Determinants of Public and Private Investment An Empirical Study of Pakistan

Rabia Saghir [1]

Azra Khan[2]

Abstract

This paper analyses the determinants of public and private investment in Pakistan using time series data for the period 1970-2010.By using co-integration and error correction the analysis shows that government investment negatively effect private investment which shows crowding out effect .In short run lagged change in government investment is significant and positive. The effect of aid on government investment is positive but insignificant in short run. Private investment has significant and positive impact on government investment.

Keywords: Government Investment, Private investment, Real interest rate,

1. Introduction

The unsustainable economic growth has been blamed mainly on high /low government expenditure, low level of investment, unfavorable weather conditions, political instability and many other factors in the country. Economists have long been interested in knowing the factors that contribute to investment in different sector of economy. Investment is a central issue in macroeconomic theory; it plays an important role in economic growth of a country as it raises the productive capacity of the economy and promotes production techniques. In recent years, emphasis has been put on the development of the private sector in developing countries to help boost economic growth and reduce poverty. In the late 1980s an alternative development strategy was to develop the private sector to boost growth in developing countries. Econometric evidence (Beddies 1999, Ghura and Hadjimichael 1996, Ghura 1997) indicates that private investment has a stronger, more favorable effect on growth rather than government investment, probably because private investment is more efficient and is less closely associated with corruption. Public and private sectors have played important roles in boosting economic development in the country.

The present study analyzes the Public and private investment in Pakistan by applying error correction model to the latest available time-series data for Pakistan's economy for the period 1970-71 to 2009-10.It provides quantitative evidence by undertaking econometric estimates of various key macroeconomic policies explaining public and private investment in Pakistan. The objective of this study is to provide quantitative evidence to identify the impact of public and private investment in Pakistan. The study is organized into five sections. Section II reviews the literature providing theoretical perspective and empirical evidence on significance of certain determinants of public and private investment. Section III includes the methodology and estimation techniques. Section IV of the study is based on results of co-integration and error correction techniques. Finally, Section V concludes the study based on the observed trends and determinants of public and private investment in Pakistan, along with suggesting recommendations for further work.

2. Literature Review

Using the case of India[3] a study seeks to investigate the crowding effect of government investment on private investment for the period 1969-2005. The results reveal that in long run government investment has had a positive impact on economy but it is less in short run. In the medium and long run there is positive relation in sense that government investment infrastructure may facilitate private investment.

[1]Lecturer. Department of Economics. Foundation University College of Liberal Arts and Sciences (FUCLAS), New Lalazar , Rawalpindi, & Ph.D Scholar ,School of Economics Science, Federal Urdu University of Arts, Science and Technology, Islamabad, Pakistan

[2]Lecturer & Ph.D Scholar, School of Economic Sciences, Federal Urdu University of Arts, Science and Technology, Islamabad, Pakistan.

[3] Mitra, P. (2006).

Another attempt had been made to investigate the effects of private investment on Pakistan[4], using simultaneous equation model for the time period 1959-1988 estimated by applying 2SLS techniques. It uses annual growth rate of gross national product and national saving as a ratio to GNP as dependent variables respectively and net private investment as a ratio to GNP, disbursements of grants and external loans, real rate of interest, as independent variables. The conclusion is that net private investment and disbursements of grants and external loans has a positive impact on government revenue.

A study was conducted on the long run determinants of private investment in Senegal[5] using time series data for 1970-2000. It uses co-integration, error correction, and unit root as estimating technique. The regression results provide an important insight into the determinants of private investment. Foreign aid flow has positive impact on private investment. It also supports the argument that public investment makes a positive and significant effect on private investment.

A study was conducted to examine short run and long run determinants of private investment for the period 1970-2005 for Argentina[6]. The results confirm the existence of long run relationship between capital accumulations and private investment. In addition, investment decisions seem to be influenced by changes in exchange rate, trade liberalization and aggregate demand in short run. There is also evidence of crowding out effect of public investment. There is no long term relationship between the public and private investment.

3. Model specification

Investment is an essential component of national income account identity and can be written as follows: I= f (GNP, RR, GI, PI, aid) ---------- (1)

The equation (1) shows investment as a function of GNP, the real rate of interest, government investment, private investment and the flow of loan and aid into the country. Total investment is divided into public investment (GI) and Private investment (PI).

3.1: Government Investment: Government investment is mainly determined by government revenue, and foreign aid. Hence the government investment equation is:

$$GI_t = \alpha_\circ + \beta_1 GNP_t + \beta_2 GR_t + \beta_3 AID_t + \beta_4 PI + \mu_t \quad \text{---------- (2)}$$

3.2: Private Investment: Government investment is also included as an explanatory variable to capture crowding out or crowding in effects. Therefore, empirical form of our private investment equation is:

$$PI_t = \alpha_\circ + \beta_1 GNP_t + \beta_2 RR_t + \beta_3 GI_t + \mu_t \quad \text{---------- (3)}$$

(GR) Government revenue, (AID) foreign aid and loan, (GI) Government investment, (PI) private investment, (GNP) gross national product. Based on the evidence provided by literature in our study and the characteristics of time series data this study uses different econometric techniques that have earlier been used by the economists. The present study takes into account the annual data for a time-series study of public and private investment in Pakistan, for the time period 1970-2010. GNP is taken in real terms deflated by CPI (2000=100). Government revenue is taken as a fraction of GDP. Aid is taken as fraction of GNP. Private investment and government investment are taken as fraction of GDP. Interest rate is in real terms. (Nominal interest rate – inflation). Data are collected from *International Financial Statistics*. In this section we perform econometric tests to find out the public and private investment in Pakistan**.** All variables used in the model are stationary at I(1). As ADF statistics are less than their critical value from Fuller's table so the null hypothesis (H0) is rejected and the series are stationary. As all the series are integrated of order one; so we check co-integration between these series. Johansen's test is used to solve the model. Unrestricted VAR model is used to choose lag length. Minimum AIC is used to identify significant lag length. Following are the results and their interpretations for each equation of our model.

4. Results of ADF Test

This study uses augmented Dickey-Fuller (ADF) unit root test to evaluate whether the series is stationary or not.

[4] Shabir, T, et al. (1992)
[5] Ouattara, B. (2004)
[6] Acossta, P.and Loza, A. (2005).

All variables used in the model are stationary at I (1). The unit root test results are presented in the Appendix. The

null hypothesis (H^0) is rejected as ADF statistics are less than their critical value from Fuller's table and the series are stationary. As all the series are integrated of order one; so we check co-integration between these series. Johansen's test of co-integration is used to solve the model. We made unrestricted VAR model to choose lag length. Minimum AIC is used to identify significant lag length.

4.1: Estimated Long Run Results

In government investment equation function all the variables used in the model are stationary at I (1) so we can find the long run relationship of public investment by using co-integration test. Minimum AIC is at lag [1], so we use this lag for co-integration test. The results of table (2) proved that two run relationships exist in government investment equation model which can be used to find the normalized co-integration test**.** The equation for public investment tells us that RGNP, government revenue, aid and private investment, have positive and significant connections with government investment in the long run. The co-efficient of GNP have positive sign and also statistically significant. Similarly result shows that private investment has significant and positive externality effect on government investment. The result shows that there is positive externality effect of higher aid on government investment. The co-integration test results reported in Table (4) argue that there exist long run relationships between the dependent variable, private investment, and independent variables. Number of co-integrating equations show that two long-run relationships exist between the variables.

Real interest rate and government investment apply negative but significant impact on real private investment. Real interest rate is significant at 10% while government investment is significant at 1% significance level. . On the base of results it can conclude that an increase in interest rate exerts negative effect on private investment. It can be argued that a decrease in interest rate creates appropriate economic environment that promotes the private sector to invest, reducing the cost of production and hence raising the profitability of the private investment. On the other hand government investment has crowding out effect on private investment. This is because the coefficient of government investment is negative implying that it exerts an upward pressure on interest rate and a negative effect on private investment.

4.2: Short Run Error Correction Results:

$$\Delta \ln GI_t = \alpha_\circ + \alpha_1 EC_{t-1} + \sum_{i=1}^{n} \beta_1 \Delta \ln GNP_{t-i} + \sum_{i=1}^{n} \beta_2 \Delta \ln GR_{t-i} + \sum_{i=1}^{n} \beta_3 \Delta \ln Aid_{t-i} + \sum_{i=1}^{n} \beta_4 \Delta \ln GI_{t-i} +$$

$$\sum_{i=1}^{n} \beta_5 \Delta \ln PI_{t-1} + e_t$$

The results reported in the table (3) shows that estimated lagged error correction term EC^{t-1} is negative and significant. The coefficient is 0.23, suggesting a slow adjustment process in government investment. Nearly 23 percent of the disequilibria of previous period's shock adjust back to the long run equilibrium in the current year. The short run response of lagged change in government investment is significant and positive which shows that the previous period's growth in government investment bring positive change in the government investment over the short run. Furthermore the changes in the revenue exert positive and significant impact on government investment in the short run. . In short run aid has insignificant impact because most of the portion of aid is used for non-development expenditures. Private investment has insignificant impact on government investment in short run. The result shows that value of (LM) is 0.43 which is quite reasonable as should be in time series analysis. To assess the structural stability of the estimated model, we also performed the CUSUMSQ test of stability. The results are presented in figure (1**).** As it can be seen from the figure, there is no movement outside the critical lines that shows the model is stable.

$$\Delta \ln PI_t = \alpha_\circ + \alpha_1 EC_{t-1} + \sum_{i=1}^{n} \beta_1 \Delta \ln GNP_{t-i} + \sum_{i=1}^{n} \beta_2 \Delta \ln RR_{t-i} + \sum_{i=1}^{n} \beta_3 \Delta \ln GI_{t-i} + \sum_{i=1}^{n} \beta_4 \Delta \ln PI_{t-i} + e_t$$

Error correction model is used to find the short run relationship of determinants of private investment function as results shown in the table (5). At this stage we estimate a dynamic error correction model (ECM) which is used for capturing the effect of macroeconomic uncertainty on private investment.

All the variables here are in first difference. The error correction term that is EC^{t-1} in the estimated equation is significant and bears a theoretically correct signs. The estimated co-efficient of EC^{t-1} indicates that approximately 14% of the disequilibrium in private investment is corrected immediately i.e. in the next year. In the estimated error correction model, the coefficient of lagged change in private investment is positive and significant at 10% significance level which shows that the private investment in the previous period led to a positive change in the private investment in the short run. This implies that current private investment decisions in Pakistan are to some extent at least influenced by the investor's past behavior. Real interest rate has insignificant effect on private investment so decrease in interest rate does not affect the cost of production in short run. This model passed a battery of diagnostic tests. The residual passed the diagnostic test of no serial correlation (0.5123) as the value of probability of F-statistics is greater than 0.05) and Ramsey's Reset test is a stability test which shows that all regression specification error in private investment function is stable. The stability of the estimated function is established by using CUSUM of squares for stability. The results are presented in figure (2). As can be seen from the figure, there is no movement outside the critical lines in the test that shows the coefficients are stable and there is no instability in the model.

5. Conclusion & Policy Implication

This study explores the public and private investment respectively. Based on co-integration tests the empirical results found long run relationship between public and private investment and its determinants. The findings are consistent with the theoretical hypothesis. In private investment model long run relationship exists between the variables. The most interesting conclusion from this study is that a negative relationship is found between private and a government investment that supports the existence of crowding out affect as was expected. Government investment adjusts back nearly 47% of disequilibrium of previous period's shock to the long run equilibrium in the current year. Government development expenditures must be improved, to minimize the cost of production of private sectors which increase the profitability of the investors. So development expenditures must be improved to support the private investment. Similarly government should make efforts to use aid for the development projects which helps to appreciate private investment.

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Appendix: Table1: Results of ADF test

	LEVEL		1st DIFEERENCE		
	Intercept	Trend & Intercept	Intercept	Trend & Intercept	
Real Interest Rate	-0.53 -(2.949) Lag(0)	-1.986 (-3.516) Lag(0)	-3.852* (-2.955) Lag(0)	-4.0144* (-3.556) Lag(0)	I(1)
Real GNP	-0.943 (-2.944) Lag(0)	-1.663 (-3.538) Lag(0)	-5.148* (-2.947) Lag(0)	-5.146* (-3.542) Lag(0)	I(1)
Government Revenue	-2.73 (-2.974) Lag(0)	-0.650 (-3.542) Lag(0)	-6.266* (-2.985) Lag(0)	-6.657* (-3.6027) Lag(0)	I(1)
Government Investment	-2.627 (-2.94) Lag(0)	-2.959 (-3.542) Lag(0)	-4.399* (-2.947) Lag(0)	-5.358* (-3.5426) Lag(0)	I(1)
AID	-1.437 (-2.947) Lag(0)	-2.821 (-3.542) Lag(0)	-6.4351* (-2.949) Lag(0)	-6.554* (-3.546) Lag(0)	I(1)
Private Investment	0.0090 (-2.94) Lag (0)	3.090 -(3.542) Lag (0)	6.499* (-2.949) Lag(0)	6.329* (-3.156) Lag(0)	I(1)

*MacKinnon critical values for rejection of hypothesis of a unit root indicate at 5% significance level

Estimated Long Run Result

Table 2: Johansen Co-integration Test for Public Investment

Maximum Eigen value	Like hood Ratio	5% Critical value	Hypothesis No of CE(s)
0.7443	87.9026	68.52	None **
0.54055	48.352	47.21	At most 1**
0.41	25.79	29.68	At most 2
0.235	10.139	15.41	At most 3
0.0764	2.36	3.76	At most 4

GI = 14.867 + 1.88**GNP** +0.964 **GR** + 1.852**AID**+1.072**PI**
t- Value 2.37** 4.28** 2.29** 5.54** 1.822**

Table 3: Error Correction

Variables	Co-efficient	Std-Error	t-statistics
ΔGI^{t-1}	-0.244	0.139	(-1.800)**
ΔGR^{t-1}	0.664	0.350	1.885**
ΔPI^{t-1}	0.048	0.440	0.1102
ΔAid^{t-1}	0.364	(0.184)	(1.884)**
$\Delta RGNP^{t-1}$	2.526	(1.352)	(1.868)**
EC^{t-1}	-0.2309	(0.0633)	-3.6454**
LM Test	0.43	Ramsey Reset Test	1.577

** Significant at 5%

Table 4: Johansen Co-integration Test for Private Investment

Max Eigen value	Like hood Ratio	5% Critical value	Hypothesis No of CE(s)
0.7316	86.06	53.12	None **
0.6236	43.97	34.91	At most 1**
0.2069	12.69	19.69	At most 2
0.1519	5.27	9.24	At most 3

** denotes rejection of the hypothesis at 5% significance level

PI = 7.712 + 1.85**GNP** - 0.279 **RR** – 1.175**GI**

t- Value 1.55** 2.06** 1.937** 4.802**

Table: 5 Error Corrections

Variables	Co-efficient	Std-Error	t-statistics
Δ PI $^{t-1}$	0.1992	0.18711	1.67*
Δ GNP $^{t-1}$	0.00147	0.56718	0.0026
Δ RR $^{t-1}$	-0.032020	0.05199	-0.6158
Δ GI $^{t-1}$	-0.0999	0.05261	-1.898*
EC $^{t-1}$	-0.1396	0.0557	-2.5029**
LM Test	0.5123	Ramsey Reset Test	1.63

** Significant at 5%.* Significant at 10%.* **Significant at 1%.

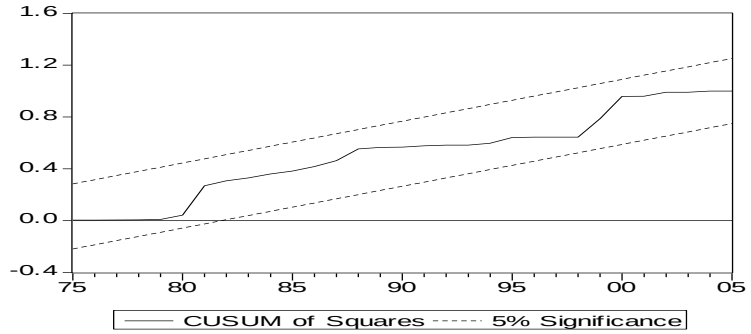

Fig (1) Government Investment

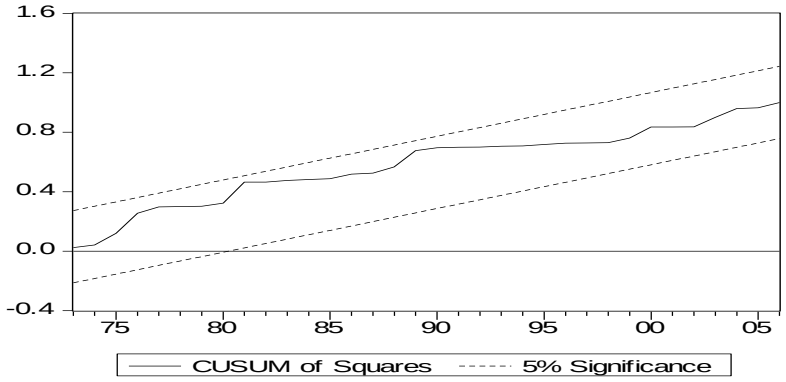

Fig (2) Private Investment