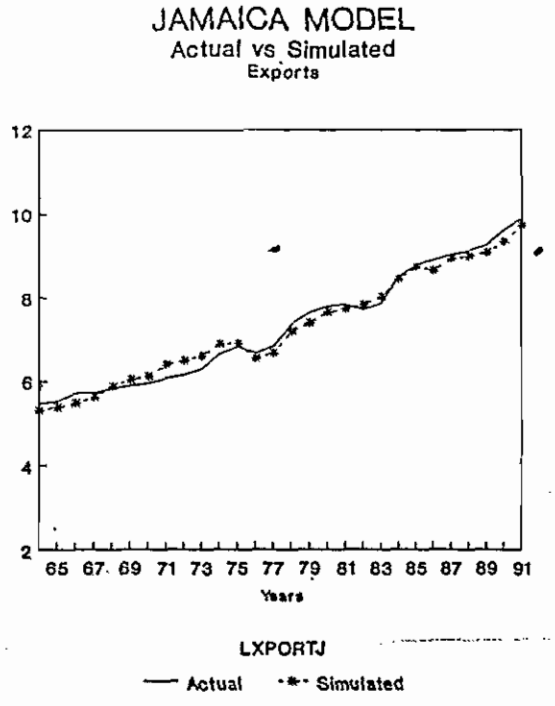


Note: Data in natural logs.

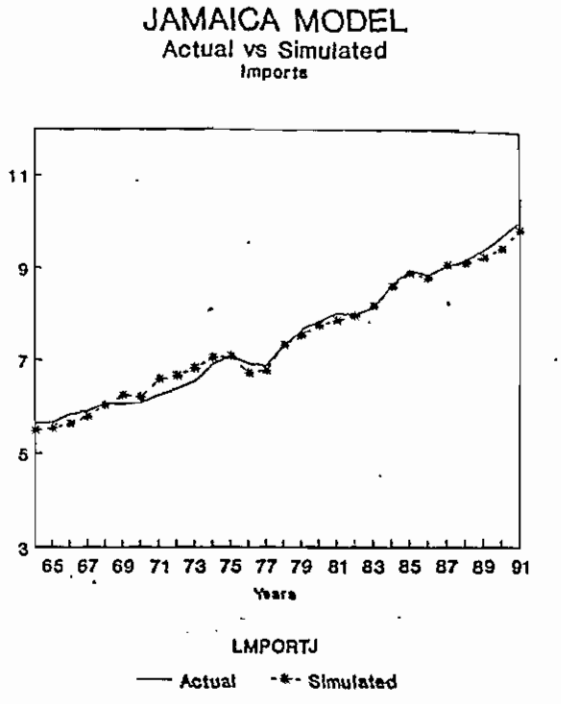


Note: Data in natural logs.

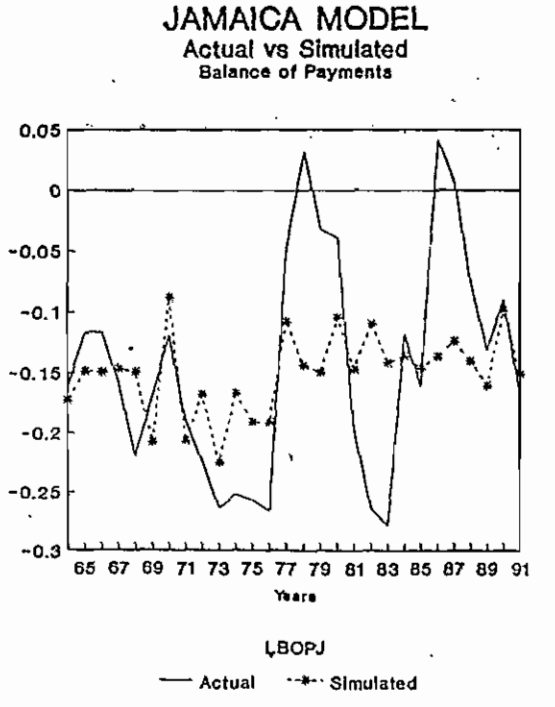
Figure 7.4 Dynamic Simulation Results: Jamaica Model



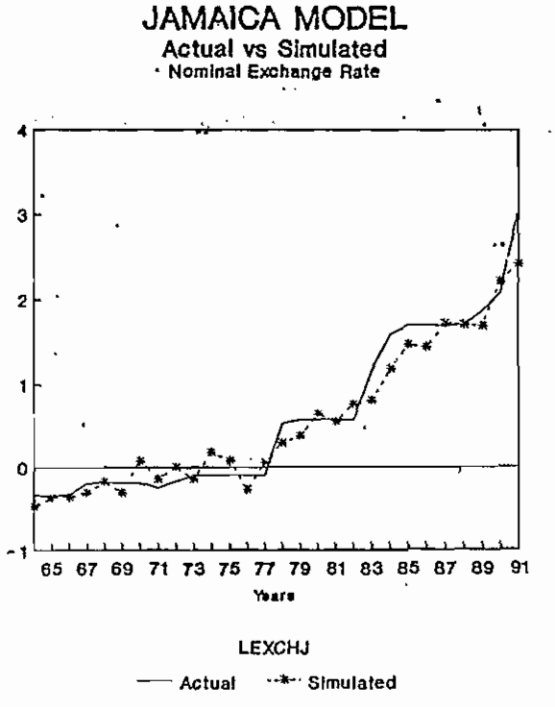
Note: Data in natural logs.



Note: Data in natural logs.

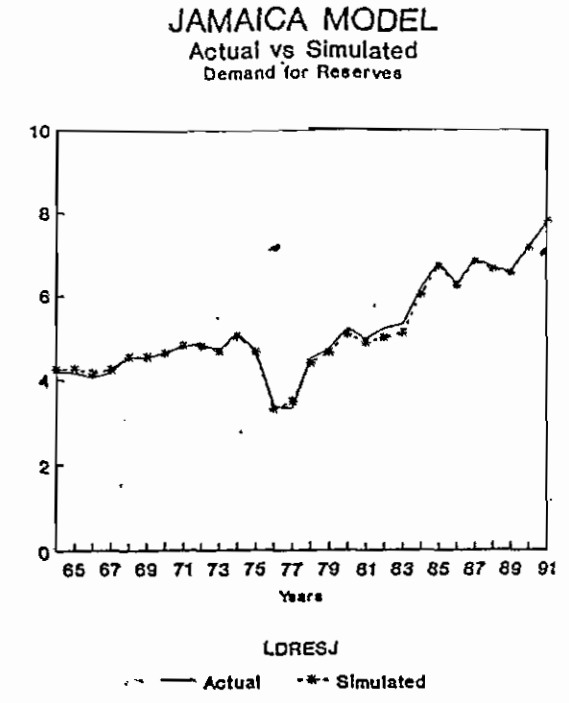


Note: Data in natural logs.

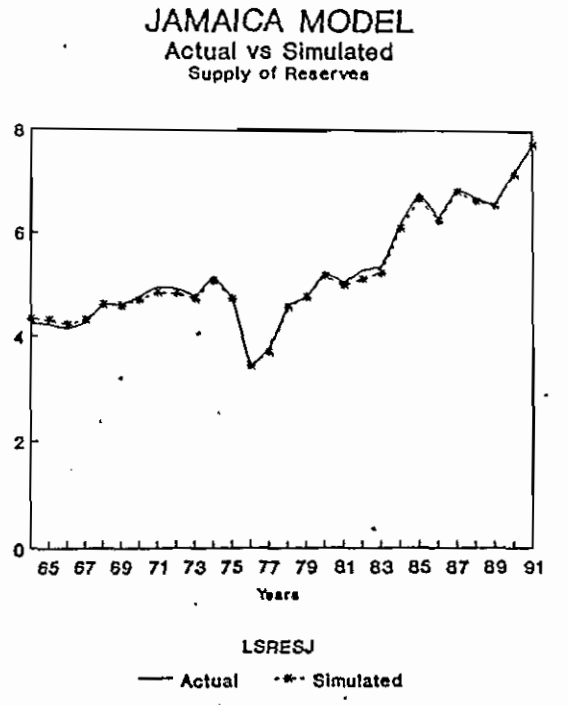


Note: Data in natural logs.

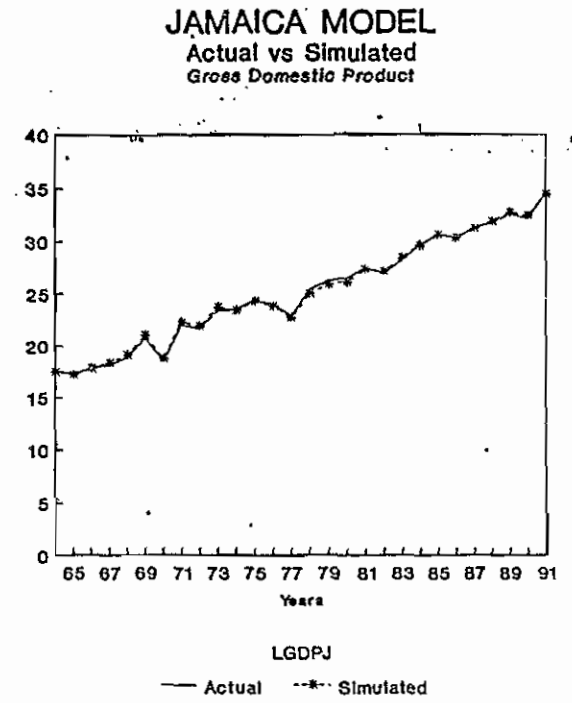
Figure 7.4 (Cont'd) Dynamic Simulation Results: Jamaica Model



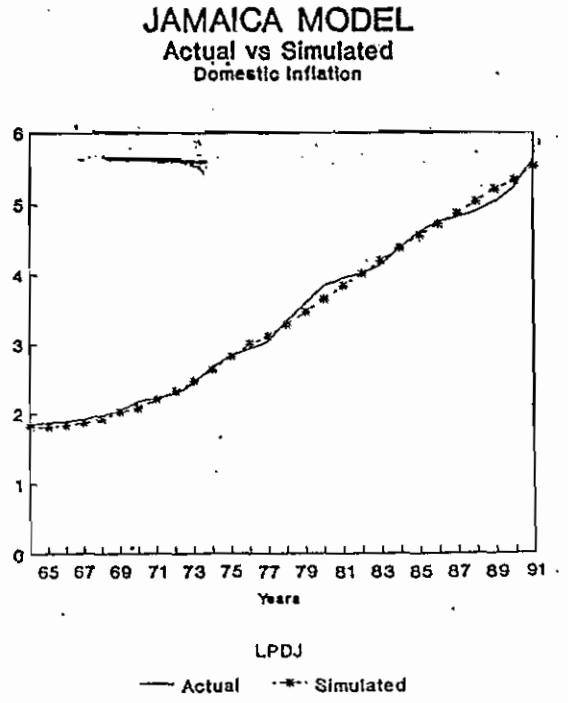
Note: Data in natural logs.



Note: Data in natural logs.

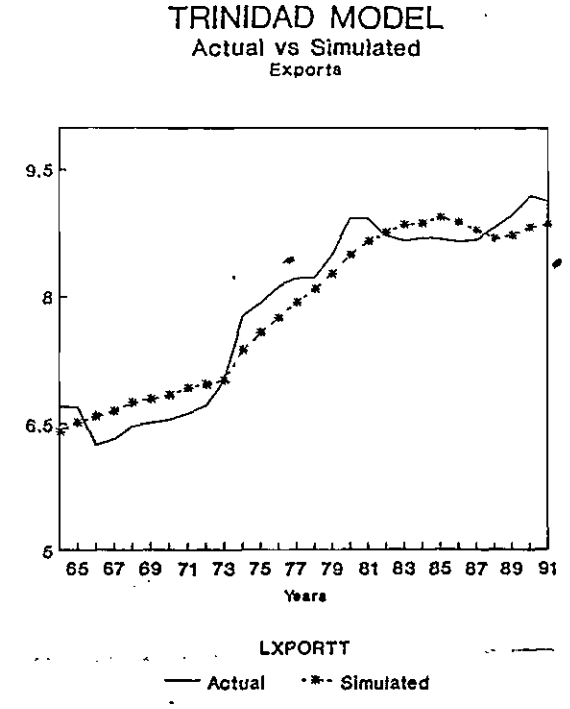


Note: Data in natural logs.

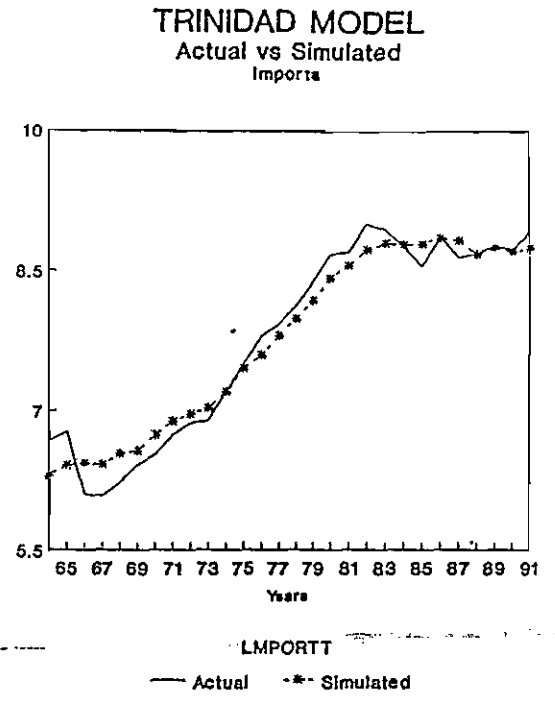


Note: Data in natural logs.

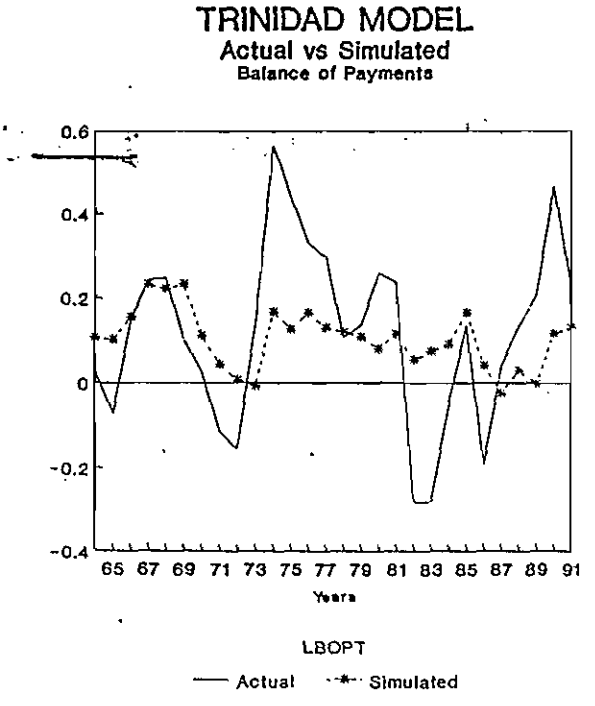
Figure 7.5 Dynamic Simulation Results: Trinidad Model



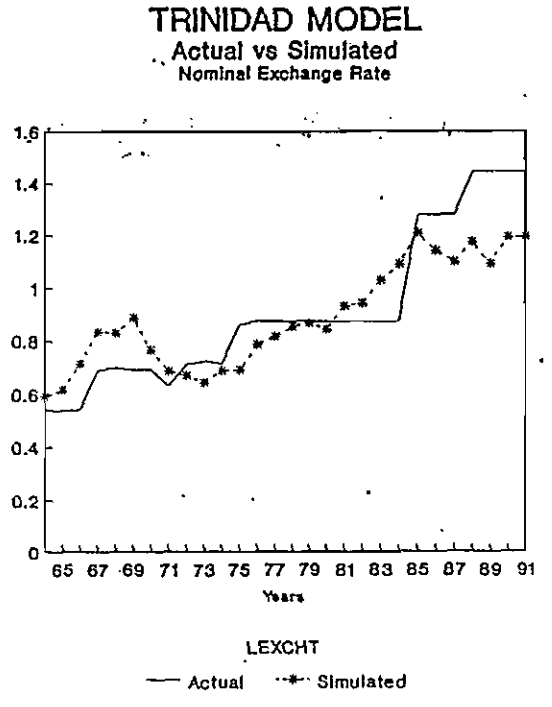
Note: Data in natural logs.



Note: Data in natural logs.

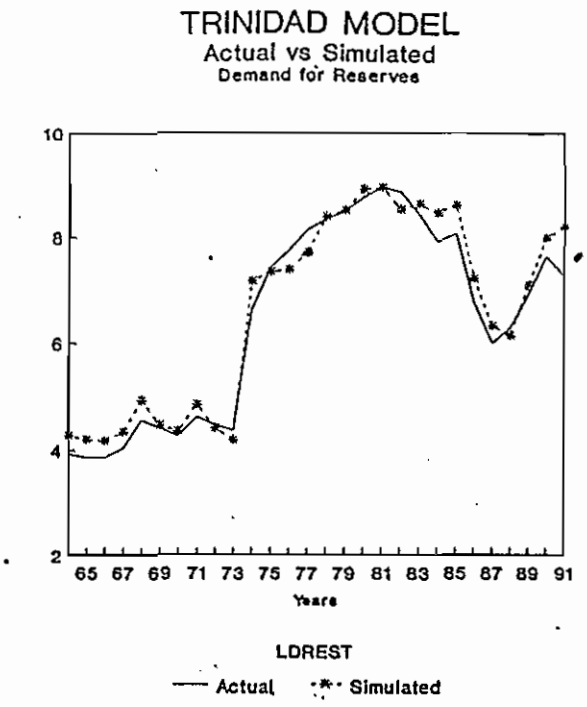


Note: Data in natural logs.

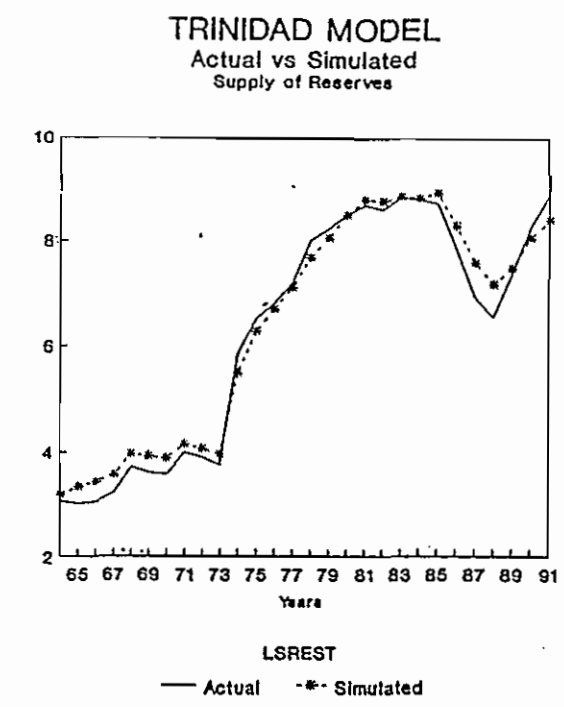


Note: Data in natural logs.

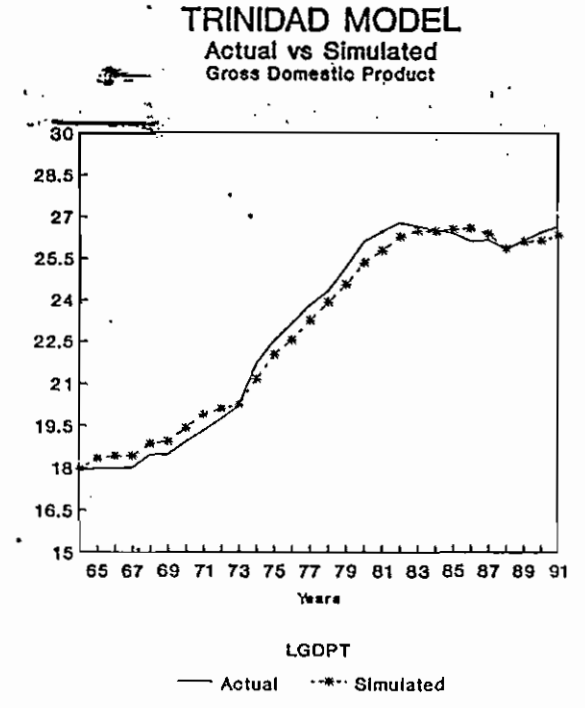
Figure 7.5 (Cont'd) Dynamic Simulation Results: Trinidad Model



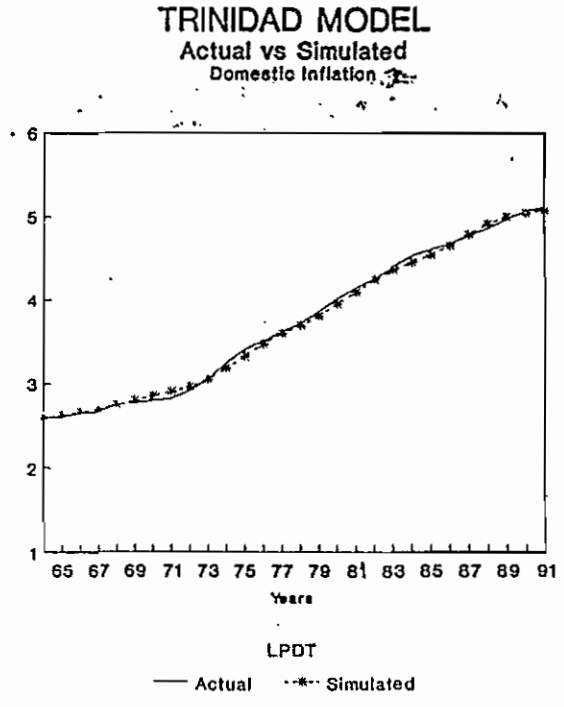
Note: Data in natural logs.



Note: Data in natural logs.



Note: Data in natural logs.



Note: Data in natural logs.

values of 0.139 (LBOPB), 0.250 (LBOPJ) and 0.518 (LBOPT) for the Balance of Payments and 0.412 (LBUDB), 0.249 (LBUDJ) and 0.422 (LBOPT) for the Budgetary variables. Nevertheless, the bias proportions of the decomposition are relatively small indicating that the U values are acceptable. Relatively large bias values were recorded for the money supply term and reserves cover (0.462) in the Jamaica Model. On the whole the simulation exercise demonstrated that the models fit well when combined as a system of equations.

POLICY SIMULATION UNDER ZERO POOLING

Appraising the effectiveness of pooling on the macroeconomy was achieved by setting the contributions of other members states equal to zero (i.e. $\delta_2=\delta_3=0.0$). Each member country, therefore, resorts back to the status quo in which it is dependent on its own level of reserve holdings. The models were then resimulated with these constraints imposed in a bid to determine the impact that the loss of additional reserves had on the major macroeconomic aggregates. The average percentage changes in the zero pooling state as against the base simulation pooling state are reported in Table 7.10 for the period 1975-1991.

The results indicate that withdrawing from a pooling arrangement led to declines in the level of reserves available for coverage in all the models with the steepest decline of

5.3% occuring in Jamaica. The broad money supply which is comprised of reserve holdings and domestic credit also fell by 3.4% in Jamaica, 2.9% in Trinidad and 1.2% in Barbados. The unavailability of additional reserves from the pool increased the nominal bilateral rate expressed in domestic currency units[11]. The magnitude of the depreciation was greatest in Jamaica and Trinidad and Tobago, where the nominal bilateral rate depreciated by 41% and 6.5%, respectively. The effect on Barbados was quite small with a depreciation of only 0.4%.

Changes in the nominal rate also filtered through to affect both the demand for imports and the supply of exports through its influence on the weighted relative price terms. As regards exports, the net effect of zero pooling in the Barbados model was an increase of 0.16%, while exports in the models for Jamaica and Trinidad and Tobago declined by 1.0% and 2.03%, respectively. The effect on exports in the case of Jamaica and Trinidad seems at first blush to be counter-intuitive since a depreciation in the nominal bilateral rate improves export prices and should therefore provide a boost to export supply. However, the full effect of the change in the bilateral rate is negated by the fall in GDP which also appears as an argument in the export supply equations. The impact on the demand for imports is however consistent with expected notions and declines of 1.02%, 1.56% and 1.76%

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[11] Recall that this increase is a defacto devaluation since more domestic currency units have to be given up to purchase the same quantity of foreign currency units.

occurred in the models for Barbados, Trinidad and Tobago and Jamaica, respectively. Changes in exports also feed into the supply of reserves while those in imports affect reserve demand. However, since the demand for and the supply of reserves are determined simultaneously, the net effect on these variables is not so easy to ascertain. The results, nevertheless, suggest that both variables increase although the magnitude of the increases are larger for reserve demand than for reserve supply. The most significant increases were contained in the Jamaica model with recorded changes in reserve demand and reserve supply of 12.4% and 11.2%, respectively.

Withdrawing from a partial pooling scheme seemed to have had a negative impact on national income as proxied by the GDP. National Income fell by 0.21% in Barbados, 0.83% in Trinidad and Tobago and 0.59% in Jamaica. The effect on domestic prices of the loss of reserves was however positive largely on account of the falls in national income, import prices and the money supply. Domestic prices declined by 0.13%, 1.22% and 2.70% in Barbados, Trinidad and Jamaica, respectively.

The policy simulations undertaken under a zero pooling arrangement demonstrate that the loss of reserves is likely to cause a depreciation in the nominal exchange rate and tends to depress the overall level of national income in all the models. At the same time a zero pooling arrangement places a

Table 7.8 Tabular Comparison of Simulation Statistics

	CCS			U		
	B'DOS	J'CA	T&T	B'DOS	J'CA	T&T
LDRES	0.982	0.994	0.972	0.015	0.009	0.026
LSRES	0.994	0.996	0.986	0.009	0.007	0.022
LRSCOV	0.993	0.992	0.983	0.009	0.0127	0.051
LMS	0.994	0.996	0.949	0.006	0.008	0.020
LXPORT	0.870	0.983	0.935	0.029	0.013	0.017
LMPORT	0.990	0.988	0.964	0.008	0.010	0.013
LEXCH	0.558	0.956	0.787	0.031	0.103	0.081
LBOP	0.014	0.493	0.204	0.139	0.250	0.518
LGREV	0.990	0.977	0.973	0.017	0.017	0.017
LGEXP	0.992	0.990	0.972	0.016	0.013	0.017
LBUD	0.158	0.373	0.308	0.412	0.299	0.422
LCONS	0.992	0.996	0.984	0.007	0.007	0.009
LPD	0.997	0.998	0.998	0.006	0.011	0.006
LGDP	0.991	0.998	0.988	0.009	0.004	0.009

where CCS - Correlation Coefficient Squared
U - Theil Inequality Coefficient

Table 7.9 Tabular Comparison of Theil U Decompositions

	UB			UV			UC		
	B'DOS	J'CA	T&T	B'DOS	J'CA	T&T	B'DOS	J'CA	T&T
LDRES	0.006	0.073	0.231	0.013	0.143	0.004	0.981	0.784	0.764
LSRES	0.012	0.255	0.122	0.071	0.091	0.120	0.917	0.654	0.758
LRSCOV	0.009	0.462	0.039	0.081	0.002	0.306	0.909	0.535	0.655
LMS	0.011	0.464	0.039	0.072	0.043	0.325	0.917	0.493	0.636
LXPORT	0.0*	0.032	0.013	0.007	0.128	0.147	0.933	0.839	0.840
LMPORT	0.0*	0.034	0.004	0.324	0.096	0.140	0.675	0.870	0.856
LEXCH	0.0*	0.068	0.024	0.284	0.192	0.418	0.716	0.740	0.558
LBOP	0.0*	0.006	0.008	0.479	0.463	0.553	0.521	0.532	0.439
LGREV	0.0*	0.026	0.024	0.687	0.121	0.312	0.313	0.853	0.664
LGEXP	0.0*	0.001	0.024	0.287	0.358	0.295	0.713	0.641	0.681
LBUD	0.0*	0.023	0.0	0.334	0.002	0.281	0.666	0.975	0.713
LCONS	0.0*	0.111	0.001	0.259	0.382	0.158	0.741	0.507	0.841
LPD	0.0*	0.039	0.055	0.163	0.087	0.141	0.837	0.873	0.804
LGDP	0.0*	0.013	0.019	0.260	0.028	0.284	0.740	0.959	0.697

UB - Bias Proportion of Theil U Coefficient

UV - Variance Proportion of Theil U Coefficient

UC - Covariance Proportion of Theil U Coefficient

* - values are smaller than 6×10^{-5}

NOTE: UB + UV + UC = 1

Table 7.10 Effects of Zero Pooling on the Macroeconomy

Average Percentage Change in effects
of Zero Pooling vs 10% Partial Pooling

ENDOGENEOUS VARIABLES	BARBADOS	TRINIDAD	JAMAICA
LDRES	+2.12	+7.98	+12.38
LSRES	+2.08	+4.67	+11.17
LMS	-1.22	-2.90	-3.38
LXPORT	+0.16	-1.00	-2.03
LMPORT	-1.02	-1.56	-1.76
LEXCH	+0.40	+6.49	+40.66
LBOP	-1.08	+3.06	+4.54
LGREV	+0.18	-1.37	-2.35
LGEXP	+0.17	-1.27	-1.40
LBUD	+106.73	-6.82	45.46
LCONS	+0.14	+0.67	+0.41
LPD	-0.13	-1.22	-2.70
LGDP	-0.21	-0.83	-0.59
LRSCOV	-1.70	-3.42	-5.29

cap on the rate of expansion of domestic prices primarily through the downward movement in money supply that results from the inability to access additional reserves.

SECTION 4: INSTITUTIONAL STRUCTURE FOR RESERVES POOLING

The success of the strategy of pooling will depend critically on the environment under which it is adopted as well as on the rules and regulations which are crafted to govern its operation. In the context of CARICOM it is useful to discuss these considerations under the following headings:

(A) Institutional Environment for Pooling
(B) Objectives and Functions of a Regional Monetary Authority
(C) Operational Rules of the Regional Monetary Authority

Institutional Environment For Pooling.

The pooling of reserves needs to be undertaken in an environment in which there exists a definite commitment to closer co-ordination of exchange rate, fiscal and monetary policy. These conditions represent the rudiments of a monetary union. Such a union presumes that a Regional Monetary Authority (RMA) will be established to oversee the operations of the reserve pool. This authority should be headed by a board of directors which comprises the governors

of the national central banks as well as finance ministers from the participating member territories. The composition of the board is important since it creates an atmosphere in which central bank governors and national governments can work towards the effective co-ordination of policies. It would also serve to partially diffuse some of the antagonisms which can arise between national finance ministers and their governors, since both parties would now have a stake in achieving common objectives. The board of directors should report to the CARICOM Secretariat and should be directly accountable to its Council of Ministers[12].

Another matter to be decided relates to the method of voting among board members. The issue of weighted vs unweighted voting will have a significant impact on the decisions of the RMA. Depending on the absolute size of the contributions of member states to the pool some countries may wish to exercise a greater degree of influence on the decisions of the RMA. A system of 'one country one vote' may be needed to ensure a more democratic stance to decision-making which can ultimately be decided by a simple majority voting rule.

To function effectively the RMA must be an independent entity. It should therefore be reasonably insulated from the

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[12] Ideally this board should be democratically accountable to a Regional Parliament but such an institution involves closer political union, a matter which has not been placed squarely on the cards given the experience with the federation.

political directorate of the various member territories so that it can carry out its task without fear of reprisals. One former Governor of the Barbados Central Bank underscores this point by noting that too often Central Bank Governors in the Caribbean and the developing world are often confronted with a difficult trade-off. They must either bow to political pressure or face the prospect of losing their jobs when they pursue a tight monetary policy stance which runs counter to the spending plans of their political bosses.

A major difficulty with the establishment of the Authority revolves around infrastructural provisions for its effective operation. The execution of its function would require administrative staff, equipment, offices and the like. Whereas this issue can only be adequately addressed in the medium term, a short-run solution would involve housing the RMA in one or more of the National Central Banks until provisions can be made for a permanent site. The financing of the RMA should be drawn from foreign exchange contributions of national central banks although the board of the RMA should be allowed to source funds from multilateral institutions to boost its resource base.

Objectives and Functions of the Regional Monetary Authority

The overall objectives and functions of the RMA will be

dictated by the form of monetary integration being contemplated. In our analysis special emphasis was placed on the importance of the notion of reserves pooling. This is but one activity in a monetary union in which exchange rates bear a fixed relationship with each other and where the national central banks submit exchange rate and reserve management to the RMA. The RMA will therefore have as its broad mandate, (a) to lend assistance to member territories so that they could maintain the value of their respective currencies and (2) to assist members to undertake sound fiscal and monetary policy. To discharge this mandate, a number of specific functions may have to be undertaken. These are listed as follows:-

- Collect Reserve Contributions from member territories.
- Allocate Reserve Credit to member states.
- Co-ordinate Exchange Rate and Monetary Policy.
- Manage the external Debt of members.
- Design methods for Fiscal Harmonization.
- Collate, analyze and present fiscal, monetary and exchange rate data on the member states.

In respect of the broad objectives outlined it will be necessary to ensure that appropriate boundary rules are laid so that no conflict of interest arises between the national central banks and their regional counterpart.

Operational Rules

A series of operational rules relating to contributions to the pool, credit allocations and penalties will also need to be developed. In respect of contributions, a decision will have to be made on the percentage contribution that each member state should commit to the regional pool. In the hypothetical pooling scenario presented above a range of possible pooling configurations was examined. The optimal contribution for each country is likely to depend on several factors including the level of reserves earned, existing foreign exchange commitments and the degree of reserve variability of the member state. The member states may therefore elect to contribute varying proportions of their foreign exchange earnings to the pool depending on their individual circumstances. If the arrangement is to work, however, the Monetary Authority should not allow member states varying proportionate contributions to the fund. This is likely to be a recipe for disaster since the funding base of the pool will vary with the fortunes or misfortunes of members. Instead a fixed proportion must be elicited from each of the territories. The experience of the West African Monetary Union can provide in this circumstance some useful guidance for CARICOM. The Central Bank of this union, for instance, maintains an operation account in which member states deposit 65% of their official international reserves.

For the member states of CARICOM, a deposit of 40% of foreign exchange earnings should be made with the fund.

The allocation of credit by the RMA should be based on the joint needs of the member territories rather on the single requirements of any individual member. This will ensure that no single country can continuously draw from the pool without gaining the approval of the other members. The RMA will also be required to impose a statutory limit on the level of credit that can be extended to any single member in a given year. In the event that a member country experiences a reserves crisis (its reserves fall below tolerable limits), the RMA should permit it to draw down its own holdings from the pool and can advance additional credit subject to strict repayment conditions.

The elimination of situations of moral hazard are of paramount importance if the pool is not to become illiquid. Some member states may become persistent debtors in such an arrangement if no stringent rules exist to enforce compliance. The RMA will therefore need to devote resources to ensure that a body of enforceable penalties is established. These penalties should encompass terms for principal and interest repayments on outstanding debt as well as targets for the size of the trade and budget deficits in each member state.

In spite of the establishment of a system of penalties, it is possible for several of the member states to experience major payments crises in the same time intervals which may

force them to access the reserve fund almost simultaneously. A situation should only be deemed a crisis for the reserves pool if its holdings of reserves fall below a prescribed threshold and not when the reserves of any single member or group of members fall below the prescribed threshold of the pool. If the former circumstance develops the regulations of the RMA should allow it to access additional funding from regional, bilateral, and/or multilateral lending institutions.

CONCLUSION

This paper has sought to demonstrate that a strategy based on the pooling of reserves would have conferred benefits, primarily through reserve savings, to the individual economies of CARICOM. In particular, those members who enter the pooling arrangement with a relatively low supply of reserves and a high degree of reserve variability would tend to derive greater overall benefit. The simulation results reveal that the additional coverage which a pooling scheme offers can play an indispensable role in maintaining the stability of the exchange rate as well as in improving the overall prospects for growth in the member states. It is, however, likely to increase domestic inflation and credit constraining mechanisms may have to be put in place to curb

price increases that result from monetary expansion. If the creation of a reserve fund for CARICOM is to provide long-term benefit to the region then more effort should be devoted to setting up the right institutional environment for a pool to operate successfully. Such an environment would imply an institutional structure which encourages monetary and fiscal policy co-ordination as well as well-defined operational regulations for over-seeing the day to day management of the fund.

Table 7.6 Simultaneous Equation Model of Pooling In CARICOM

MODEL STRUCTURE

RESERVES BLOCK

$$LDRES_t(i) = \alpha_0 + \alpha_1^{(+)}*LMPORT_t(i) + \alpha_2^{(+)}*LMS_t(i) + \alpha_3^{(+)}*LSRES_t(i) + \alpha_4^{(+)}*LRSVAR_t(i) + u_1.$$

$$LSRES_t(i) = \beta_0 + \beta_1^{(+)}*LXPORT_t(i) + \beta_2^{(+)}*LDRES_t(i) + \beta_3^{(+)}*LSRES_{t-1}(i) + u_2.$$

$$LRSPOL_t(i) = \delta_1*LSRES_t(i) + \sum\delta_j*LSRES_t(j);\ 0<\delta_j<1,\ 0<\delta_1<1.$$

$$LRSCOV_t(i) = (1-\delta_1)LSRES_t(i) + \gamma*LRSPOL_t(j);\ 0<\delta_1<1.$$

$$LMS_t(i) = LDC_t(i) + LRSCOV_t(i);$$

FOREIGN TRADE BLOCK

$$LXPORT_t(i) = \eta_0 + \eta_1^{(+)}*LGDP_t(i) + \eta_2^{(+)}*[\{LEXCH_t(i)*LPX_t(i)\}/(LPD_t(i))] + u_3.$$

$$LMPORT_t(i) = \zeta_0 + \zeta_1^{(+)}*LGDP_t(i) + \zeta_2^{(-)}[\{LEXCH_t(i)*LPM_t(i)\}/(LPD_t(i))] + \zeta_4^{(+)}*LRSCOV_t(i) + u_4.$$

$$LEXCH_t(i) = \theta_0 + \theta_1^{(-)}*LRSCOV_t(i) + \theta_2^{(-)}*LBUD_t(i) + \theta_3^{(-)}*LBOP_t(i) + u_5.$$

$$LBOP_t(i) = LXPORT_t(i) - LMPORT_t(i).$$

GOVERNMENT BLOCK

$$LGREV_t(i) = \kappa_0 + \overset{(+)}{\kappa_1}*LXPORT_t(i) + u_6.$$

$$LGEXP_t(i) = \lambda_0 + \overset{(+)}{\lambda_1}*LGEXP_{t-1}(i) + \overset{(+)}{\lambda_2}*LGREV_t(i) + u_7.$$

$$LBUD_t(i) = LGREV_t(i) - LGEXP_t(i).$$

PRICES, CONSUMPTION AND NATIONAL INCOME BLOCK

$$LCONS_t(i) = \psi_0 + \overset{(+)}{\psi_1}*LGDP_t(i) + \overset{(+)}{\psi_2}*LCONS_{t-1}(i) + u_8.$$

$$LPD_t(i) = \varsigma_0 + \overset{(+)}{\varsigma_1}*LPM_t(i) + \overset{(+)}{\varsigma_2}*LPD_{t-1}(i) + \overset{(+)}{\varsigma_3}*LMS_t(i) + \overset{(+)}{\varsigma_4}*LGDP_t(i) + u_7.$$

$$LGDP_t(i) = LCONS_t(i) + LINV_t(i) + LGEXP_t(i) + LBOP_t(i).$$

Table 7.7 Estimation Results for The Pooling Model

TSLS RESULTS FOR RESERVES BLOCK

Demand for Reserves

Barbados

$$LDRESB_t = \underset{(1.244)}{0.361} - \underset{(-2.327)}{0.339}*LMPORTB_t + \underset{(1.735)}{0.184}*LMSB_t + \underset{(10.75)}{1.125}*LSRESB_t - \underset{(-0.301)}{0.028}*LRSVARB_t$$

Rbar=0.992 SEE=0.090 SSR=0.1877 DW=1.4069

Jamaica

$$LDRESJ_t = \underset{(-3.559)}{-0.451} + \underset{(1.878)}{0.235}*LMPORTJ_t - \underset{(-1.751)}{0.224}*LMSJ + \underset{(32.24)}{1.050}*LSRESJ_t - \underset{(-1.657)}{0.054}*LRSVARJ_t$$

Rbar=0.996 SEE=0.069 SSR=0.1337 DW=2.343

Trinidad and Tobago

$$LDREST_t = \underset{(1.474)}{2.280} + \underset{(1.467)}{0.693}*LMPORTT_t - \underset{(-3.615)}{1.045}*LMST + \underset{(9.369)}{1.074}*LSREST - \underset{(2.760)}{0.054}*LRSVART_t$$

Rbar=0.959 SEE=0.371 SSR=3.171 DW=1.519

Supply of Reserves

Barbados

$$LSRESB_t = \underset{(0.794)}{0.126} + \underset{(2.112)}{0.016}*LXPORTB_t + \underset{(9.757)}{0.888}*LDRESB_t$$

$$+ 0.082*LSRESB_{t-1}$$
$$(1.000)$$

Rbar=0.992 SEE=0.090 SSR=0.193 Dh=1.834
Qstat=9.34

Jamaica

$$LSRESJ_t = 0.265 + 0.028*LXPORTJ_t + 0.962*LDRESJ_t$$
$$(3.280) \quad (2.240) \quad (26.84)$$

$$- 0.042*LSRESJ_{t-1}$$
$$(-1.127)$$

Rbar=0.996 SEE=0.074 SSR=0.130 Dh=1.659
Qstat=9.87

Trinidad and Tobago

$$LSREST_t = -3.661 + 0.594*LXPORTT_t + 0.459*LDREST_t +$$
$$(-4.270) \quad (3.605) \quad (6.331)$$

$$+ 0.378*LSREST_{t-1}$$
$$(4.810)$$

Rbar=0.983 SEE=0.295 SSR=2.088 Dh=1.723
Qstat=10.42

TSLS RESULTS FOR FOREIGN TRADE BLOCK

Supply of Exports

Barbados

$$LXPORTB_t = 1.128 + 0.281*LGDPB_t$$
$$(0.986) \quad (15.86)$$

$$- 0.468*[\{LEXCHB*LPXB_t\}/(LPDB_t)]$$
$$(-0.328)$$

Rbar=0.909 SEE=0.263 SSR=1.728 DW=1.4363

Jamaica

$$LXPORTJ_t = \underset{(6.028)}{3.333} + \underset{(5.829)}{0.144}*LGDPJ_t + \underset{(4.974)}{0.674}*[\{LEXCHJ*LPXJ_t\}/(LPDJ_t)]$$

Rbar=0.982 SEE=0.187 SSR=0.872 DW=1.754

Trinidad and Tobago

$$LXPORTT_t = \underset{(5.451)}{1.954} + \underset{(9.805)}{0.233}*LGDPT_t + \underset{(2.571)}{0.645}*[\{LEXCHT*LPXT_t\}/(LPDT_t)]$$

Rbar=0.972 SEE=0.174 SSR=0.757 DW=1.658

Demand for Imports

Barbados

$$LMPORTB_t = \underset{(0.256)}{0.141} + \underset{(8.401)}{0.284}*LGDPB_t - \underset{(-2.517)}{1.359}*[\{LEXCHB*LPMB_t\}/(LPDB_t)] + \underset{(2.147)}{0.113}*LRSCOVB_t$$

Rbar=0.988 SEE=0.098 SSR=0.232 DW=1.523

Jamaica

$$LMPORTJ_t = \underset{(4.428)}{2.870} + \underset{(7.278)}{0.161}*LGDPJ_t - \underset{(-3.191)}{0.489}*[\{LEXCHJ*LPMJ_t\}/(LPDJ_t)] + \underset{(1.785)}{0.061}*LRSCOVJ_t$$

Rbar=0.986 SEE=0.159 SSR=0.611 DW=1.809

Rbar=0.996 SEE=0.038 SSR=0.258 Dh=2.35
Qstat=11.48

Trinidad and Tobago

$$LGEXPT_t = \underset{(1.536)}{0.147} + \underset{(8.636)}{0.503}*LGEXPT_{t-1} + \underset{(8.278)}{0.493}*LGREVT_t.$$

Rbar=0.996 SEE=0.091 SSR=0.205 Dh=2.10
Qstat=10.78

TSLS RESULTS FOR PRICES, CONSUMPTION AND NATIONAL INCOME BLOCK

Private Consumption

Barbados

$$LCONSB_t = \underset{(3.597)}{0.661} + \underset{(2.836)}{0.127}*LGDPB_t + \underset{(4.256)}{0.591}*LCONSB_{t-1}$$

Rbar=0.994 SEE=0.071 SSR=0.125 Dh=1.672
Qstat=7.52

Jamaica

$$LCONSJ_t = \underset{(0.540)}{0.099} + \underset{(1.865)}{0.035}*LGDPB_t + \underset{(10.78)}{0.892}*LCONSB_{t-1}$$

Rbar=0.995 SEE=0.042 SSR=0.183 Dh=1.783
Qstat=8.35

Trinidad and Tobago

$$LCONST_t = \underset{(3.083)}{0.383} + \underset{(5.215)}{0.109}*LGDPT_t + \underset{(9.768)}{0.654}*LCONST_{t-1}$$

Rbar=0.994 SEE=0.082 SSR=0.167 Dh=1.948
Qstat=9.74

Domestic Prices

Barbados

$$LPDB_t = -1.125 + 0.564*LPMB_t + 0.329*LPD_{t-1} + 0.041*LMS_t + 0.069*LGDP_t$$
$$(-3.218)\quad (2.522)\quad (4.015)\quad (2.620)\quad (1.479)$$

Rbar=0.998 SEE=0.031 SSR=0.022 Dh=1.649
Qstat=5.32

Jamaica

$$LPDJ_t = -0.854 + 0.141*LPMJ_t + 0.798*LPDJ_{t-1} + 0.084*LMSJ_t + 0.069*LGDPJ_t$$
$$(-2.081)\quad (1.346)\quad (6.837)\quad (2.598)\quad (1.013)$$

Rbar=0.996 SEE=0.076 SSR=0.132 Dh=1.702
Qstat=8.91

Trinidad and Tobago

$$LPDT_t = 0.175 + 0.137*LPMT_t + 0.771*LPDT_{t-1} + 0.067*LMST_t - 0.012*LGDPT_t$$
$$(1.633)\quad (4.014)\quad (18.390)\quad (2.421)\quad (-0.799)$$

Rbar=0.998 SEE=0.026 SSR=0.016 Dh=2.051
Qstat=10.31

Rbar - Adjusted R-Squared
SEE - Standard Error of the Regression
SSR - Sum of Squared Residual
DW - Durbin Watson Statistic
Dh - Durbin H-Statistic
Qstat - Ljung-Box Q Statistic

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