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COMPONENTS OF PUBLIC EXPENDITURES AND PRIVATE INVESTMENT IN MALAYSIA

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The paper empirically analyzes private investment- public expenditure relations for Malaysia. In the analysis, public expenditures are disaggregated using three different divisions, namely, (i) public investment and public consumption, (ii) public current expenditure and development expenditure, and (iii) military and non-military expenditures. Using standard econometric methods of time series, we find evidence for the long-run relations between private investment and its determinants. In the long run, public investment and public development spending have a positive relation with private investment. Meanwhile, public consumption and public current spending enter negatively in the long-run private investment equation. Interestingly, both military and non-military expenditures have positive impacts on private investment. Lastly, using an error correction modeling, we find evidence supportive of private investment adjustment to deviations from its long-run value. These results suggest the important role of the public sector in explaining private investment behavior.

1. Introduction

Private investment as an important and robust determinant of long run economic growth is well recognized. In Malaysia, this recognition is reflected in part by recent concern over current level of real private investment and by the government's continuous emphasis that the private sector especially firms should play a leading role in the economy. Prior to the Asian crisis of 1997, real private investment had increased steadily and moved in tandem with real gross domestic products (GDP). In 1980, the ratio of private investment to real GDP

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was roughly 19%. It then increased to 22% in 1990 and reached 32% in 1997. However, since then, private investment has dropped drastically and, in 2004, stood at 9% of real GDP. The low level of private investment has persisted despite the quick recovery by Malaysia from the crisis, where 7.4% decline in real GDP in 1998 was quickly reversed by its 5.7% increase in 1999. This recent decline in Malaysia's private investment has raised interest on its potential causes or, more generally, determinants of private investment.

One aspect that has continuously caught the attention of economists is on possible influences of public expenditures on private investment. Since the Asian crisis, the government of Malaysia has run budget deficits as part of a package to revive the economy from the recession of 1998. Thus, as the traditional view would argue, this may have created the "crowding-out" effect and, accordingly, is a potential cause for the private investment slack. However, to attribute the recent decline in private investment to persistent budget deficits recorded since the crisis would be hasty since theories also admit positive or no influences of public spending on private investment. Namely, recent literature on the issue has highlighted potential "crowding-in" effect as opposed to "crowding-out" effect of public spending. Public spending tends to promote private investment indirectly by increasing the economy's aggregate demand and, consequently, firms' expected profitability. Moreover, public expenditure in the form of infrastructure, education, health, and research and development investment may enhance private investment through their positive influences on private capital productivity. Equally likely, the recent drop in private investment may have nothing to do with public spending if the Ricardian equivalence is the right description of reality (Barro, 1974).

These theoretical ambiguities on the public spending – investment link highlight the need for empirical analyses. Accordingly, in the present paper, we analyze the empirical behavior of private investment in Malaysia in an attempt to answer a question whether the public sector contributes to the decline in private investment. In the analysis, we take note of two recent refinements that incorporate various categories of public expenditures and argue for the inclusion of a government financing variable. Essentially, the recent literature has emphasized the importance of making distinction between various categories of public expenditures since they may have different degrees of substitutability or complementarity to private investment (Aschauer, 1989). In the paper, we look at three different divisions of public spending – (i) public investment and public consumption; (ii) current expenditure and development expenditure; and (iii) military and non-military spending. In addition, it is noted that looking at the expenditure side of the government can create systematic biases in parameter estimates if the financing side is implicitly assumed away (Kneller et al., 1999). In this case, we control for the financing side of the government budget by adding government revenue in the analysis.

The rest of the paper is structured as follows. In the next section, we detail the empirical framework and data used in the analysis. Section 3 discusses the empirical results. Lastly, the final section provides a summary of the main findings and some concluding remarks.

2. Empirical Framework

In line with Laopodis (2001) and Wang (2005), we use a simple accelerator model of investment augmented to include components of government expenditures and government revenue. More specifically, the investment equation is specified as:

$$pinv_t = \beta_0 + \beta_1 gdp_t + \beta_2 gx_{1t} + \beta_3 gx_{2t} + \beta_4 gr_t + u_t \tag{1}$$

where *pinv* is real private investment; *gdp* is real gross domestic products; gx_1 and gx_2 are components of government expenditures; *gr* is government revenue; *u* is the error terms; and β_i, i = 1, ., 4, are the model parameters. The interest rate is excluded from the specification since its effect is already accounted for through government spending and deficits (Laopodis, 2001). It should be noted that we differ from Laopodis (2001) and Wang (2005) by adding government revenue as an additional independent variable. In this way, the coefficients of government spending can be appropriately interpreted as the effect of the increase in deficit-financed government expenditure, which is central in the crowding-out and crowding-in debate. Moreover, as Kneller et al. (1999) show, its inclusion is important to avoid systematic bias in parameter estimates.

Equation (1) can be viewed as a long-run investment equation. As it is well known, direct application of the OLS estimation method to (1) may yield spurious results if the variables are non-stationary and do not share a long-run equilibrium relation (or are not cointegrated). Accordingly, following standard time series practices, we first evaluate temporal stochastic properties of the variables in (1) by applying unit root and cointegration tests for the variables' stationarity property and their long-run relation. Briefly, a time series variable can be classified according to its integration order. The variable is said to be integrated of order *d* if it requires differencing *d* times to achieve stationarity. In other words, if the variable is integrated of order 1 or higher, it is non-stationary. Then, a linear combination of non-stationary variables is normally non-stationary. However, if it is stationary, the variables are said to be cointegrated or share a long-run equilibrium relation. This means that the variables in (1) can not deviate arbitrarily away from each other as they are tied by the model long-run parameters, conventionally termed as the cointegrating vector. In short, the presence of cointegration validates the presence of equation (1).

To establish the integration order of the variables, we apply the commonly-used augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. Then, to test for cointegration, we apply the maximum likelihood approach of Johansen (1988) and Johansen and Juselius (1990). The test is noted to have more power than alternative tests of cointegration including the two-step Engle and Granger (1987) cointegration test (Gonzalo, 1994). Moreover, treating all variables as potentially endogenous using a vector autoregressive specification, the test is capable of identifying the number of cointegrating vectors governing the long-run relations among the variables. In applying the test, we impose a requirement that the error terms from the Johansen-Juselius VAR-type estimation are serially uncorrelated (Hall, 1989; Johansen, 1992).

Apart from the interest in the long-run parameters, we are also interested in short-run dynamics of the private investment. In this context, the aforementioned unit root and cointegration tests can also be viewed as pre-test exercises for proper specification of private investment dynamics. Namely, given cointegration, the dynamics of private investment must be represented by an error correction model (ECM) as:

$$\Delta pinv_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \Delta pinv_{t-i} + \sum_{i=1}^{p} \alpha_{2i} \Delta gdp_{t-i} + \sum_{i=1}^{p} \alpha_{3i} \Delta gx_{1,t-i} + \sum_{i=1}^{p} \alpha_{4i} \Delta gx_{2,t-i} + \sum_{i=1}^{p} \alpha_{5i} \Delta gr_{t-i} + \lambda u_{t-1} + \theta Crisis_t + \varepsilon_t \qquad (2)$$

where Δ is the first difference operator, *Crisis* is the Asian crisis dummy variables taking the value of 1 from 1998 onwards and 0 otherwise, *u* is the error correction term obtained from equation 1 and all variables are as defined above. Equation (2) allows the changes in investment to be influenced by lagged changes in other variables as well as by the deviations of the levels variables from their long-run equilibrium. Thus, it conveniently incorporates both short-run dynamics and the long-run information contained in the data. The crisis dummy variable is included to account for possible influences of the Asian crisis on the dynamics of private investment. This is important as the noted reduction in private investment may be due to the crisis and have nothing to do with the noted persistent budget deficits.

The data used in the present analysis are annual covering the period 1970-2004 sourced from *Quarterly Statistical Bulletin* (various issues) and *Monthly Statistical Bulletin* (various issues) published by Malaysia's Central Bank, Bank Negara Malaysia. We measure private investment using private gross fixed capital formation (*pinv*). The main determinant of the accelerator model included is gross domestic products (*gdp*). Bank Negara Malaysia publishes figures of public expenditures in two separate sections of the bulletins: National Accounts and Federal Government Finance. Under the National Accounts, public consumption (*gcon*) and capital formation (*ginv*) are reported. Meanwhile, under the Federal Government Finance, federal government expenditures are divided into current expenditure (*gcur*) and development expenditure (*gdev*). Each is further subdivided into defense and security and others, from which we construct military spending (*gmil*) and non-military spending (*gnmil*) of the federal government. It should be noted that the subdivision for the current public expenditure has been re-classified since 2003. Accordingly, the data for military and non-military spending are available only up until 2002. Lastly, the government revenue is the total revenue of the federal government (*gr*). The nominal values of these variables are deflated using GDP deflator to obtain corresponding real figures and they are expressed in natural logarithm.

3. Empirical Results

As a preliminary analysis of the data, we first subject each time series to ADF and PP unit root tests. In implementing the tests, we include both the drift and trend terms. The Schwartz Information Criterion (SIC) is applied to determine the lag order of the ADF test. Table 1 reports the test results. As may be observed from the table, both tests fail to reject the unit root null hypothesis for all level variables. However, they are stationary when expressed in first difference. Accordingly, all variables are integrated of order 1, the property that allows for their possible long-run co-movement. To ascertain this, we apply the VAR-based Johansen-Juselius cointegration test. In the test, we include the 1997/1998 crisis dummy variable to account for the possible influences of the crisis. The VAR lag order is set to 1, which we find sufficient to render the error terms serially uncorrelated. The results of the test are reported in Table 2. From the table, we may note evidence supportive of cointegration among the variables. Both the trace and maximal eigenvalue statistics suggest the presence of a unique cointegrating vector governing the long-run relations between private investment and its determinants.

Table 3 presents the estimated long-run parameters (*i.e.* equation 1), which are readily available from the Johansen-Juselius procedure. The results clearly suggest the differential effects of various public spending components. As expected, both public investment and public development expenditure have a positive relation with private investment. Meanwhile, public consumption and public current expenditure seem to be negatively associated with private investment in the long-run. Interestingly, we document evidence that both military and non-military public expenditures have positive influence on the investment of the private sector. Since development or investment expenditures are parts of military and non-military spending, the results are not unexpected. In other words, in the Malaysian context, those expenditures directed to expanding public capital or to development programs may possibly crowd-in private investment in the long-run. Lastly, as can also be noted from the table, private investment is negatively related to government revenue, a result that should be expected.

Apart from these long-run relations, we also estimate the short-run dynamics of private investment using an error correction modeling to see whether private investment adjusts to changes in other variables in the short run. The results of the estimation for the three systems with different divisions of public expenditures are presented in table 4 through table 6. As noted, we add the crisis dummy variable to account for the influences of the 1997/1998 Asian crisis on private investment. The crisis has shattered confidence of the private sector. Accordingly, it may independently affect the private investment in the short run. Starting with the maximum lag of 2, we use the general-to-specific procedure to obtain final investment equations. To add credence to the estimation, we perform various diagnostics tests. These include the RESET test for model mis-specification, Jargue-Bera (J-B) test for normality, the LM test for serial correlation and the CUSUM and CUSUM of squares tests for structural stability.

Overall, the dynamic models perform well. The adjusted R-squared is reasonably high suggesting that at least 60% of variations in investment changes are explained by the regressions. Dividing public spending into current and development spending seems to offer the most fit to the data. Moreover, the models pass all diagnostic tests but one. It needs to be noted that, with the inclusion of the crisis dummy variable, we find the models to be structurally stable. We also fail to reject the null hypothesis of no specification error, normality of the error term and no serial correlation at conventional levels of significance. The exception is the model with public spending division into military and non-military expenditure. The RESET test for the model indicates model specification error. Accordingly, it should be interpreted with caution.

The error correction term in all three models has the expected negative coefficient and it is significant at better than 1% significance level. This suggests that private investment adjusts to deviations from its long-run equilibrium value. Taking the results of table 5 as an example, i.e. the regression equation with the highest explanatory power, the error-correction coefficient is estimated to be -0.4256. This means that 42.56% of the last year disequilibrium is corrected by changes in the investment rate. In other words, any changes in the included variables that lead to deviations of the private investment from its long run value will result in the adjustment of private investment. To see this adjustment in a more intuitive way, we can write the dynamic investment function of table 5 as:

$$\Delta pinv_t = K - 0.4256 u_{t-1} \quad (3)$$

$$u_{t-1} = pinv_{t-1} - [14.44 + 4.658 gdp_t - 3.312 gr_{t-1} + 1.032 gdev_{t-1} - 0.578 gcur_{t-1}] \quad (4)$$

where K represents other terms in the equation. From (3), we may note that private investment adjusts upward when $u_{t-1} < 0$ and vice versa. Given initially the long-run equilibrium value of private investment ($u_{t-1} = 0$), the increase in government development expenditure or a reduction in government current expenditure will cause private investment to be below its equilibrium value, as can be seen clearly from equation (4). Accordingly, given $u_{t-1} < 0$, private investment moves upward to restore equilibrium. In the literature, this response or process of adjustment has been appropriately termed as long-run causality.

Note that the crisis dummy variable enters negatively and significantly in all three regressions. This suggests that the Asian crisis has played a significant role in private investment slack. Apart from the crisis dummy, we may note from table 5 and table 6 that real GDP growth has significant and positive short-run dynamic effect on private investment. Lastly, the results from table 5, i.e. the equation with the best goodness of fit, also offer evidence that lagged changes in government current expenditure and government revenue explain short-run variations of private investment. Reinforcing the long-run results, changes in current expenditure has a negative impact on private investment. However, as may be noted from the table, a once-lagged change in government revenue has a positive coefficient. Perhaps, in the short run, the increase in public revenue is related to higher government spending as propounded by “tax-and-spend” hypothesis, which then feeds positive business expectations.

Based on these results, our answer to the main thesis of the paper as to whether public spending plays a role in the recent private investment decline is affirmative. Private investment has not increased in tandem with the V-shaped recovery and sustained positive growth of real GDP since the 1997/1998 Asian crisis. Indeed, private investment as a ratio to GDP has declined and remained low. Within the same period, we note a generally downward trend of public development and investment spending and an upward trend of public current and consumption spending. In 1997, public development and current expenditure to GDP ratios stood at 5.6% and 15.8% respectively. Despite the increase in public development spending ratio to roughly 10.5% by 2001, it recorded a downward trend since and reached 6.4% in 2004. Meanwhile, government current expenditure ratio has exhibited a clear upward trend since the crisis. By 2004, the ratio was 20.3%. Similar patterns are also observed for public investment and public consumption to GDP ratios. Given the positive coefficient of development spending and negative coefficient of current spending, these patterns may have explained the current investment slack. Having said these, it needs to be noted that public expenditure alone may not fully account for the reduction in private investment. From the estimation, we believe that the crisis is likely to have independent impact on private investment behavior.

4. Conclusion

The recent decline in Malaysia's private investment has caught attention of economists and policymakers. In this paper, we make an attempt to empirically analyze Malaysia's private investment by focusing on the possible complementarity or substitutability role of components of public expenditures. Total expenditure of the federal government is divided in three different ways, namely, (i) public investment and public consumption, (ii) public current expenditure and development expenditure, and (iii) military and non-military expenditures. In the analysis, we make use of time series econometrics of cointegration and error correction modeling to assess the long-run relations between private investment and its determinants as well as short-run dynamics of private investment.

The cointegration result suggests the presence of a long-run investment equation. The long-run parameter estimates suggest a positive relation between public investment and private investment. Similarly, public development expenditure is positively related to private investment. Meanwhile, both public consumption and current expenditure have negative long-run impacts on private investment. These results conform well to the view that only those productive components of public spending have a "crowding-in" effect. Interestingly, we find positive relations of both military expenditure and non-military expenditure to private investment. The short-run dynamic models of investment also suggest the adjustment of private investment to correct for deviations from its long-run value. In other words, there exists a long-run causality from the included variables (namely, real GDP, public spending and public revenue) to private investment. Finally, we note the significant role of the crisis, real output and public current expenditure in the short run.

Based on these results, we conclude that the current structure of public spending may have played an important role in explaining private investment slack. After the crisis, there seems to a noticeable increase in public consumption and public current expenditure. However, public investment and public development expenditure remain low. In other words, the low level of productive public spending may have not encouraged private investment and, accordingly, not alleviated the “crowding-out” effect of public consumption and public current expenditure. Having said these, it also should be noted that the Asian crisis does play an independent and significant role in accounting for the drop in private investment.

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Table 1: ADF and PP Unit Root Tests

	Level		First Difference	
Variables	ADF	PP	ADF	PP
pinv	-1.727	-1.726	-4.492*	-4.455*
gdp	-1.570	-1.832	-4.919*	-4.875*
grev	-2.202	-2.052	-6.795*	-7.094*
ginv	-2.887	-2.320	-3.850**	-3.832**
gcon	-3.402	-3.426	-6.956*	-8.613*
gcur	-1.752	-2.750	-5.900*	-9.063*
gdev	-2.386	-2.622	-4.945*	-4.869*
gmil	-2.576	-2.850	-5.106*	-5.094*
gnmil	-2.941	-2.943	-5.908*	-6.205*

Note: * and ** denote rejection of the unit root null hypothesis at 1% and 5% significance levels respectively. In the implementing the tests, both drift and trend terms are included. The lag order of the ADF test is chosen using the Schwartz Information Criterion (SIC).

Table 2: Johansen-Juselius Cointegration Test

Test	Null Hypothesis				
Statistics	r =0	r ≤ 1	r ≤ 2	r ≤ 3	r ≤ 4
(a) *pinv, gdp, grev, ginv, gcon*					
Trace	101.14	44.67	22.44	11.25	3.42
Max	56.46	22.24	11.19	7.82	3.42
(b) *pinv, gdp, grev, gdev, gcur*					
Trace	114.66	41.15	23.40	9.97	1.17
Max	73.52	17.75	13.43	8.80	1.17
(c) *pinv, gdp, grev, gmil, gnmil*					
Trace	96.17	43.55	23.07	9.73	3.96
Max	52.62	20.48	13.35	5.77	3.96
Critical Values (5%)					
Trace	*68.52*	*47.21*	*29.68*	*15.41*	*3.76*
Max	*33.46*	*27.07*	*20.97*	*14.07*	*3.76*

Note: the lag order is set to 1, which is sufficient to render the error term serially uncorrelated. The crisis dummy is also included in the test.

Table 3: Estimated Long-Run Parameters of Investment Function

(a) *pinv, gdp, grev, ginv, gcon*

$$pinv_t = 5.669 + 3.054gdp_t - 1.766gr_t + 0.691ginv_t - 0.883gcon_t$$
$$\qquad (0.342) \qquad (0.465) \qquad (0.201) \qquad (0.421)$$

(b) *pinv, gdp, grev, ginv, gcon*

$$pinv_t = 14.44 + 4.658gdp_t - 3.312gr_t + 1.032gdev_t - 0.578gcur_t$$
$$\qquad (0.433) \qquad (0.498) \qquad (0.140) \qquad (0.318)$$

(c) *pinv, gdp, grev, gmil, gnmil*

$$pinv_t = 27.17 + 7.134gdp_t - 8.874gr_t + 1.399gmil_t + 3.294gcur_t$$
$$\qquad (0.916) \qquad (1.153) \qquad (0.771) \qquad (0.662)$$

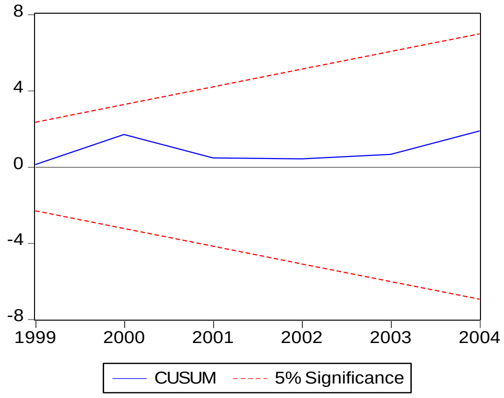
Note: standard error in parentheses.

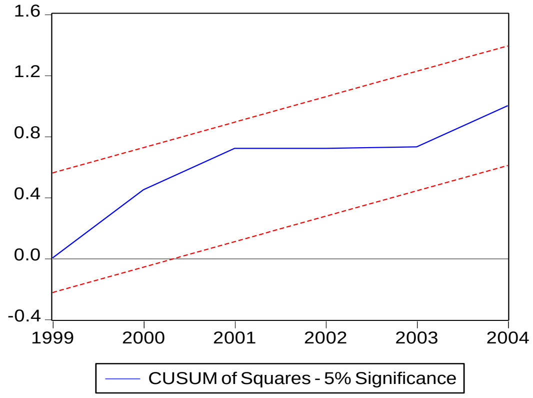
Table 4: Estimation Results – Public Investment and Consumption

$$\Delta pinv_t = 0.2356 - 0.845 Crisis_t - 0.538 u_{t-1}$$

$$(0.000) \quad (0.000) \qquad (0.000)$$

Adj-R^2= 0.5999	RESET = 0.162 (0.851)	LM(1) = 0.4496 (0.502)
N = 34	JB = 0.307 (0.857)	LM(2) = 1.2923 (0.524)





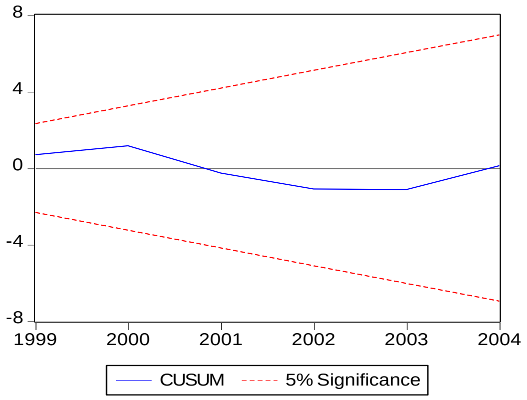
Note: Numbers in parentheses are p-values. RESET is Ramsey's mis-specification test, JB is Jarque-Bera test for normality, LM is Breusch-Godfrey LM test for auto-correlation, and CUSUM and CUSUM of Squares are tests for structural stability.

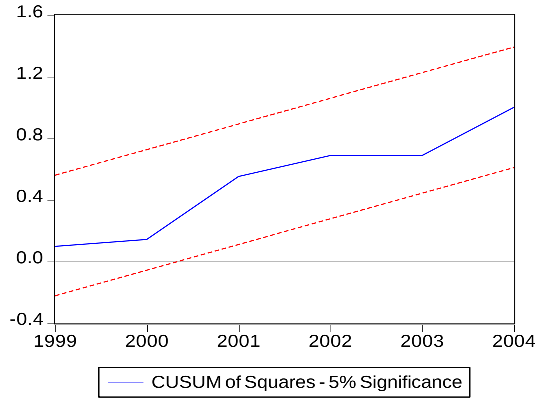
Table 5: Estimation Results – Public Development and Current Expenditures

$$\Delta pinv_t = 0.1549 - 0.9972Crisis_t - 0.3558\Delta pinv_{t-1} + 1.9108\Delta gdp_{t-1}$$
(0.057) (0.000) (0.041) (0.074)

$$+0.6340\Delta grev_{t-1} - 0.6452\Delta gcur_{t-1} - 0.4256u_{t-1}$$
(0.054) (0.039) (0.000)

Adj-R^2= 0.6998	RESET[2, 24] = 1.757 (0.194)	LM1) = 0.171 (0.679)
N = 33	JB = 0.826 (0.662)	LM(2) = 0.246 (0.884)



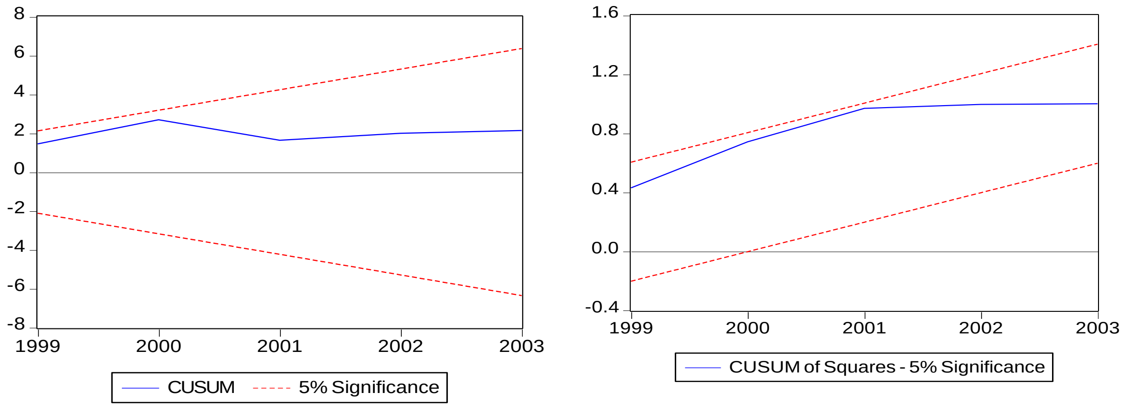


Note: Numbers in parentheses are p-values. RESET is Ramsey's mis-specification test, JB is Jarque-Bera test for normality, LM is Breusch-Godfrey LM test for auto-correlation, and CUSUM and CUSUM of Squares are tests for structural stability.

Table 6: Estimation Results – Military and Non-military Expenditures

$$\Delta pinv_t = -0.125 - 0.6808Crisis_t - 0.4376\Delta pinv_{t-1} + 2.9575\Delta gdp_{t-1} - 0.1523u_{t-1}$$
$$(0.878) \quad (0.000) \qquad (0.034) \qquad (0.020) \qquad (0.001)$$

Adj-R^2= 0.6228	RESET[2, 24] = 4.862 (0.016)	LM1) = 1.844 (0.174)
N = 32	JB = 1.302 (0.521)	LM(2) = 0.864 (0.434)



Note: Numbers in parentheses are p-values. RESET is Ramsey's mis-specification test, JB is Jarque-Bera test for normality, LM is Breusch-Godfrey LM test for auto-correlation, and CUSUM and CUSUM of Squares are tests for structural stability.