Role of Public Expenditures and Macroeconomic Uncertainty in Determining Private Investment in Large Scale Manufacturing Sector of Pakistan

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Abstract

Considering the importance of large scale manufacturing sector in Pakistan economy we analysed investment behavior of private sector in large scale manufacturing. The main emphasis in this paper has been to explore the role of public expenditures (development and non development) and macroeconomic uncertainty in determining private sector's fixed investment in large scale manufacturing. It is found that most of the series are non-stationary and there is one cointegrating relationship between the private investment, public consumption expenditures, public development expenditures and size of market. The dynamic ECM model of private investment indicates public development expenditures enhance the private investment whereas non-development expenditures and macroeconomic uncertainty negatively affect private investment.

Keywords: Private Investment, Public Expenditures, Macroeconomic-uncertainty, Large-scale Manufacturing, Cointegration, Pakistan.

1. Introduction

Keynes (1936) believed that government intervention is needed to activate the private investment. Policy makers believed that private investment is slow in Pakistan due to insufficient infrastructure and government investment. This study examines the relationship of private investment in large scale manufacturing with Public expenditures and macroeconomic uncertainty. Generally, it is argued that public investment may crowd-in or crowd-out private sector. The strong empirical evidences may guide the policy makers as to which components of expenditures should be minimized and which may be enhanced to encourage private investment (Hermes and Lensink 2001).

Most studies found a positive relationship between private investment and public investment[1]. In some cases a negative relationship has been reported[2]. Studies for Pakistan, such as Khan (1988) and Naqvi et al. (1993) estimated only disaggregated private investment functions using conventional econometric methodologies. Looney (1997) estimated relationship between private investment in large-scale manufacturing and infrastructure by applying Engle Granger (1987) methodology. Naqvi (2002) estimated the relation between aggregate public and private fixed capital formation for Pakistan. This study provides estimates of private investment behavior of large scale manufacturing during the period 1972-2005.

The review of economy highlights that Pakistan is basically an agrarian underdeveloped economy with negligible industrial base. The adoption of industrial development through the import substitution strategy resulted in impressive growth in large-scale manufacturing but after the war of 1965 private investment slowed down due to the sharp decline in foreign resources and sudden increase in defense expenditures. After the separation of East Pakistan in 1971, the policy of nationalization was adopted, as a result private investment fell sharply, but public investment doubled. In the late 1970s the nationalization process was reversed gradually, as a result the private investment exhibited a positive trend. The accumulation of budget deficit and worsening of balance of payment in late eighties forced the government to seek International Monetary Fund's (IMF) assistance in 1987 in the form of Structural Adjustment Programmes. In December 1988 new government came to power, however the privatization efforts did not gain momentum. Sanctions by the international communities and freezing of foreign currencies accounts by the government after the nuclear explosion in 1998 darkened the investment prospects. The economic revival plan of 1999, the strict adherence to IMF program, and events in the aftermath of September 11, 2001 helped to ease the public debt situation. This has had a favorable impact on the investor's confidence. The easy access to industrial raw materials coupled with liberal incentives for investors helped to improve investment climate in Pakistan.

Section-2 describes specification of the econometric model. Section-3 deals with estimation methodology and the data issues. Estimated results of unit roots, cointegration analysis and Error Correction Mechanism (ECM) modeling are given in section-4. Finally conclusion and policy implications are presented in section-5.

2. Econometric Model

The theories of investment postulated that the investment mainly depends on interest rate, income factor and uncertainty variables. Public development expenditures and public consumption expenditures are incorporated to capture the explicit role of public expenditures in the determination of investment (Ahmed and Qayyum 2008, and Aschaver, 1989). The interest rate negatively effects the private investment because when interest rate increases the returns on investment declines (Fischer, 1930). Income level affected the private investment positively as higher income level would tend to dedicate more of their resources to finance investment[3]. Private Investment is considered to be negatively related to uncertainty as the fixed investment decisions cannot be undon if future events turn out to be unfavorable (Dixit and Pindyck, 1994). Further capital once installed is immobile as compared to labour.[4] Following Ahmad (2007), Ahmad and Qayyum (2007) we can write private investment function for large scale manufacturing sector of Pakistan as;

$$\mathbf{LPIM_t = f(LCG_t, LIG_t, LA_t, LGDP_t, UN_t, \varepsilon_t)} \quad (1)$$

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1 For example Aschaver (1989), Greene and Villanuva (1991), Munnell (1992), Shafik (1992), Oshikaya (1994), Ramirez (1994), Ghura and Goodwin, (2000) and (Mamatzakis, 2001).

2 For instance Akkina and Celibi (2002), Pereira and Sagales (2001), Williams and Darius(1998), Wai and Wang(1982).

3 Private investment is positively affected by income level as Chhibber & Wijnbergen (1988) for Turkey, Ramirez (1994) for Mexico, Monadjemi (1996) for Australia, Britian & US, Mamatzakis (2001) for Greece, Pereira and Sagales (2001) for Spain, Akkina and Celibi (2002) for Turkey, Kim & Lim (2004) for Korea and Ouattara Bazoumana (2005) for Senegal.

4 Capital equipment becomes industry- specific and can hardly be put to another use or productive process or activity without incurring a substantial cost.

Where PIM_t is real private fixed investment in large scale manufacturing, GDP_t is real gross domestic product, IG_t is real public development expenditures, CG_t is real public consumption expenditures, A_t is interest rate (weighted average rate of return on advances), UN_t is macroeconomic uncertainty measure (derived by percentage change in the annual inflation rate) and ε_t is error term assumed to be independent and identically distributed (iid). All series are collected at constant market prices of 1980-81. The data for advancing rate are taken from State Bank of Pakistan (various issues) and all other series from, Government of Pakistan (various issues).

Assuming non-stationarity of data and existence of cointegrating relationship between the private investment in manufacturing sector, public consumption expenditures, public development expenditures and size of market, the dynamic private investment model can be represented by error correction mechanism such as:

$$\Delta Y_t = \mu + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \Pi Y_{t-1} + \varepsilon_t \quad (2)$$

This model includes variables both in levels and in differences. Assuming series are I(1), then first difference of the series are stationary. Moreover, if there is a cointegrating relationship between I(1) variables then the linear combination of these variables is I(0). It means that $\prod_i Y_t$ term is also stationary. The error correction model therefore captures both long-run and short-run dynamics of private investment. The long-run matrix Π can be factorized as $\Pi = \alpha\beta'$. In the presence of the cointegration relationship, the vector β has the property that $\beta' Y_t$ is stationary, though Y_t itself is nonstationary. The vector α is a loading vector. It gives the speed of adjustment towards the state of equilibrium. Expected sign of the error correction parameter is negative.

3. Econometric Methodology

We apply the cointegration approach, following three steps methodology (Ahmad and Qayyum, 2007 and Qayyum, 2002) to achieve the stable dynamic private investment function for the large scale manufacturing. As a first step we test the stationarity of data by applying the Augmented Dickey-Fuller (1979, 1981) test. In a second step we test the existence of cointegrating relationship between the variables and estimate long run function by using the Johansen (1988) maximum likelihood method. Final step involves estimation of dynamic private investment function that is obtained through error correction mechanism and general to specific methodology.

The estimation process starts with the unrestricted general model where every variable enters with a three lag length. Final lag length is selected through the applicantion of AIC and SBC criteria. The preferred private investment function would pass a battery of diagnostic tests such as no autocorrelation, no heteroskedasticity, no ARCH, and test of stability such as CUSUM and CUSUM of Squares.

4. Empirical Results

We have followed three steps methodology. This includes testing of time series properties of data, estimation of long run private investment function and a parsimonious stable error correction private investment function. The results are reported here in after.

4.1. The Long-run Private Investment Function for Large-scale Manufacturing:

As a first step, we tested order of integration of individual series by application of Augmented Dickey-Fuller (ADF) test [5]. The findings are reported in Table 1. As can be seen from the Table, all variables except macroeconomic uncertainty are integrated of order one, I(1). Macroeconomic uncertainty is stationary therefore it cannot be included in the cointegration analysis.

5 We also apply PP test which confirmed the results of ADF.

Table 1: Testing Order of Integration by Augmented Dickey-Fuller Test

Variables Level	ADF-stats	Lag Length	Variables First Difference	ADF-stats	Lag Length	Result
LCG_t	-1.8929^{C}	1	ΔLCG	-5.7572^{C}*	0	I (1)
LIG_t	-2.0418^{C}	0	ΔLIG	-6.3662*	0	I (1)
LPI_t	$-2.9464^{C,T}$	0	ΔLPI	-4.1524*	0	I (1)
$LGDP_t$	-1.8033^{C}	0	ΔLGDP	-4.8653^{C}*	0	I (1)
$LINF_t$	-0.8715	0	ΔLINF	-6.9322*	0	I (1)
LA_t	-2.4434^{C}	0	ΔLA	-4.0108*	0	I (1)
UN_t	-6.6425^{C}*	0				I (0)

The existence of cointegrating relationship between the private fixed investment in large-scale manufacturing and its determinants is explored and then long-run model estimated in this section. We have investigated the number of cointegrating vectors by applying the likelihood ratio test that is based on the maximal eigenvalue and trace statistics of the stochastic matrix of the Johansen (1988) procedure. The inflation rate and interest rate are found insignificant using LR test, so those are dropped from cointegration analysis. The results are presented in Table 2. As can be seen from the Table, there exist one long run relationship among private fixed investment in large-scale manufacturing, public consumption expenditures, public development expenditures and size of market (i.e., GDP). The error term series is well behaved.

Table 2: Johansen Test for Cointegration

Maximum Eigenvalue Test.			Trace Test		
Null Hypothesis	**Alternative Hypothesis**	**Test Statistic**	**Null Hypothesis**	**Alternative Hypothesis**	**Test statistic**
r = 0	r = 1	40.66264*	r = 0	r ≥ 1	62.87032*
r = 1	r =2	22.01971	r = 1	r ≥2	28.56126
r = 2	r = 3	11.57143	r = 2	r ≥ 3	9.982116
r = 3	r = 4	0.259255	r = 3	r ≥ 4	0.218743

Note: 1. * Indicates significant at the 5 percent level.
2. Variables included in the cointegrating vector: LPIM, LCG, LIG and LGDP.

After normalizing coefficients of the explanatory variables on private investment in large scale manufacturing (PIM) long-run private fixed investment function is obtained and presented in Table 3. The estimated coefficients of LCG, LIG and LGDP have a priorri and significant signs with elasticities 1.24, 2.87 and 0.87, respectively.

Table 3: Normalized Coefficients of Cointegrating Vector

Variables	Coefficient	Standard error	T-Value
LCG_t	-1.241132*	0.58461	-2.123
LIG_t	2.867333*	0.56375	5.086
$LGDP_t$	0.871932*	0.41577	2.097
$Constant_t$	-16.91322	_	_

Note: (*) represent significance at 5 % critical values.

The cointegration analysis indicates that in the long run public consumption expenditures have negative effect on private fixed investment in large-scale manufacturing. The analysis also reveals positive long run relationship between private fixed investment in large-scale manufacturing and public development expenditures. It indicates the importance of providing basic infrastructure to private sector of the economy as a way to create the appropriate economic environment that prompts private sector incentives to invest in large-scale manufacturing. Therefore, public development expenditures on construction, electricity, gas, transport and communication increases the return to investment and hence raises the profitability of the private fixed investment in this sector.

The estimated coefficient of gross domestic product (GDP) is positive and significant. This indicates that investors take initiative when there is an increase in the size of market demand. Overall empirical findings support the view that provision of basic infrastructure is the most important determinant of private fixed investment in the large-scale manufacturing sector.

4.2. Dynamic Model of Private investment in Large-Scale Manufacturing

The error correction mechanism (ECM) is used to specify the short-run dynamic model. Following general to specific approach we start with model that includes three lags of each explanatory variable and error correction term EC_{t-1}. All the variables, except macroeconomic uncertainty variable (UN) are transformed into stationary by taking first difference. This uncertainty variable (UN) is used to capture the effect of macroeconomic uncertainty on the private investment in large-scale manufacturing. This variable is used in the form of next period as $UN_{t+1,}$ indicating expected uncertainty. The error term (EC) represents the long-run private fixed investment function of the large-scale manufacturing sector.

After estimating the model, we gradually eliminate insignificant variables. The results suggest that in this case out of sixteen explanatory variables in the general model only eight variables sustained to establish short-term relationship with the private investment in the large-scale manufacturing sector. The preferred parsimonious error correction model is presented in Table 4. The estimated model passed diagnostic tests of no autocorrelation [$\chi^2(1) = 0.47$], no heteroskedasticity [$\chi^2(4) = 18.03$], normally distributed [$\chi^2(2) = 0.59$], no ARCH [$\chi^2(1) = 0.48$] at the 5 percent level of significance. Moreover, CUSUM and CUSUM of Squares test confirmed the parameter stability of the estimated function .[6]

Table 4: Error Correction Model of Private Investment in Large-Scale Manufacturing (ΔLPIM)

Variables	Coefficient	Standard Error	T-Statistics
$\Delta LPIM_{t-1}$	0.614528	0.188979	3.25
$\Delta LPIM_{t-2}$	0.532675	0.192296	2.77
ΔLCG_{t-1}	0.601315	0.323648	1.86
ΔLCG_{t-3}	0.823096	0.351529	2.34
ΔLIG_{t}	0.875445	0.208816	4.19
ΔLIG_{t-2}	-0.519736	0.197360	-2.63
$\Delta LGDP_{t-2}$	-4.048276	1.608901	-2.52
UN_{t+1}	-0.180008	0.084225	-2.14
EC_{t-1}	-0.819674	0.178090	-4.60
Constant	-0.081868	0.085509	-0.96
R-squared = 0.686229		F(10, 31) = 5.888061	

The estimated coefficient of error correction term (EC) is -0.82 which is highly significant with theoretically correct sign. It indicates that approximately 82 percent of the disequilibrium in the private fixed investment is corrected immediately, i.e. in the next year. It suggests a high speed of convergence to equilibrium if a disequilibrating shock appears. The estimated negative and significant coefficient of the next period's uncertainty proxy indicates that expected macro economic instability and uncertainty in coming year depresses private fixed investment in large scale manufacturing. The coefficient of current uncertainty is not significant, rather expected uncertainty appears to affect private investment in large-scale manufacturing more significantly. It may reflects the situation that investment in this sector consists of large projects, with long gestation period.

5. Conclusion and Policy Implications

The results of the study support the proposition that public development expenditures lead to enhance private investment in large scale manufacturing and public non-development expenditures have considerable negative affect on private investment. The study also shows that economic instability and

[6] Results are not reported here can be produced on request.

uncertainty tends to depress the private investment in large-scale manufacturing. The study also supports that larger the size of market, higher will be the private investment. The study recommends the following strategies to promote sustained private investment: development expenditures should be enhanced to encourage private investment; and non development expenditures should be curtailed at bare minimum level. Secondly, the analysis suggests that a high degree of macroeconomic stability, low and predictable inflation have paramount importance to ensure a strong response of private investment to economic incentives. Therefore overall harmony and stability in the country is essential for the promotion of private investment. There is also a need to expand the size of the market to encourage private investment.

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