
**SHORT AND LONG RUN IMPACT OF MACROECONOMIC VARIABLES ON
PRIVATE INVESTMENT BEHAVIOR IN SAUDI ARABIA: A COINTEGRATION
ANALYSIS**

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ABSTRACT

This paper empirically investigates the short and long-run relationship between private investment, public investment, growth in output, credit available, interest rate, and budget deficit in Saudi Arabia during the period 1970-2015. The objective of the paper is to determine whether there is a stable long-run relationship. The study employs Johansen (1990) multivariate co integration approach for checking the existence of long-run integration among the variables along with Vector Error Correction Model (VECM) to examine the short-run dynamics. Further, Granger Causality test is carried out. The results indicate the presence of stable long-term relationships and show that private investment is positively influenced by growth in output (accelerator effect), public investment, and availability of credit. Interest rate and budget deficit are negatively related to private investment. The short-run dynamics results reveal that public investment crowds out private investment in the short run. Unidirectional Granger causality is reported from government investment and growth in output to private investment in two period lag. There is also unidirectional causality from interest rate to private investment.

Keywords: Private Investment, Public Investment, Cointegration, Causality, Saudi Arabia

INTRODUCTION

The issue of the interaction between public policy and private investment in developing countries has been studied in different dimensions in the past literature. There are different macroeconomic variables identified by various economists which affect private investment behavior. The variables are GDP, interest rate, public investment, inflation, credit available, exchange rate and budget deficit etc. In this context, the present study investigates the existence of stable long-run relationship between private investment and macroeconomic variables such as output, growth, interest rate, public investment, credit available and budget deficit. The long-run dynamic interaction between private investment and these variables is important to policy makers aiming to understand how public policy can stimulate private investment. Like many other countries in the world, Saudi Arabia is trying to maintain a high investment rate that is necessary to attain

sustainable high economic growth rate. In this regard, it established a package of direct and indirect incentives for stimulating private investors to increase their activities in the economy.

Saudi Economy is an oil based economy where oil revenue is the major source of income for government. The sharp decline in oil prices accompanied by geopolitical instability in the region have resulted in large cuts in the government expenditures that had been the primary source of liquidity creation and demand growth in the Saudi economy. As a result, budget deficits started to increase annually. Last year, the government has introduced the National Transformation Program (Vision 2030). It aims to diversify the economy and increases the private sector's role by emphasizing on privatization, public-private partnerships and improving business climate. Indeed, expanding the role of the private sector is necessary condition for diversifying the economy, creating jobs for nationals and reducing reliance on oil. Also, would help implement a gradual and sustained fiscal consolidation (IMF, 2016).

The contribution of the private sector to real GDP during the past five decades has varied, recording its highest level of 52 percent in 1985 and its lowest level of 13 percent in 1970. Despite the government support, the current rate of private sector growth is low, although increasing, in large part due to the decline in oil output. In 2015, the private sector contribution to real GDP reached 39.3 percent. The growth in the non-oil sector of the Saudi economy has been largely determined by responses to rising demand for non-traded goods and services, especially for the non-government services and construction sectors.

2. Study objective

The motive behind the study is that the current work on the impact on macroeconomic variables on private investment behavior in Saudi Arabia is very limited. Accordingly, this will extend the literature by producing empirical analysis on the relationship between of macroeconomic variables and private investment behavior. The objective of the study is three-fold: first to explore whether there is a stationary long-run relationship between private investment and public policy variables in Saudi Arabia, second to determine whether government investment complements or crowds out private, third to examine the size and the direction of the effect of aggregate demand on private investment behavior.

3. Source of the Data

The main source for the data on fixed capital formation is found in various issues of *National Accounts*, published by the Saudi Arabia Ministry of Economy and Planning; General Authority of Statistics. The source for other variables will be the Saudi Arabian Monetary Agency (SAMA) Annual Report.

4. Literature Review

Numerous studies have investigated the relationship between private investment and macroeconomic variables. One of the first papers that examined this linkage was done by Sundarajan and Thakur (1980). Using OLS the results showed that public investment exerts a negative influence on private investment. The study suggests substitutability between the public and private investment. Wai and Wong (1982) conducted a study on determinants of private investment in five developing countries (Mexico, Thailand, Malaysia, Greece and Korea). The results showed that government investment has a contributory effect where less financial crowding-out. Bank credit was important in Thailand, while capital inflow was the most important variable in Mexico. The paper concluded that government investment, the change in credit available to the private sector, and capital inflow to the private sector play important roles in determining private investment. Blejer and Khan (1984) examined the impact of government economic policy on private investment. Annual data from 24 developing countries made up the pooled base. The study found that the level of private investment activity was positively related to the change in expected real GDP, the availability of funds, and negatively to the cyclical factor. Chhibber and van Wijnbergen (1988) studied public policy and private investment in Turkey using a flexible accelerator model and annual data for 1970-1986. The paper suggested that government policies have a marked impact on private investor behavior. Government can crowd out the private sector if it accumulates a large budget deficit that it cannot finance from abroad. Exchange rate policies and other export promotion policies have a major impact on private investment. Shafik (1990) conducted a study on private investment behavior in Egypt using stationarity and cointegration techniques for testing the long-run equilibrium relationship for the period 1960-1986. The study found that change in GDP, mark-up, cost of factors, and government investment had a significant and positive effect on private investment behavior.

Gali (1998) used annual data from 1963-1993 to study the impact of public investment on private capital formation in Tunisia. He used Error Correction Model to investigate the long-run effects of public investment on private capital formation. The variables used are GDP, private investment, and government investment. He found that public investment had a negative impact on private investment in both the long run and the short run. The paper suggested that a shrinking of the public sector may stimulate private investment. Acosta and Loza (2005) estimated the long and short run determinants of private investment in Argentina for the period 1970-2005. The results indicated the existence of long-run relationship between capital accumulation and private investment. It also showed that investment decisions are influenced by changes in exchange rate, trade liberalization and aggregate demand. The study found evidence of crowding out effect between the public and private investment. Using the case of Pakistan, Saghir and Khan (2012) conducted study to identify the determinants of private investment in Pakistan using annual data from 1970-2010. The study found that government investment crowds out private investment in the long-run, while lagged change in government investment is

significant and positive in the short-run. Agu(2015), employed an Error Corrected Model to estimate determinants of private investment in Nigeria using annual data for the period from 1970-2012. He found that private investment slowed due to increased lending rate, reduced public expenditure, reduced saving, political instability and inadequate infrastructure.

A few studies are done on private investment behavior in the Saudi Arabia. Looney (1992) conducted a study to determine factors affecting private sector investment in the Saudi economy using annual data covering 1960-1988 and a modified version of the flexible accelerator. Private investment was seen as a function of non-oil GDP, oil revenues, available credit, government investment in infrastructure, and inflation. The study concluded that expected inflation, oil revenues, public investment and credit all exerted a positive and highly significant effect on private investment. Ghassn (2014) used annual data from 1968 to 2006 to test for the existence of long run equilibrium relationship between the real private and total public investment in Saudi Arabia using the weak exogeneity and ARDL cointegration tests. The variables used are investment by public enterprises, infrastructure investment, expected demand (real GDP), credit to private investment and real interest rate. The study found that public enterprises investment crowds out private investment in short and long run. However, since the establishment of the Saudi General Investment Authority (SAGIA) in 2000 the number of licenses for foreign companies working in Saudi Arabia have increased significantly and the Foreign Direct Investment (FDI) increased from US\$ 12.1 in 2005 to US\$28 billion in 2010.(SAGIA 2015). Therefore, it is expected that government investment complements private investment in the long-run.

5.The Model

Following Acost and Loza (2005) and Ghassan (2014), the behavior of private investment in Saudi Arabia can be explained by the following equation:

$$Pi = F (Gi + Y+ CR + DF+ R + Ut) \text{ with } \frac{\partial Pi}{\partial Gi} > 0 \text{ or } < 0, \frac{\partial Pi}{\partial Y} > 0, \frac{\partial Pi}{\partial CR} > 0, \frac{\partial Pi}{\partial R} < 0, \frac{\partial Pi}{\partial DF} < 0 \text{ or } > 0$$

Where

Pi = Private investment

Gi = government investment

Y= non-oil GDP

CR= credit available to the private sector

DF= Budget deficit

R= interest rate

Ut= Error term

Private investment is expected to be positively related to aggregate demand (economic activity), credit available to private sector and negatively related to the opportunity cost variable (interest rate). The relationship with government investment and budget deficit could be positive or negative. Taking the log of real private investment, real non- oil GDP, real government investment and real credit available we obtain the following:

$$\text{Ln (PI)} = \alpha_0 + \beta_1 \ln(Y) + \beta_2 \ln (\text{GI}) + \beta_3 \ln(\text{CR}) + \beta_4 (\text{DF}) + \beta_5 (\text{R}) + \mu_t \quad (1)$$

6. Empirical Findings and results

In order to empirically analyze the long run relationship and dynamic interaction among variables and to avoid the potential problem of estimating spurious relationships, it is necessary to test time series properties of the variables under investigation for unit roots. A popular unit root test is the Augmented Dickey–Fuller (ADF) test (Dickey and Fuller, 1981). The null hypothesis for ADF test is:

H₀: the variable has a unit root

The ADF test statistics are given in Table1. Results indicate that H₀ is rejected for all variables at I(1), and all variables contain unit root in I(0).

Table 1. Tests of time series stationary at first difference

Variables	Dickey- Fuller (level)	Dickey- Fuller (first difference)
LPI	1.9*	6.13**
LGI	2.3**	6.19**
LY	2.4**	3.5**
R	2.3**	4.8**
LCR	3.6**	3.6**
DF	2.5***	5.5**

*Note *, **, ***: statistically significant at the 10 percent, 5 percent and, 1 percent level*

7.Cointegration Technique

Cointegration is a technique used to test whether or not a long-run relationship exists between non-stationary economic variables. There are two methods for estimating the cointegration variable: the Engle and Granger’s cointegration test procedure and the Johansen maximum likelihood procedure. The first test approach is limited to bivariate analysis, while the other test is developed to test multivariate series. The latter is the most widely accepted procedure for cointegration analysis in the current literature. The Johansen maximum likelihood procedure is summarized in the following Error Correction form:

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \dots + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \gamma + \varepsilon_t \quad (2)$$

where ΔX_t represent the vector of observations on all variables in the system at time t, the Γ s are estimable parameters in the short run, γ is some constant vector, ε_t is a vector of white noise, and the Π matrix contains the cointegrating relationships. All variables must be non-stationary in levels. It is hypothesized that $\Pi = \alpha \beta$, where the cointegrating vectors are in the β matrix and the α matrix, describes the speed of adjustment for each variable change to return to their long-run equilibrium (Philips and Cutler, 1998). In this test we look for the number of cointegration vectors appear in the series. The presence of at least one cointegrating vector is sufficient for the existence of cointegration among the variables. The twin statistics of trace and maximum eigenvalue are used to determine the number of cointegration vectors. The Johansen cointegration statistics are reported in table (2).

Table 2. Results of Johansen estimation procedure

5 percent Critical Value of CE (s)	Trace Statistics	Eigenvalue	Hypothesized No.
118.01	171.101	0.83200	None*
88.8038	115.802	0.76848	At most 1
63.8761	70.4454	0.63466	At most 2
42.9152	39.2304	0.52611	At most 3
25.8721	16.0802	0.30710	At most 4
12.5179	4.70702	0.14087	At most 5

**denotes rejection of the hypothesis at the 0.05 level*

Trace and Max-eigenvalue tests indicate 3 cointegrating equations

Table 2 presents the summary of the results of cointegration analysis using the Johansen test. It is therefore evident that long run relationship exists among variables and moving together towards a stable long-run equilibrium. The normalized cointegrating regression vector is:

$$LPI = 8.24 + 1.05 LY + 0.60 LGI + 0.08 LCR - 0.42 R - 0.001 DF$$

t-ratio	7.5	5.1	3.3	5.3	4.3
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This means that economic growth, government investment and credit available have positive effect on private investment, while interest rate and budget deficit have negative effect.

8. Granger Causality

After proving the existence of long-run equilibrium among variables a Granger causality test can be conducted. As Engel and Granger (1987) pointed out, if two variables are cointegrated, then Granger-Causality must exist in at least one direction. The result in table 3 shows that growth in GDP is strongly granger causes private and government investment behavior in the Saudi economy, but not in reverse manner. It further implies unidirectional causality between government investment and private investment. These results are consistent with the theoretical argument as theory states that growth in aggregated demand stimulates investment and production. Moreover, public investment in infrastructure facilitates private sector activities (Ashauer,1989) There is also unidirectional causality from interest rate to private investment which implies that there is a reaction of private investment when interest rate changes.

Table3. Two lags causality test result

Causality direction	F-test	probability
LGI does not GC LPI	2.63	0.0908
LY does not GC LPI	8.406	0.0015
LY does not GC	5.45	0.010
R does not GCLPI	2.521	0.0901

9. Vector Error Correction Model Results

The Vector Error Correction Model (VECM) is a short dynamic model. The deviation from equilibrium in the short run can be captured through VECM. In general the following mathematical form generates a VECM:

$$\Delta Y_t = \theta_0 + \sum_{i=1}^p \alpha_i \Delta X_{t-i} + \sum_{i=1}^p \beta_i \Delta Y_{t-i} + \rho_1 \varepsilon_{t-1} + \mu_{1t} \quad (3)$$

The term $\rho_1 \varepsilon_{t-1}$ in equation (3) represent the correction term that captures deviation of the relationship among the variables from long-run equilibrium and short-run parameters. The regression result is presented in table 4it also presents the adjustment coefficients for the set of variables that determines private investment in Saudi Arabia.

Table 4: adjustment coefficients for the variables

	D(LPI)	D(LGI)	D(LY)	D(LCR)	D(R)	D(DF)
ε_{t-1}	-0.20	-0.323	-0.564*	-1.970	-10.126*	-9.606
D(LPI(-1))	1.561	1.997	6.483	-0.2034*	-0.2034	6.864
D(LPI(-2))	0.1294	0.2621	0.298*	1.3956	1.3956	3.710
D(LGI(-1))	-1.399*	-1.7500*	0.2621*	-5.354*	-5.354*	-5.553
D(LGI(-2))	-.1576	-0.2520	-0.1876	1.1649	-1.649	3.070
D(LCR(-1))	0.1490	0.1623	-0.0723	-0.7976	-0.7976	-7.374
D(LCR(-2))	0.2264	0.2099	-0.0790	0.10322	-0.8733	3.337
D(LY(-1))	2.2096	2.1213	-0.7049	-4.8832	-26.0677	-2.0775
D(LY(-2))	1.0167	0.6847	-0.3652*	-3.0134	-7.4199	-3.1487
D(DF(-1))	5.0012	6.0042	1.003	-7.0087	2.0043	0.2094
D(DF(-2))	1.0035	1.1004	1.1008	6.0070	1,4405	-0.1314

D(R(-1))	0.1125	0.1496	-0.0002	0.08369	0.4305	1.3568
D(R(-2))	0.0023	-0.0234	0.0239	0.0727	0.0026	1.7530
R-squared	0.72	0.66	0.83	0.69	0.67	0.42

9.1 Long-run elasticity

The long-run parameter for government investment was positive and significant with small coefficient 0.60. This estimate means that a 1% increase in government investment on average increases private investment by 0.60 %. We also found that the parameter coefficient on GDP was positive and significant with coefficient of 1.05. This estimate indicates that 1% increase in economic growth on average increases private investment by 1 %.The sign on credit available was positive with small coefficient. The signs on interest rate and budget deficit were negative and statistically significant.

9.2 Short-run elasticity

The short run analysis shows that the coefficient of the EC_{t-1} in table 4 was (-0.20) and revealed that approximately 20 % of last year’s discrepancy between private investment and its long-run equilibrium value was corrected by as much as 20%. The short-run coefficient of government investment was negative and bigger in magnitude relative to the long-run. Possible explanation is that government investment is crowding out private investment in the short-run on available resources in the economy. Economic growth (aggregate demand) was positive with large coefficient, but insignificant. Credit available was positive and insignificant. Interest rate and budget deficit were negative but insignificant. In general, the short-run elasticity are greater in magnitude relative to the long-run elasticity, which indicates that private sector tends to respond more to short term stimuli than long-run.

10. Conclusion and Recommendations

The objective of the paper is to investigate the impact of macroeconomic variables on private investment behavior in Saudi Arabia. The Johanson’s procedure of cointegrationis carried out to test the hypothesis of the existence of long-run relationship between variables such as GDP, government investment, private investment, credit available, interest rate, and budget deficit for the period 1970-2015. The result supports the long-run equilibrium relationship among variables. The study found that economic growth, government investment and credit available have positive effect on private investment, while interest rate and budget deficit have negative effect. Further, the short-run dynamics are captured by using Vector Error Correction Model. The results revealed that government investment crowds out private investment in the short run, which implies that an increase in government investment in the short-run competes with private

investment in the available resources in the economy. GDP growth was positively related to private investment. Interest rate was significant with the wrong sign. Moreover, credit available and budget deficit have insignificant effect on private investment in the short-run. Unidirectional causality was reported from GDP to both private and government investment. Further, unidirectional causality was found from public investment to private investment. There is also unidirectional causality from interest rate to private investment. It implies that there is a reaction of private investment decisions when interest rate changes but not in reverse. The main conclusion from this study is that economic growth plays a major role in enhancing both public and private investment. The policy implication that can be extracted from this study is the importance of implementing prudent macroeconomic policies that aim to diversify the economy and promote sustainable economic growth through increasing the role of the private sector. Our findings should be great interest to policy makers to resist any temptation to adopt large cuts in public investment to restore fiscal discipline. Giving private sector greater role in providing infrastructure projects through BOT scheme is needed to stimulate private capital formation and strengthen the role of private sector in the Saudi economy. Finally, additional work can be done using quarterly data to investigate the relationship.

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