Understanding the Influences on Private Investment in Barbados during the 1966-1990 Period

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Abstract

This paper employs cointegration theory and the error correction mechanism to examine the influences on private investment behavior in the Barbadian economy during the period 1966-1990. The estimation results indicate that changes in output, government investment and the supply of credit to the private sector are significant in explaining short-run variations in private investment. These variables, along with real interest rates, also have significant influences on private investment in the long run.

1. Introduction

Development economists have for several decades recognized the importance of investment for successful economic growth.[1] Indeed, the contribution of investment to growth is generally found to be larger in developing countries than in the industrial world, although there are marked differences between different subgroups in developing countries.[2] Worrell (1993) in his review of the investment literature in the Caribbean noted the connection between investment and economic growth when he remarked that "a critical factor in the disappointing economic performance of Caribbean countries in the 1980's has been the failure to invest sufficiently in new activities so as to adjust to changing economic circumstances" [Worrell (1993) p. 243].

Despite the recognition that investment is vital for economic growth, there has been surprisingly little research on its determinants in the Caribbean and in developing countries as a whole. Stern (1989 p. 672), for example, in his survey of development economics, noted that "what determines investment is very much an outstanding question in research on economic growth". Blejer and Khan (1984), Shafik (1992) and Worrell (1993) have also expressed concern about the lack of empirical studies on the influences on investment behaviour in developing countries. Studies on the Caribbean have looked at investment in the Jamaican bauxite and cement industries [Girvan (1967) and Williams (1972), respectively], foreign investment [Codrington (1987), Farrell (1987), Ramsaran (1989), Craigwell (2006), Griffith et al. (2008)], public investment [Vital (2003), Mathais and Birchwood (2004), Roache (2007)] and aggregate investment [Bourne (1988), Ramsaran (1988), Worrell (1993)]. With regards to the determinants of private investment in Caribbean economies, the search of the literature uncovered only two studies: Watson (1992) on the Guyanese economy and Roache (2006) who focused on a sample of Caribbean economies.

The aim of this paper is therefore to extend the Caribbean empirical literature on investment behaviour by formulating and testing a model of private investment behaviour for the Caribbean economy of Barbados for the 1966-1990 period. The concentration is on private investment for the following reasons.

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[1] Of course, it has also been established in the literature that other potentially important factors such as entrepreneurial skill, the process of learning and implementation of improved organizational arrangements which facilitate an efficient utilization of resources, political and social stability, a developed and well-managed financial system, strong export performance and investment in human capital can enhance the growth process. Nevertheless, investment remains one of the most important determinants of a country's economic growth.

[2] See International Monetary Fund (1988) for evidence on the linkage between investment and economic growth in developing countries.

First, as the Barbadian government, like other Caribbean governments, faced fiscal austerity in the mid-1970s and again in the early 1980s there was a growing realization that future growth would have depended increasingly on capital formation in the private sector. Second, the estimation of a private investment function facilitates the analysis of the impact of government investment policy on private investment, an issue which did not receive adequate treatment in the earlier investment literature. Also contributing to the interest in private investment is the research suggesting that private sector investment has been more directly related to economic growth in developing countries than has public sector investment [Khan and Reinhart (1990)]. Restricting the coverage to the period 1966-1990 allows us to assess the impact of government investment policy on capital formation in the private sector in the immediate twenty five years post Barbados' independence from the United Kingdom.

The remainder of the paper is organized as follows: section 2 discusses the determinants of private investment in developing countries on a theoretical basis; section 3 deals with the econometric methodology; data considerations are discussed in section 4; the estimation results are examined in section 5 and section 6 presents a concluding summary.

2. Theoretical Analysis

Theoretical and empirical studies on investment behaviour in developing countries have identified an accelerator-type variable such as the level of output, interest rates and a financing variable as important determinants of investment. In addition to these determinants, we consider explicitly the impact of government investment policy, foreign capital and the inflation rate on private investment in Barbados.

Following the works of Clark (1917) and Samuelson (1939) on the accelerator principle and those of Chenery (1952) and Koyck (1954) on the flexible accelerator principle, it is well accepted that the level of output exerts a positive influence on investment. The impact of interest rates on private investment has been the subject of much debate in the literature. In the popular models of financial development [Fry (1988, 1989) and World Bank (1989)], which recognize the importance of debt finance to private investors and emphasize the disequilibrium financial conditions in developing countries, an increase in real interest rates will exert a positive influence on private investment via the channel of increased financial savings. A rise in real interest rates will increase financial deepening as economic units switch some of their savings from real to financial assets and from foreign to domestic assets (substitution effect). Because investment opportunities abound in Less Developed Countries [McKinnon (1973), Shaw (1973)] and financial institutions are in an informational advantageous position, the increase in financial savings will necessarily stimulate higher levels of investment activity. However, these models disregard the consideration featured in the Keynesian and neoclassical investment models that higher real interest rates, by having an adverse cost effect on profitability, may reduce investment.

Another important determinant of investment is the availability of finance. The rudimentary nature of capital markets in developing countries limits the financing of private investment to the use of retained profits, institutional finance (mainly bank credit) and foreign borrowing. Of these, the flow of bank credit to the private sector is quantitatively very important, particularly for developing countries which experience rapid economic growth. "In these countries, the newly emerging business firms whose numbers tend to increase rapidly may require substantial amounts of resources from the financial system, unlike the well-established firms in developed countries whose activities tend to depend more on retained profits" [Tun Wai and Wong (1982) p.20]. Further, changes in the availability of credit for working capital, by relieving the pressures on entrepreneurs for the daily operations, can influence the rate of growth of investment and its efficiency, and rolling over bank loans can sufficiently lengthen the maturity of the debt. Finally, in countries heavily dependent on imported machinery and equipment, and where advance import deposits are requested, credit availability will facilitate imports and exercise a positive impact on private investment. We should note, however, that it is not just the quantity of financial resources allocated to the private sector, but also the distributional pattern of credit that is important for the enhancement of investment activities. In small open economies where imports figure prominently in the economy's consumption mix and the degree of substitutability between foreign goods and locally produced goods is low, substantial credit allocations to the personal sector may have a minor impact on investment in fixed capital. This occurs because most of the consumption expenditure would be directed towards goods produced in overseas markets.

Internally-generated funds have also been identified as an important determinant of private investment in developing countries [Tybout (1983), Leite and Vaez-Zadeh (1986)]. This relationship is particularly strong for smaller enterprises whose access to funds in credit markets, characterized by informational constraints and loan decisions based mainly on reputation, quality of collateral and special knowledge of industries/sectors, is limited [Wood (1994)]. In cases when stock markets exist, they are usually inactive which gives firms greater latitude to retain profits for investment since there is normally little pressure from shareholders, often family, to distribute dividends.

Another variable which has attracted considerable attention in the theoretical and empirical literature on the investment process in developing countries is foreign capital inflows [see, for example, Stillson (1976), Bourne (1988), Worrell (1993)]. The effects of foreign financing are broadly similar to those of domestic institutional finance – both tend to increase investment because they expand the pool of financial savings.[3] Theoretically, foreign direct investment could produce the following effects on the domestic economy. Firstly, foreign investment may have a direct linkage effect on investment in domestic industries. For example, the establishment of a foreign automobile plant may induce investment in domestic tyre and petrochemical industries. Conversely, the competitive advantage of the foreign investor caused by technological, organizational and marketing superiority, generous fiscal incentives and other privileges could crowd out investment in the competing domestic industries [Kim and Seo (2003)]. Secondly, the increase in output or expenditure resulting from an increase in foreign direct investment could produce an accelerator effect on domestic investment. Thirdly, the availability of private foreign capital may relax a foreign exchange constraint on investment (by facilitating imports of strategic materials and equipment) in the direct investment enterprises, and related domestic industries. To the extent that these enterprises are export-oriented, the export performance of the domestic economy will be enhanced. An improved export performance generally has positive implications for the growth process in developing countries, as documented by Kavoussi (1984), Rana (1987) and Agama (2010). Fourthly, endogenous growth theory asserts that technological advancement stimulates economic growth by creating externalities that compensate for diminishing returns to capital [Romer (1990), Mankiw et al. (1992)]. Foreign direct investment may therefore facilitate improvement in the efficiency of domestic investment by allowing local firms access to advanced technologies not available domestically – the technological diffusion argument [see, for example, Borensztein et al. (1998) and Blonigen (2005)]. Also, the increased competition provided by foreign firms in the domestic market can cause greater efficiency of domestic firms and stimulate them to introduce new technologies [Wang and Blomstrom (1992), UNCTAD (1999), Koojaroenprasit (2012)]. Finally, to the extent that foreign capital inflow increases money supply, putting pressure on domestic resources which cause domestic prices to rise, it would have an adverse impact on the trade account [Stillson (1976)]. It is expected that the inflow of foreign capital to the private sector will have a positive impact on private investment, although the precise relationship will have to be determined empirically.

An issue which has received inadequate attention in the investment literature is the impact of government investment policy on private investment. This is somewhat surprising given the extensive role of government in the evolution of private investment in the economic history of many countries. The effect of government on private investment in much of the earlier investment literature is implicit and/or limited to a fairly narrow range of factors, such as the interest rate and taxation. Another strand of research has focused on other aspects of government policy which can affect private investment. This work has concentrated on the debate as to whether public sector investment "crowds out" or "crowds in" private investment [Blejer and Khan (1984), Aschauer (1989)]. On the one hand, public sector investment may detract from private investment activity when the investment involves public enterprises producing marketable goods that compete with the private sector, or when heavy spending for public capital projects leads to high interest rates, severe credit rationing, or a heavier current or future tax burden. On the other hand, public investment activity may be complementary to private investment, particularly where public investment involves useful infrastructure – transportation systems, water and sewage systems, electricity, schools, and the like. Given the theoretical ambiguity, whether government investment "crowds in" or "crowds out" private investment is a matter for empirical analysis.

[3] A theoretical discussion of how an increase in foreign capital inflows can increase total financial savings is contained in Khan and Knight (1982). However, a number of studies have indicated that a substantial part of the external resources has gone into increased consumption (and financing large budget deficits) so that the national savings ratio has been adversely affected [Weiskopf (1972) and Fischer (1989)].

The domestic inflation rate has also been identified as a factor affecting private investment in developing countries. High rates of inflation adversely affect private investment by increasing the riskiness of long-term investment projects, reducing the average maturity of commercial lending and distorting the information content of relative prices [Greene and Villanueva (1991)]. In addition, high inflation rates are usually considered an indicator of macroeconomic instability and a country's inability to control macroeconomic policy, both of which adversely affect decisions to invest. Thus, we expect that the domestic inflation rate will have a negative impact on private investment.

On the above theoretical basis, the private investment function can be represented by:

$$PI = f[\underset{+}{Y}, \underset{\pm}{GI}, \underset{\pm}{RI}, \underset{+}{PCI}, \underset{+}{PSC}, \underset{+}{IR}]$$

where PI is real private investment (gross private capital formation); Y is real output; GI is real public sector investment; RI is real interest rate; PCI is real net private capital inflows; PSC is real domestic credit to the private sector, and IR is the domestic inflation rate (percentage change in the consumer price index). The signs indicate the anticipated direction of impact of the explanatory variables. Data limitations did not allow for the inclusion of internally-generated funds in the empirical analysis.

3. Econometric Methodology

Various mechanisms have been offered to represent the process by which firms adjust their actual stock of capital to desired levels. One mechanism enjoying some popularity is the partial adjustment mechanism, which implies that the actual stock of capital adjusts to the difference between the desired stock in the current period and the actual stock in the previous period [see Tun wai and Wong (1982) and Blejer and Khan (1984) for applications]. The partial adjustment mechanism is however a rather ad hoc scheme. It is well known that the partial adjustment mechanism constrains the adjustment pattern in the regressand to be the same regardless of the source of the initial disturbance [Laidler (1985)].

In the context of the investment model, the partial adjustment model results in consistent undershooting if the economy is growing since firms incur a cost for any change, even a 'planned' or 'desirable' one.[4] A mechanism which circumvents this problem is the error correction mechanism. The error correction framework implies that agents adjust their behaviour as new information becomes available. For example, faced with a growing target capital stock, firms will adjust the actual capital stock to the desired levels by correcting for expectational errors in the previous period until they reconcile their actual and desired levels. The other advantages of the ECM approach are well documented in the literature.[5] First, the statistical framework is attractive, in that it encompasses models in both levels and differences of variables and is compatible with long-run equilibrium behaviour. Indeed, error correction models have proven to be successful at describing a variety of long-run macroeconomic relationships.[6] Second, the literature on cointegration provides a theoretical rationale for the empirical success of error correction models.[7] Indeed, if a set of variables cointegrate then we can specify a corresponding error correction or dynamic equation for these variables based on the Granger Representation Theorem [Engle and Granger (1985, 1987)].

In this exercise, we utilize the error correction framework to study the behaviour of investors within a dynamic environment. Such a framework is intuitively appealing because it provides a realistic representation of how rational, but fallible, agents make decisions. In jurisdictions in which information may be rather imperfect, decisions regarding investments are likely to be characterized by gradualism and revision [Shafik (1992)].

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[4] This idea is conveyed in the investment models with convex costs of adjustment [Lucas (1967) and Abel (1983, 1985)].

[5] For a detailed discussion on error correction models, see Salmon (1982, 1988), and Alogoskoufis and Smith (1991).

[6] The notion of an error correction model is considered to be a very powerful organizing principle in applied econometrics and has been applied successfully to such mainstream problems in developing countries as money demand [Domowitz and Elbadawi (1987), Craigwell (1991)], inflation [Downes et al. (1991, 1993)], investment [Shafik (1992), Watson (1992)], savings [Watson and Ramlogan (1991), Wood (1995)] and economic growth [Lewis and Craigwell (1998), Akinlo (2004), Imoudu (2012)].

[7] The literature on cointegration is voluminous. Important early contributions are Engle and Granger (1987, 1991) and Dickey et al. (1991).

The steps in the exercise are as follows:

(i) Investigate the temporal characteristics of the variables in the private investment function. This involves the use of testing procedures such as those developed by Dickey and Fuller (1979, 1981) and Sargan and Bhargava (1983) to determine the degree of differencing required in order to induce stationarity.

(ii) Formulate the static "long run" theoretical relationship and test for a vector of cointegrated variables. We assume that the normalization is on private investment and use the Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF) and Cointegration Regression Durbin-Watson (CRDW) statistics to test for the stationarity of the error term in the static regression equation.

(iii) Estimate the error correction or dynamic "short-run" representation of the relationship and test for the adequacy of the resulting equation. This dynamic equation would include the lagged error term from the estimated "long run" equation as a regressor, which measures the extent of deviation from long run equilibrium.

4. Data: Sources and Considerations

Data employed in this exercise were obtained primarily from various statistical publications in Barbados and cover the period 1966–1990. All relevant variables are expressed in millions of Barbados dollars at constant 1974 prices. The investment variables are deflated by the implicit gross domestic capital formation deflator, while the output variable (gross domestic product at factor cost) and the financing variables are deflated by the GDP deflator and the consumer price index, respectively. Data for private and public sector investment were obtained from Barbados Economic Reports prepared by the Ministry of Finance and Planning, and International Monetary Fund, Government Financial Statistics Yearbooks. Data for domestic credit to the private sector, gross domestic product and the consumer price index were obtained from various issues of the Central Bank of Barbados, Annual Statistical Digest.

The real rate of interest is the nominal weighted average rate on time and savings deposits at commercial banks corrected for inflation. The calculation of real interest rates requires data on expected inflation, a non-observable variable. Thus, the anticipated price level, p^e, is determined using the formula $p^e = e^{i^*} p_{t-1,}$ where i^* is the continuously compounded rate of inflation and p_{t-1} is the price level in the previous period [see Fry (1980)].[8] The interest rate variable is not adjusted for taxation, since taxes on interest income in Barbados were only a recent phenomena (being introduced for the first time in the early 1980s). The interest rate data were obtained from various issues of the Central Bank of Barbados, Economic and Financial Statistics. Finally, data on net capital inflows to the private sector were taken from various issues of the Balance of Payments Reports published by the Central Bank of Barbados.

Because economic growth might be affected by changes in private investment, we treat the real growth rate (in the ECM) as endogenous and utilize the instrumental variable technique. The instruments chosen include the ratio of real exports to gross domestic product, change in labor force, real domestic savings as a ratio of gross domestic product, terms of trade and the cost of borrowing in real terms [see Fry (1980) and Rana (1987)].

5. Estimation Results

5.1 Unit Roots

The time series behaviour of each series is presented in Table 1 using the Dickey-Fuller, Augmented Dickey-Fuller and Cointegration Regression Durbin-Watson tests.[9] The results indicate that all the series have unit roots which is a fairly common finding in economic times series.

[8] Estimation results were also obtained with real interest rates calculated using the current period value of the percentage change in the consumer price index as the expected inflation rate, and the previous year's value (or static adaptive expectations). The latter formulae did not produce materially different results to those reported.

[9] The results were obtained using the MICROFIT program. The applicable significance points for the Dickey-Fuller and Augmented Dickey-Fuller tests are given in Fuller (1976 p. 373), and the critical values for the Cointegration Regression Durbin Watson test are provided by Sargan and Bhargava (1983 p. 157).

5.2 Cointegrated Models

The results of the long-run or cointegrated private investment equations are presented in Table 2. In these results the R^2 is fairly high and the DF, ADF and CRDW statistics are generally acceptable, indicating that the residuals are stationary[10]. An examination of equations (1) and (2) reveals that the Private Capital Inflows (PCI) and Inflation Rate (IR) variables are statistically insignificant. Also, the inflation rate does not have the anticipated impact, based on the earlier theoretical explanation. Despite the fact that the "t" statistics in a cointegration regression are upwardly biased [(Stock (1987)], we can accept the insignificance of the coefficients of PCI and IR, since if a variable is insignificant when "t" statistics are upwardly biased, it will certainly be insignificant for the true value of the "t" statistic [Shafik (1992)]. Accordingly, we retain equation (3) as our preferred model on the grounds of it having a near stationary error process, a high R^2 and significant parameter estimates.

Banerjee et al. (1986) have demonstrated that there could be considerable small sample bias in the cointegrating vector estimates; this bias declines more slowly than theoretically expected. Their theorem (2) shows, however, that the bias approaches zero as R^2 goes to 1. Given that our reported R^2 is 0.931, the bias may be small in our case.

Table 1: Testing for Unit Roots: Dickey-Fuller (DF), Augmented Dickey-Fuller ADF and Cointegration Regression Durbin-Watson (CRDW) Tests

Variable	DF H_0:I(1)	DF H_0:I(2)	ADF H_0:I(1)	ADF H_0:I(2)	CRDW H_0:I(1)	CRDW H_0:I(2)
Private Investment (PI)	-1.49	-4.83	-1.57	-3.20	0.09	2.06
Government Investment (GI)	-0.88	-5.70	-0.59	-5.52	0.18	2.24
Private Capital Inflows (PCI)	-2.17	-6.18	-1.69	-4.34	0.68	2.37
Private Sector Credit (PSC)	-2.63	-3.31	-2.48	-2.81	0.16	1.29
Output (Y)	-0.82	-4.74	-0.60	-3.29	0.07	1.99
Interest Rate (RI)	-2.60	-4.83	-2.63	-5.16	0.89	2.06
Inflation Rate (IR)	-2.20	-4.93	-1.67	-4.87	0.67	1.99
		t = 2.66			CRDW = 1.07	

[10] The critical values determined by Engle and Yoo (1987 p. 157), and Blangiewicz and Charemza (1990 p. 360) were used as a guide in reaching our conclusion of cointegrated variables based on the Dickey-Fuller tests. Also, in the case of the CRDW test, critical values presented in Hall (1986) were utilized.

Table 2: Cointegration Regression for Private Investment:
(Dependent Variable is the Logarithm of Real Private Investment)

Variable	1	2	3
C	-7.52	-7.66	-7.39
	(-2.23)	(-2.40)	(-2.43)
LY	1.36	1.39	1.37
	(1.91)	(2.12)	(2.15)**
LGI	0.19	0.19	0.20
	(3.13)	(3.39)	(3.78)*
LPSC	0.47	0.46	0.45
	(2.12)	(2.26)	(2.33)
PCI	0.001	0.001	
	(0.78)	(0.79)	
RI	-0.004	-0.005	-0.005
	(-1.59)	(-1.85)	(-1.91)***
IR	0.008		
	(0.14)		
R^2	0.919	0.919	0.931
$\bar{R}^2$	0.889	0.895	0.917
DF(t)	-3.55	-3.57	-3.81
ADF(t)	-3.86	-3.85	-4.23
CRDW	1.58	1.59	1.86

Y is real GDP, GI is real government investment, PSC is real domestic credit to the private sector, PCI is real private capital inflows, RI is real interest rate, IR is the inflation rate, L is the natural logarithm; R^2 is the coefficient of multiple correlation, CRDW is the Cointegration Regression Durbin-Watson statistic, DF(t) is the Dickey-Fuller statistic and ADF(t) is the Augmented Dickey-Fuller statistic. Figures in parentheses indicate t-values for the coefficients. One asterisk (*) indicates statistical significance at the 1 percent level, two asterisks (**) indicate statistical significance at the 5 percent level and three asterisks (***) indicate significance at the 10 percent level.

5.3 Error Correction Model

Having identified those variables constituting a cointegrating set, we explored the dynamics of the private investment process. Following the "general to specific modeling" procedure [Hendry and Richard (1982), Gilbert (1986)], an initially over-parameterised model with one lag on the dependent and independent variables was continually simplified and reparameterised until a parsimonious representation of the data generation process was obtained. The resulting dynamic equation is:

$$\Delta \mathrm{LPI} = \underset{(1.04)}{0.034} + \underset{(2.19)**}{0.723}\Delta L\hat{\mathrm{Y}} + \underset{(3.0)*}{0.183}\Delta LGI + \underset{(2.16)**}{0.338}\Delta LPSC + \underset{(1.40)}{0.0073}\Delta RI - \underset{(-3.62)*}{0.921}ECM(-1)$$

$R^2 = 0.633$ SER = 0.1219 D'h' = 1.89 LM = 2.95 RR = 0.426

NRM = 0458 HET = 2.16 ARCH = 0.2723 PCI = 0.80

CHOW = 0.549 HAUSMAN = 0.93

Notes: $\Delta L\hat{Y}$ is the instrumental variable estimate of the real growth rate (ΔLY); D'h' is Durbin 'h' statistic; LM is the lagrange multiplier test for first order serial correlation; RR is Ramsey's (1969) specification error tests; NRM is Bera-Jarque (1980) normality test; HET is a variant of White's (1980) test of heteroscedasticity; ARCH is Engle's (1982) autoregressive conditional heteroscedasticity test; CHOW is Chow's (1960) test for structural change or stability, PCI is a predictive accuracy test [see Chow (1960) and Davidson and MacKinnon (1981)], and HAUSMAN is the Hausman (1978) test for exogeneity. Figures in parentheses are estimated t-statistics.

The Lagrange Multiplier test for serial correlation in the residuals indicates that serial correlation is not a problem. Examination of the residuals using Engle's ARCH test of first order suggests that the null hypothesis of constant variance should be accepted. The Ramsey's RESET test indicates that the functional form of the model is quite good. The Chow statistic of 0.549 is below the critical 5 percent value of 3.09, indicating that the model has stable coefficients. The result of the predictive accuracy test indicates that the model has good predictive power. The Hausman test reveals no evidence of simultaneous equation bias in the estimates[11]. Thus, the wide range of diagnostic tests suggests that the residuals of the dynamic equation do not violate classical assumptions. Furthermore, the lagged residuals from the levels regression, ECM(-1), which represents the equilibrium error term, is statistically significant, implying an intelligible long-run or equilibrium solution in the level of private investment, that is, that the variables constitute a cointegrated set. Therefore, the coefficients of the cointegration regression can be appropriately interpreted as the long-run coefficients in the relationship.

5.4 Analysis of Estimation Results

We now undertake an analysis of the estimation results for the long-run and short-run private investment equations. The output variable has the expected positive impact and the estimated coefficients are significant at the five percent level. This result is consistent with the accelerator model of investment and confirms the findings of numerous studies.

For the effect of financial flows on private investment, the granting of domestic credit to the private sector has a positive influence with the elasticity measure slightly larger in the long-run scenario. This result corroborates the findings of previous studies [for example, Leff and Sato (1980), Fry (1980) and Bourne (1988)] that financial intermediation could play a vital role in stimulating private investment and, hence, economic growth in developing countries. Since control over domestic credit of the banking system remains one of the principal tools of monetary policy in Barbados, the result has important implications for the wider issue of the real sector's response to changes in monetary policy.

The empirical results provide evidence of a direct complementary relationship between government investment and private investment. The coefficient of the GI variable in the dynamic equation indicates that a one percent increase in government investment will have a direct effect of increasing private investment by 0.18 percent in the short term. The long-run coefficient of the GI variable is slightly larger and also significantly positive. The finding that government investment is complementary to private investment confirms results observed in studies by Greene and Villanueva (1991), Sarmad (1991) and Watson (1992), but is contrary to Balassa's (1988) findings for his cross-sectional study.

It is important to note that the result of a complementary relationship between government and private investment should be accepted with caution, since it is based only on the direct effect of government investment policy and no explicit account is taken of the potential indirect crowding-out effect which occurs when there is a net resource transfer from the private to the public sector that results ex post from the various means used to finance public sector activities, including bond sales, institutional credit, etc.

[11] The instrumental variables used in the Hausman Test are lagged changes in government investment and private sector credit, both in logarithms; and lagged changes in the interest rate.

A crude indicator of this financial crowding-out effect in the study is provided by the sign and magnitude of the coefficients on the PSC variable.[12] The positive signs on the estimated coefficients suggest that if the overall quantity of domestic financial resources is given, then the effect of any attempt by the government to increase its share of domestic financing at the expense of the private sector would lead to crowding out and to a decline in private investment.

Interestingly, the long-run coefficient on the real interest rate, though rather small, was negative and statistically significant (at the 10 percent level). This finding is more consistent with the neoclassical model of investment than with the McKinnon-Shaw hypothesis, as it suggests that high real interest rates serve more to deter investment by raising the user cost of capital than to promote investment by increasing the volume of savings. The reported result corroborates the findings of Haque, Lahiri and Montiel (1990) and Greene and Villanueva (1991). The statistical insignificance of the interest rate variable in the short run may reflect the long time frame of investment decisions compared to the short-run fluctuations in interest rates.

6. Conclusion

In this paper, we employed cointegration theory and the error correction mechanism to model private investment behaviour in the Barbadian economy during the twenty-five years after the country gained independence from the United Kingdom in 1966. The estimation results for the error correction model indicated that changes in output, government investment and the supply of credit to the private sector are significant in explaining short-run variations in private investment. These variables, along with real interest rates, also have significant influences on private investment in the long run.

Some conclusions can be drawn from the analysis. Firstly, it is possible to identify a well-behaved empirical function for the private investment process in the small economy of Barbados. From a development planning viewpoint, such an investment function may be of immense benefit to the planning authorities in their determination of appropriate policy measures in order to achieve a desired level of private investment consistent with the target of economic growth. Second, the positive impact of the output variable means that government should ensure that its macroeconomic programme focuses on boosting aggregate output on a sustained basis. Third, the results indicate that domestic credit availability could play an important role in stimulating private investment activity and, hence, economic growth. Thus, the financial system has a vital role to play in the functioning of the Barbadian economy. Sound knowledge of the factors influencing the supply of institutional finance to the private sector is therefore of crucial importance. Fourth, the existence of a complementary relationship between government investment and private investment should be carefully observed by policy-makers. This result indicates that successive administrations in Barbados over the 1966-1990 period were generally successful in fashioning an enabling environment for private investors. The Government should therefore ensure that it continues to devote an appropriate proportion of its spending to productive activities which help to spur private investment. Finally, formulation of financial policy should take due recognition of the result that real interest rates have an adverse (though small) effect on private investment in the longer term.

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[12] See also Tun wai and Wong (1982) and Blejer and Khan (1984). Sarmad (1991) employed a direct measure of crowding-out, the coefficient of the variable z_t (the difference between the fiscal deficit and the inflow of foreign capital to the public sector), in his cross sectional study of developing countries.

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