



## The Determinants of Investment in Barbados

by

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### *ABSTRACT*

*This paper investigates trends of investment in the Barbadian economy from a sectoral point of view - the traded and non-traded sectors - and seeks to determine the factors driving investment in these two sectors of the economy. Since an equitable sectoral distribution of investment is essential for balanced growth and development in the economy, this study will enlighten policy-making decisions aimed at encouraging (or discouraging) investment in the traded and non-traded sectors.*

## *INTRODUCTION*

Investment may be defined as any increase in the capital stock of an economy. As the stock of capital increases, the economy experiences growth which leads to development. Many studies have suggested this relationship between investment and economic growth. IMF (1989) reported that the growth rate of real GDP had on average declined for all developing countries between the period 1971-1980 and 1981-1989. Gibbs( 1994) postulated that the principal reason for this slowdown was a reduction in the investment rate, which was shown to be positively and significantly related to real growth rates. [ Reference should be made to the study undertaken by the IMF (1988) on a large cross-section of developing countries.] However, it is important to recognise that the rate and style of a country's development will largely depend on which sector of the economy enjoys the most rapid investment.

In dependent economies, investment may occur in the traded and non-traded sectors<sup>1</sup>, respectively. While investment in the non-traded sector promotes infrastructural development e.g. improvement in communication and transportation services, investment in the traded sector allows countries to earn foreign exchange. Since any shortage in foreign exchange earnings can impede a nation's growth and overall development, it is of upmost importance that investment in the sector which earns foreign exchange not lag for a continuum of time behind the sector that uses it.

The present paper studies the investment behaviour in Barbados (1974-1996) from a sectoral point of view. An earlier paper [Griffith, 1998] revealed that investment in the non-traded sector contributed more to GDP than the traded sector. At the beginning of the period, investment in the traded sector contributed 11.3% of GDP - only 1.4% less than that from the

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<sup>1</sup>The traded sector produces goods and services which are sold at home and abroad, while in the non-traded sector, goods and services are produced exclusively for sale at home.

non-traded sector (refer to *Chart A.1*). However, by 1996, investment in the non-tradeables had contributed 4.6% more to GDP than its counterpart. The average for the period was 7.2 % of GDP for investment in the tradeables and 11.9% of GDP for the non-tradeable investment. The average total investment for the period (19.16% of GDP ) somewhat hides the decline of almost half of total investment to GDP for the entire period. In terms of its contribution to GDP, these figures suggest that investment in the non-tradeable sector is becoming increasingly significant in the Barbadian economy. This finding is consistent with an earlier study done by Worrell (1990), who believes that there is too much investment in the non-traded sector in the Caribbean, in general, and that the current trend can lead to balance of payments disequilibrium.

It is against this background that we seek to determine the factors which drive investment in both sectors of the economy. The central goal of which is to pinpoint policies which will [where necessary] direct investment away from the non-traded sector to the traded sector. The paper is presented as follows: An outline of the different theories purported for modelling investment behaviour along with an analysis of their relevance to developing countries is presented in *Section 1*. In *Section 2*, an investigation of determinants of investment in each sector is carried out. The preferred hypothesis along with methodology is presented in *Section 3*. Analysis of the results is outlined in *Section 4* followed by some concluding remarks.

## 1: A SURVEY OF THE LITERATURE

Several theories have been proposed for modelling investment behaviour. This section presents a survey of the literature on econometric studies of investment. An examination of the appropriateness of their use in modelling investment in the traded and non-traded sectors of dependent economies is also presented in this section. The theories being investigated are:-

1. The Neoclassical Theory;
2. The Keynesian Theory;
3. The Acceleration Principle;
4. Jorgenson's Model.

### *The Neoclassical Theory*

The neoclassical theory of investment behaviour looks at the interaction between the production function and the securities market. In this theory, the factors of production (capital and labour) are assumed to be fully employed and subject to diminishing returns. In addition, labour is assumed to be fixed with capital being variable. This can be written as follows:

$$Y = F(k, \bar{L}) \quad (1)$$

The marginal productivity of capital ( $MP_K$ ), defined as the change in output over the change in capital, is expected to decrease as the stock of capital increases.

In the neoclassical-type economy, there are three assets- money, securities and capital goods.

$MP_K$  and the interest rate are defined as the rate of return of capital goods and on securities, respectively. As expected, there is no return on money and thus no incentive for holding it as an asset.

The ideal conditions for investing is when the marginal productivity of capital is equal to the rate of interest and investment will continue until the former is more than or equal to the latter.

### *The Keynesian Theory*

This theory is similar to the neoclassical theory of investment. The Keynesian theory introduces the role of expectation and when contemplating investment, the decision is based on three factors; the price of the asset, the expected returns, and the rate of interest. For an investment to be considered, the present value of the stream of expected returns (R) over the life of the asset (t), given by

$$PV = \sum_{t=1}^n \frac{R_t}{(1+i)^t} \quad (2)$$

must at least cover the price of the asset. In other words, the expected net returns after being discounted must be equal to the price.

$$P = \sum_{t=1}^n \frac{R_t}{(1+i)^t} \quad (3)$$

The rate of discount which satisfies this equation, the yield of asset Keynes referred to as the "marginal efficiency of the asset". As investment increases, the marginal efficiency of

investment declines.

The finance required to undertake investment is either borrowed or owned. The rate of interest on borrowed and owned investment is seen as the actual cost and the opportunity cost, respectively. Investment remains profitable as long as the marginal efficiency of the asset exceeds the market rate of interest.

Unlike the neoclassical theory of investment, the Keynesian theory makes provision for supply analysis of investment. Keynes examined the supply side of capital goods sector which is assumed to be characterised by rising supply. In this treatment of investment, only replacement investment is necessary.

**The Acceleration Principle**

This principle relates investment to the rate of change in income or sales. Investment is a partial or complete adjustment of the real capital stock  $K_{t-1}$  at the beginning of the interval to its desired level  $K_t^*$

The capital stock adjustment process in period t can be divided into two subprocesses.

1.  $K_t^* - K_{t-1}^*$
2.  $\beta (K_{t-1}^* - K_{t-1})$  where  $0 \leq \beta \leq 1$

The acceleration model assumes that the desired level of capital is a proportion of output in the present and past period. That is,

$$(i) K_t^* = \gamma Y_t \quad (ii) K_{t-1}^* = \gamma Y_{t-1} \quad (4)$$

Therefore, investment may be represented as follows:

$$I_t = \alpha (K_t^* - K_{t-1}^*) + \beta (K_{t-1}^* - K_{t-1}) \quad (5)$$

$$= \alpha (\gamma Y_t - \gamma Y_{t-1}) + \beta (\gamma Y_{t-1} - K_{t-1}) \quad (6)$$

$$= \alpha \gamma (Y_t - Y_{t-1}) + \beta (\gamma Y_{t-1} - K_{t-1}) \quad (7)$$

However, St. Cyr and Ramlogan (1991) suggest that the accelerator model fits data badly and Jorgenson reports that it was rejected in tests by S. Kuznets (1935), J. Tinbergen (1938), H.B. Chenery (1952), L.M. Koyck (1954) and B. Hickman (1957).

**Alternative to the accelerator model**

The flexible accelerator model, as an alternative to the accelerator model, focusses on the time structure of the investment process. The principal proponent of this model, Robert Eisner, suggested that the desired level of capital is determined by long-run considerations. Although the specification of desired capital has been the subject of enormous debate, the validity of the flexible acceleration principle remains undisputed. Jorgenson(1971) argues that capital is adjusted toward its desired level by a constant proportion of the difference between desired and actual capital. That is:-

$$K_t - K_{t-1} = (1-\lambda) (K_t^* - K_{t-1}) \quad (8)$$

Or alternatively expressed as a distributed lag function relating actual level of capital to past desired levels of capital.

$$K_t = (1-\lambda) \sum_{r=0}^{\infty} \lambda^r K_{t-r}^* \quad (9)$$

with geometrically declining weights.

A second alternative to the accelerator model, which suggests that investment depends on the level profits was first proposed by Tinbergen(1938) and (1939) and subsequently developed by Klein(1950) and (1951). The following are two alternative explanations of this theory. Firstly, Tinbergen (1938) argues that realised profits measure expected profits and secondly, the rate of investment may be constrained by the supply of funds. The strong version of the theory implies that financial constraint operates at all times, while in the weaker version, implies that financial constraint operates at low rate of capacity utilisation. Any extreme pressure on the capacity may result in the use of finance from outside sources.

All three determinants of desired level of capital - output, internal funds and cost of external finance - may be included in a flexible accelerator model. While this model takes into consideration the change in capital stock, it does not account for gross investment. The change in capital stock is given as gross investment less replacement investment:

$$K_t - K_{t-1} = A_t - \delta K_{t-1} \quad (10)$$

where  $A_t$  is gross investment and  $\delta$  is the replacement, a fixed constant.

Distribution replacement is given as a proportion of actual capital stock. Therefore, by adding a specification of the desired level of capital and a model of replacement, the flexible accelerator model may be transformed into a complete theory.

### *Jorgenson's Model*

This model is based on the neoclassical theory of optimal capital accumulation, the objective of which is to maximise net worth. This objective is achieved by choosing an optimal capital path and an optimal labour path. Chiang (1992) suggests that the present-value of net worth is obtained by first looking at the net revenue at any point of time. Thus:

$$PQ(K, L) - WL - m(K' + \delta K_t)$$

- where
- $K'$ -  $dK/dt$ ;
  - $PQ$ - firm's cash revenue and  $P$ - product price;
  - $WL$ - wag bill;  $W$ - money average rate;
  - $mI_g$ - expenditure on new capital where  $m$ - price of "machine" and  $I_g = K' + \delta K_t$ ;
  - $\delta$ - depreciation rate.

Applying the discount factor  $e^{-\rho t}$  to this expression and summing over time, the present-value net worth  $N$  of the firm is given as:-

$$N[K, L] = \int_0^{\infty} [PQ(K, L) - m(K' + \delta K)] e^{-\rho t} dt$$

The improper integral will converge because if the presence of the discount factor  $e^{-\rho t}$

and the net-revenue expression has an upper bound. There will be two Euler equations yielding two optimal paths,  $K_t^*$  and  $L_t^*$  and the optimal capital path can then be

lead to  $I_t^*(t)$ , the optimal level of investment.

### *Relevance to developing economies*

In light of the fact that these models were proposed for developed countries, it is reasonable to expect that they cannot readily be applied to developing countries. One inherent feature of these models is the use of capital stock as a variable. Developing countries do not record information on capital stock, making it virtually impossible to observe the stock adjustment mechanism. In addition, the lack of well-functioning markets and the enormous role of government in capital formation in dependent economies - resulting in distortions- make these models inappropriate. Because of these shortcomings, the focus of studies in the literature has been on testing hypotheses put forward in explaining investment in less developed economies.

## **2: DETERMINANTS OF INVESTMENT IN THE TRADED AND NON-TRADED SECTORS**

It has been suggested that investment in the non-traded sector is stimulated by growth of real output in the economy. This postulate follows the theory of the flexible accelerator, where the investor attempts to increase capacity to narrow the gap between expected demand and production in the previous period [Worrell, 1990]. However, in his study of investment in the Caribbean, empirical results revealed that real output in the previous period had no impact on investment in the non-traded sector (proxied by investment in buildings) in Barbados and Jamaica. There was, however, a noticeable accelerator effect in Trinidad and

Tobago. On the other hand, finding a model which mimics investment in the traded sector is a lot more complex.

The interest rate can capture the financial constraint to investment that exist in highly open economies. Worrell (1990) postulates this because the mobility of funds ensures that finance is rationed only by the interest rate. However, in a case where the interest rates are controlled by the government, the real change in domestic credit can be used as the relevant financial variable, instead of the interest rate [Haque et al, 1994]. Thus, the availability of bank credit to the investor may act as a constraint to investment in the economy [Khan (1988), Tun, Wai and Wong (1982)]. Oshikoya (1994) too, reports that credit policy affects investment directly through the stock of credit available to firms that have access to preferential interest rates rather than through the indirect rate channel. Therefore, the interest rate, although being considered a major determinant of investment - as in the Keynesian model - is believed that its role is more important in developed countries.

The high import content of the investment process in the developing world suggests that these imports, which include raw materials, intermediate and capital goods, should be employed as an explanatory variable in the investment function [Rashid (1984)]. However, Tun Wai and Wong (1982) argues further that since the importation of these goods depends on the availability of credit, it can be included with the rest of bank credit.

If government investment is concentrated in infrastructural projects, it may encourage investment from the private sector: Thus having a positive impact on total domestic investment. Conversely, an increase in public sector investment can result in large fiscal deficits which may "crowd out" private sector investment. Therefore, the impact of changes in government investment on private investment and by extension the traded and non-traded

sector remains ambiguous.

Results from an earlier paper on investment in traded sector in the Caribbean [Griffith, 1998] suggests that this segment of investment was influenced by changes in exchange rates. The real devaluation of domestic currency contains elements of two measures - demand and supply side. A real devaluation will have the effect of reducing domestic investment through its negative impact in domestic absorption in the short-run.

On the demand side, the rise in the overall price level causes a reduction in real wealth and expenditure which will trickle down to in the form of a decline in investment spending - an expenditure - reducing effect of exchange rate policy. On the other hand, the expenditure-switching aspect of a devaluation is a supply side phenomenon as it increases the price of the tradeable good relative to the non-tradeable goods in the domestic economy. Therefore, it is reasonable to expect that devaluation will stimulate investment in the traded sector while, at the same time have a depressing effect of investment in the non-traded sector.

The stability of the economy is a major factor in deciding whether to invest in a particular country. Inflation rates can be seen as a signal of macroeconomic stability and hence if too high can increase the riskiness of investment. Greene and Villnueva ( ) found that a higher inflation rate had a negative effect on private investment for 23 developing countries in their pooled time series cross-sectional study.

The terms of trade variable is of particular importance in modelling investment in the traded sector and is one of the most important indicators of external shocks to the economy. Both oil and non-oil producing countries in the Caribbean experienced these shocks during the oil boom of the early 1970s. While oil exporting countries enjoyed large current account

surpluses, adverse movements in the terms of trade increased the cost of imports relative to income and also reduced the purchasing power of exports for importing nations. As the current account deficit to GDP is an indicator of external balance and macroeconomic stability, any decline would have a severely negative impact on investment. Therefore, as the terms of trade improve, the traded sector will enjoy more investment.

Oshikoya(1994) postulates that the presence of large external debt burdens constitute another source of uncertainty in the macroeconomic environment. Higher debt service payments have the effect of reducing the amount of funds available for investment in either sector of the economy. In addition, many developing countries face liquidity constraints in the international capital markets because of large arrears on debt service obligations. Finally, the empirical results of many studies have confirmed that high debt to GDP ratio has a strong negative impact on investment rates in developing countries.

### 3: MODEL AND METHODOLOGY

The preferred hypothesis for modelling investment in the non-traded and the traded sectors in Barbados is given by:-

$$RIN_t = f(RG_{t-1}, RER_t, DSR_{t-1}, RGOVINV_t, RCDC_t) \quad (i)$$

$$RIT_t = f(TOT_t, RER_t, RGOVINV_t, DSR_{t-1}) \quad (ii)$$

where:-

RIN - investment in the non-traded sector to GDP ratio;

RIT	- investment in the traded sector to GDP ratio;
RG	- the lagged rate of real output growth;
RER	- the index of the real exchange rate <sup>2</sup> ;
DSR	- the lagged ratio of external debt service payments to exports of goods and services;
RGOVINV	- government investment to GDP ratio;
RCDC	- real change in domestic credit;
TOT	- changes in the terms of trade;

By the way of definition alone, one would expect that the real exchange rate to have an impact on both the traded and non-traded sectors. If the domestic price of the non-tradeable goods increases faster than the price of the tradeables in the rest of the world, the RER will rise. This represents a deterioration of the country's competitiveness [Bynoe-Mayers, 1997] and subsequent decrease in demand for non-tradeables while increasing demand for tradeables which results in the traded sector enjoying more investment at the expense of investment in the non-traded sector. On the contrary, a decline in RER represents an improvement in the country's competitiveness as the price of the traded goods increases faster than the non-traded goods; bringing about a decline in investment in the tradeables while investment in the non-traded sector increases.

Real changes in domestic credit and real growth are expected to have positive effects on investment in the non-traded sector. Although the former should have a positive impact on investment in the traded sector, it is anticipated that its effect will not be significant enough to merit inclusion. At this stage, although it is not clear which model the traded sector follows, it is believed that there is no accelerator effect; thus the exclusion of the real growth

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<sup>2</sup>The real exchange rate is measured as the relative price of non-tradeables to tradeables.

rate as a variable.

While only one uncertainty variable, DSR, is included in the first equation, another one is added in the second to help capture the effect of external instability on investment in the traded sector. External trade shocks are captured by changes in the terms of trade index and any improvement (characterised by positive changes in the index) is expected to encourage investment in the traded sector. As mentioned earlier, the correlation between the rate of government investment and investment in the two sectors remain ambiguous. The data are presented in *Table A.1* in Appendix A. The model is tested using cointegration analysis.

### *COINTEGRATION ANALYSIS*

A weakly stationary<sup>3</sup> series has a constant mean and constant, finite variance. Thus a time series is stationary if its mean is independent of time and its variance is bound by some finite number and does not vary systematically with time [Cuthbertson *et al.*, 1992]. A non-stationary time series, on the other hand, will have a time-varying mean (or variance) making reference to it impossible without reference to some specific time period. In this case, the series is said to possess a unit root.

Stationarity is of particular importance to model builders for three main reasons. Firstly, a crucial question in the ARIMA modelling of a single time series is the number of times the series needs to be first differenced before an ARMA model is fit. Secondly, stationarity of regressors is assumed in the derivation of standard inference procedures for regression models - thus non-stationary regressors invalidate many standard results and require special treatment. Thirdly, in cointegration analysis, the question of whether the disturbance term

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<sup>3</sup> In the literature, the main concern is with weakly stationary stochastic processes.



where:- R- rate of interest on loans;  
 CAR- current account balance to GDP ratio.

and

$$RIT_t = f(CAR_t, RGOVINV_t, RER_t) \quad (iv)$$

+                    +/ -                    +

The interest rate on loans was utilised instead the real change in domestic credit because it yielded better results. Results from *Table B.1* in Appendix B show that all the variables are I(1). The estimation output using OLS methodology along with the results of the test for cointegration are given below. This is also shown graphically in *Chart B.1* and *Chart B.2* in Appendix B.

$$RIN_t = 5.77 - 0.20*DSR_{t-1} + 0.78*RGOVINV_t + 0.50*R_t \quad (v)$$

(2.504)    (-3.491)            (3.079)            (2.707)

where the t-statistics are in parentheses.

Adjusted R<sup>2</sup> = 0.74; D-W stat = 2.27; ADF = -2.3690 [-1.9593]; PP = -4.5182[-1.9583]  
 where the 5% critical values (without intercept or trend) are in square brackets.

$$RIT_t = 10.34 - 0.22*CADR_t + 0.96*RGOVINV_t - 0.06*RER_t \quad (vi)$$

(4.575)            (-5.463)            (4.344)            (-2.960)

where the t-statistics are in parentheses

Adjusted R<sup>2</sup> = 0.93; D-W stat = 1.60; ADF = -3.5213 [-1.9583]; PP = -3.7025[-1.9574]  
 where the 5% critical values (without intercept or trend) are in square brackets.

Examination of the adjusted R<sup>2</sup> and the Durbin-Watson statistic together reveal that the regressions were not spurious. Both Durbin Watson statistics indicate that the null hypothesis of no positive autocorrelation should be accepted in each model; the Breusch-Godfrey Serial Correlation LM tests confirmed this. Therefore, it is safe to say that 74% of the variation in the rate of investment in the non-tradeables is explained by the debt service ratio the previous period, the rate of government investment and the rate of interest. While the real exchange rate, current account deficit ratio and the rate of government investment together account for 93% of the variation in investment in the traded sector if Barbados.

The first-stage of the Granger-Engle two step estimation revealed that residuals from the regressions were stationary implying that the variables are cointegrated. Since the variables are “on the same wave length”, statistical inference can now be made about them. All the variables in equation (v) are significant with the debt service ratio having the correct sign. Thus in the long run, an increase of one percentage point in the debt service ratio leads to a decline in the rate of investment in the non-traded sector by about 0.2 percentage points. On the other hand, a similar increase in the rate of government investment and interest rate impacts positively on the investment rate to the magnitude of 0.78 and 0.5 percentage points, respectively.

However, the sign on the rate of interest on loans variable was opposite to what was expected on an a priori basis. This is contrary to the Keynesian investment function which argues for an inverse relationship. However, the McKinnon - Shaw (1973) hypothesis suggests a direct relationship. Galbis (1976) and Fry (1980) confirmed this hypothesis by showing that within

the range of low interest rates - typical observed in many developing countries- a positive relationship between investment and interest rates was possible. This arises in a situation where the inflation rate was higher than the interest rate and investment could not take place for lack of savings, so that a rising interest rate could stimulate savings and result in increased investment.

There was less success with the model for the traded sector. Although having a large adjusted  $R^2$ , two of the variables carried the wrong sign making the "good fit" suspect. External shocks which can cause the current account balance to GDP ratio to deteriorate should reduce the rate of investment in the traded sector, while increases in the real exchange rate should increase investment in this sector. A percentage increase in the rate of government investment increases investment in the traded sector by 0.96 percentage points.

An attempt to estimate the error correction mechanisms was unsuccessful as in the first model the coefficient on the error term was greater than one which implies that the system is explosive. Also, an investigation of the effects of changes in RER and lagged RG in the short run was futile due to insufficient number of observations. For the traded sector, not much weight is placed in this error correction model because of the magnitude and sign of the error corrector.

Although it is still too early to make conclusions from the findings of the present study, it is within reason to say that the model for investment in the non-traded sector is plausible in the long run but not in the short run. Investment in the traded sector requires some more research as the suspicion is that a relevant variable is most likely missing from the present

model. At this preliminary stage, therefore, it seems mindless to speak of implications for policy until two concrete models are established.

### **CONCLUDING REMARKS**

The purpose of this study was to determine the factors driving investment in the traded and non-traded sectors of the Barbados. This was investigated in the cointegration analysis framework yielding largely inconclusive results. At this stage, it is clear that a large amount of work is still required and this forum is being used to give some useful insight in this regard.

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## APPENDIX A

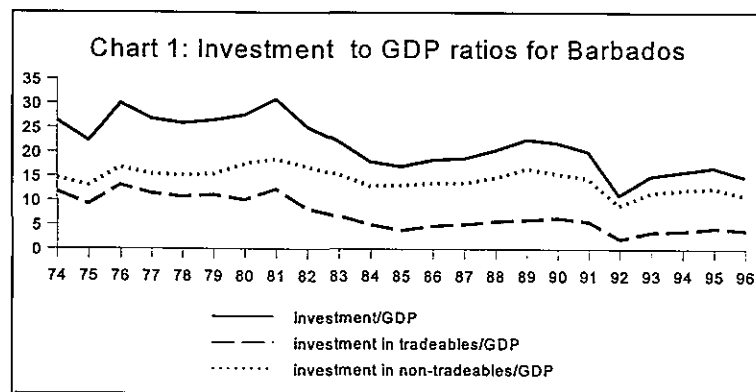


TABLE A.1: DATA

YEAR	CADR	DSR	R	RCDC	RER	RG	RGOVINV	CTOT
1974	-15.3	6.0	12.4	n.a.	93.5	-2.3	3.3	15.0
1975	-10.0	5.0	11.3	n.a.	83.5	-1.9	3.1	9.0
1976	-18.3	5.0	10.3	n.a.	108.3	4.4	1.0	-10.0
1977	-11.5	6.0	10.0	29.1	104.9	3.6	4.0	4.0
1978	-10.3	6.0	10.0	-46.2	107.5	4.9	4.0	-8.0
1979	-10.7	5.0	10.1	25.0	108.0	7.9	4.6	-3.0
1980	-1.9	4.0	11.0	-34.7	100.0	4.4	4.3	5.0
1981	-9.2	6.0	14.0	47.9	105.4	-1.9	5.2	-6.0
1982	-2.6	7.0	13.5	-9.7	111.8	-4.9	3.3	-11.0
1983	1.1	6.0	11.9	11.5	107.6	0.5	2.4	2.0
1984	4.7	6.0	12.0	0.4	111.9	3.6	0.9	1.0
1985	7.7	7.0	10.9	-11.1	114.2	1.1	1.8	-3.0
1986	2.3	9.0	10.2	27.0	119.2	5.1	3.6	-3.0
1987	-0.5	12.0	10.3	24.0	114.6	2.6	2.3	-4.0
1988	0.5	12.0	11.1	36.3	113.0	3.5	2.4	7.0
1989	-0.04	11.0	12.7	13.5	123.6	3.6	2.5	0.0
1990	-2.6	17.0	12.1	25.0	128.1	3.3	3.5	-5.0
1991	-2.7	21.0	15.0	28.2	129.0	-3.9	2.2	-1.0
1992	7.7	23.0	12.6	7.0	123.9	-5.7	1.4	-2.0
1993	5.2	13.0	11.3	-1.0	115.7	0.8	1.2	-1.0
1994	4.6	16.0	11.9	4.6	119.2	4.0	1.6	1.0
1995	3.3	17.0	11.8	-5.1	109.5	2.9	1.0	n.a.
1996	2.0	19.0	11.9	29.9	123.4	5.2	2.0	n.a.

Sources: *Annual Statistical Digest*, Central Bank of Barbados, various issues.  
*Economic and Financial Statistics*, Central Bank of Barbados, various issues.  
*International and Financial Statistics*, International Monetary Fund, various issues.  
 Bynoe-Mayers N., "Measuring the real exchange rate using GDP deflators", Central Bank of Barbados, *Economic Review*, June 1997.  
*Handbook of International Trade and Development Statistics*, United Nations, various issues.

## APPENDIX B: RESULTS

TABLE B.1: UNIT ROOT TEST ON REGRESSORS IN EQUATION (3) & (4)

SERIES	ADF critical values (5%) at:			P-P critical values (5%) at:		
	<i>intercept</i> (-3.0114)	<i>intercept &amp; trend</i> (-3.6454)	<i>none</i> (-1.9583)	<i>intercept</i> (-3.0038)	<i>intercept &amp; trend</i> (-3.6330)	<i>none</i> (-1.9574)
<i>LEVELS</i>						
RIN	-1.3751	-3.5124	-0.4822	-1.7566	-2.7673	-0.7964
RIT	-0.8040	-2.2892	-1.1771	-1.3858	-2.7312	-1.5930
R	-2.5896	-2.8609	-0.1377	-2.6680	-2.9043	-0.3257
DSR	-0.8018	-2.7240	0.5214	-0.6777	-2.7363	0.6547
RGOVINV	-1.6344	-3.1625	-0.8629	-1.8608	-2.9245	-0.9218
CADR	-1.4024	-1.5998	-1.6661	-2.0060	-2.6379	-2.2817
RER	-3.1035	-3.1846	1.1107	-2.0551	-3.3033	0.9115
<i>FIRST DIFFERENCE</i>	<i>intercept</i> (-3.0199)	<i>intercept &amp; trend</i> (-3.6591)	<i>none</i> (-1.9592)	<i>intercept</i> (-3.0114)	<i>intercept &amp; trend</i> (-3.6454)	<i>none</i> (-1.9583)
RIN	-3.7344	-3.5910	-3.6953	-5.4253	-5.5243	-5.5406
RIT	-3.4474	-3.3986	-3.1237	-6.1272	-5.9490	-6.0454
R	-3.4565	-3.3469	-3.5498	-4.7177	-4.5751	-4.8489
DSR	-3.9896	-3.9106	-3.7425	-4.9017	-4.7982	-4.7255
RGOVINV	-3.5392	-3.3700	-3.5670	-4.8742	-4.7374	-4.9885
RER	-4.0695	-3.7390	-4.0467	-6.6518	-7.1254	-6.4135
CADR	-3.8691	-4.1290	-3.5826	-6.8463	-6.2892	-6.7088

