EFFECT OF PUBLIC INVESTMENT ON PRIVATE INVESTMENT IN KENYA

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DECLARATION

I hereby declare this submission is my original work and has not been previously submitted for examination in another University.

Student

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APPROVAL

This research paper has been submitted for examination with my approval as the University supervisor.

Supervisor

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LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller
AIC	Akakie Information Criterion
ARDL	Auto Regressive Distributed Lag
CBK	Central Bank of Kenya
CRS	Constant returns to scale
DS	Domestic Savings
ECM	Error Correction Model
EXD	External Debt
GDP	Gross Domestic Product
IMF	International Monetary Fund
KANU	Kenya African National Union
LIR	Lending Interest Rate
MEC	Marginal Efficiency of Capital
MTP	Medium Term Plan
NARC	National Rainbow coalition
NPV	Net Present Value
PDC	Private Domestic Credit
PPP	Public Private Partnership -
SGR	Standard Gauge Railway

ABSTRACT

This paper aimed at determining wheatear public investment encourage or inhibits private investment in Kenya using annual data between 1980-2017. An ARDL technique was employed where private domestic credit, lending interest rate, domestic savings, external debt, GDP growth and domestic savings were used as control variables in the model. Stationarity was conducted using the ADF test. The only stationary variable at level was GDP growth rate with other variables becoming stationary after first differencing. Results from the causality test indicates that public and private investment do not Granger cause each other. From the short run dynamic ARDL model, the first period lag of public investment was positive and significant an indication of crowding in effect. But its effect was negative and insignificant in the long run model. Private domestic credit and external debt were significant in both the short run and long run while domestic savings was significant only in the short run. From the obtained results, the government should intensify its PPP initiative by including the risk-incentive and also involve the private sector in its infrastructure policy formulation and lastly the management of investment projects should be delegated to the private sector.

CHAPTER ONE

INTRODUCTION

1.1 Background

Investment is critical in explaining business cycle and long term economic growth. For developing nations, economic growth is positively affected by investment and this effect is significant. If the investment-output ratio rises by 1 percent, then the economy will grow by about 0.1 to 0.2 percent in developing nations. Investment has two components, public and private investment. Public investment influence growth indirectly whereas private investment directly influences growth (Khan and Reinhart, 1989).

It's estimated that if private investment to output ratio increases by 1 percent then the Kenyan economy will grow by about 0.8 percent (Institute of Economic Affairs, 2000). Therefore, private investment is a primary factor that stimulates growth in Kenya. Between 1996 and 2011 the private sector output increased by 68 percent in absolute terms whereas the public sector output had relatively remained constant over the same time period (African Development Bank, 2013). In terms of employment in Kenya, public sector employment accounts for 29.7 percent while the private sector accounts for 70.3 percent which is a slight decline from 2016 by 0.9 percent (Republic of Kenya, 2018).

This indicates that the two key macroeconomic variables, economic growth and employment, are greatly dependent on Private investment. Therefore, the general economic health of Kenya is highly dependent on the status of its private sector (African Development Bank, 2013). Since the overall economy is positively influenced by private investment (Khan and Reinhart, 1989), its therefore important to maintain a stable investment climate.

1.1.1 Overview of Private Investment in Kenya

This form of investment has experienced huge fluctuations over the past years in Kenya. Various factors, which are either political, social or economic in nature, can be attributed to these fluctuations. Figure 1:1 shows a clear path that private investment follows at different time periods.

Figure 1:1 Private investment trend in Kenya
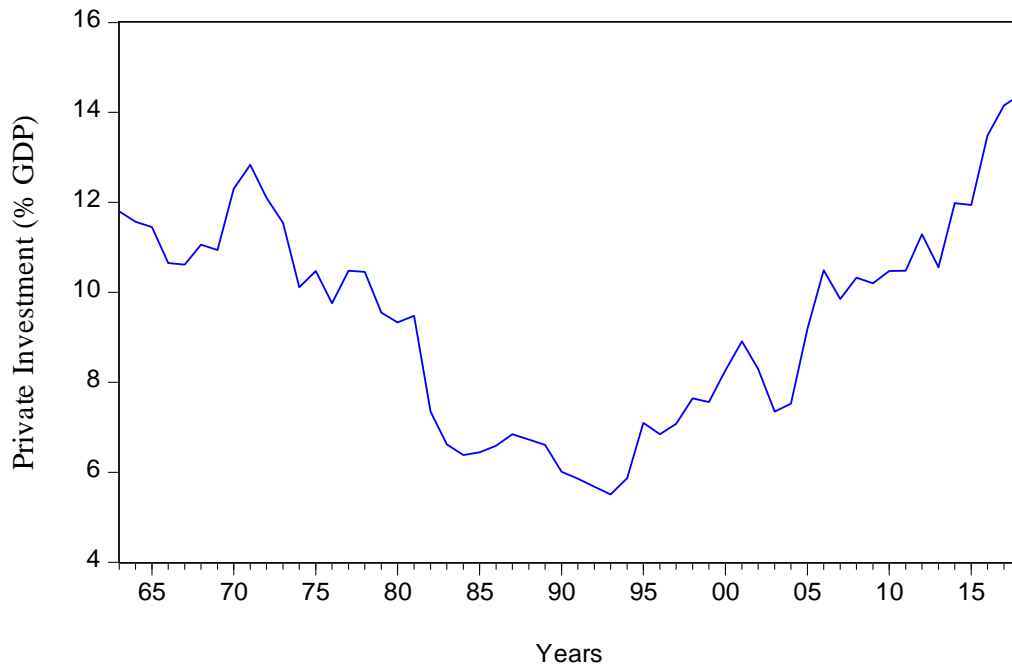
Source: Derived from the International Monetary Fund Data (2017)

After independence, the government developed the KANU Manifesto to drive development in Kenya. It adopted the import substitution strategy for industrialization which is capital intensive. This strategy mainly focused on the manufacturing sector that depends on private investment. The government was keen to provide incentives to the private sector investors through, protection of infant industries, offering investment allowance and adopting a progressive tax structure (Republic of Kenya, 1965). As a result, Kenya performed well through the 60's where the manufacturing sector expanded at a rate of 10 percent annually (O'Brien and Ryan, 1999). These policies ensured that private investment remained relatively high, on average at 11.5 percent, from 1963 to 1973.

In the early 70's, Kenya experienced a series of economic shocks. Beginning with the oil crisis in 1973, the breakdown of the common market for East African countries in 1977, the tea and coffee boom between the period 1976-78, and lastly was the oil price shock of 1979. This lead to macroeconomic instability, deteriorating terms of trade and an upsurge in balance of payment deficit. To counter this the government intensified its import substitution strategy which was already overdue thus reducing competition which made industries less efficient, coupled with high cost of production and all this acted as a disincentive for private sector investments (Chege *et al*,

2014). This explains the huge fluctuations experienced by the private investment in the 70s as shown in figure 1:1.

Following the crisis of the 1970's, in 1980 the World Bank and IMF introduced programs for economic adjustments as conditions for the uptake of their loans and grants. The two Bretton Woods institutions accused Kenya of frustrating the implementation process of this programs while Kenya claimed that the conditions were unfit in its social structure. This lead to the suspension of loans and grants to Kenya in late 80's and early 90's. Thus constraining the government to rely on domestic debt to finance its expenditure. This reduced the supply of loanable funds available to borrowers, thus negatively affecting private sector investment (Rono, 2002).

Since 2003, after the NARC government took over power, private investment has been on an upward trend. Between 2004-2006 it had a sharp increase as shown in figure 1, and this is attributed to the government committing itself to reduce the domestic debt from 4.2 percent of GDP in 2002-03 to 3.7 per cent by 2005-06 to ease pressure on interest rate and compensating this by external borrowing (Republic of Kenya, 2003). This impacted positively on the private sector's bank credit, which rose by 8.7 percent of GDP between 2001 and 2006 (Republic of Kenya, 2012) thus enabling the mobilization of resources by the private investors for investment.

From 2007 the private investment has been increasing gradually, but not on a smooth path, up to 2015. Between 2015 and 2016, the private sector domestic credit growth declined from 18 percent to 4.3 percent largely due to banks preference to purchase government bonds which negatively affects private investment (CBK, 2017). The government introduced interest rate capping in 2016 and it has affected the private sector growth negatively. However, if public investment is crowded out by public borrowing due to interest rate capping is yet to be determined explicitly (CBK, 2018).

1.1.2 Overview of Public Investment in Kenya

Public investment is an important component confined in government expenditure. Public investment is basically capital expenditure by the state necessary to finance both physical and soft infrastructure. The government usually use development expenditure as an adjustment variable more often as compared to the recurrent expenditure (OECD, 2012). Figure 2 below shows the public sector investment in different time periods since independence.

Figure 1:2 Public investment trend in Kenya
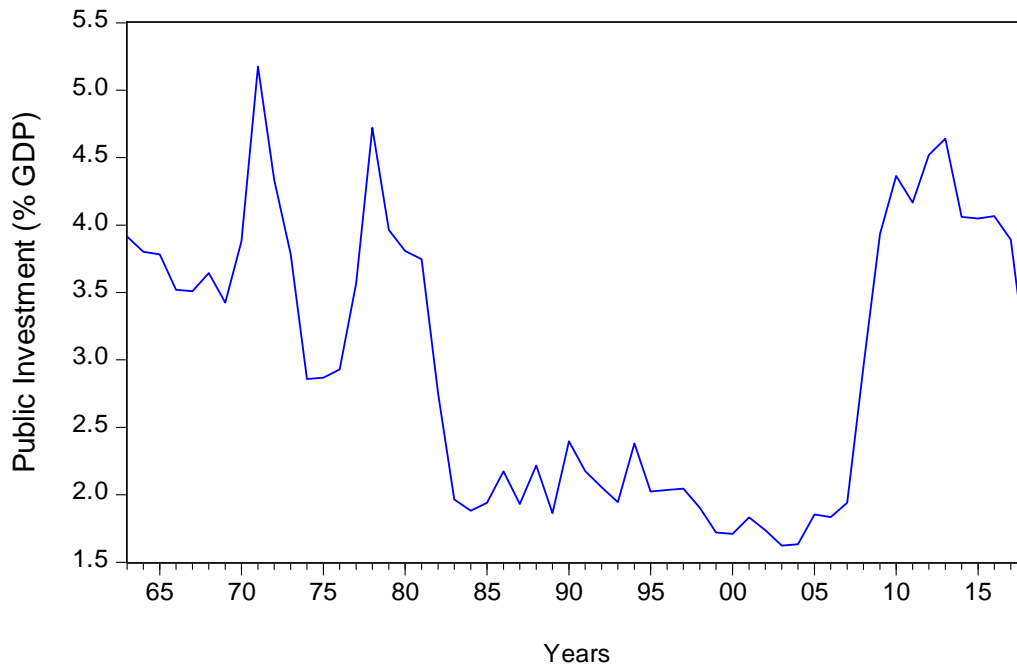
Source: Derived from the International Monetary Fund Data (2017)

The huge fluctuations of public investment experienced in the 70's and early 80's was due to multiple economic shocks experienced within the period. The coffee boom of 1976 caused fiscal indiscipline on the governments side as it increased its recurrent expenditure impacting negatively on the fiscal deficit that increased to 9.5 percent by the year 1977. After the coffee prices began to decline the current account deficit rose and the government reverted to concessional loans and grants from aid donors to finance the deficit. The debt service ratio also increased by 11.4 percent for the period 1977-1983. During this period, public recurrent expenditure was growing faster than even the economic growth (O'Brien and Ryan, 1999).

Between 1991 to 1994, the fiscal position remained difficult raising by about 6 percent within this period. In addition, there was high inflation of about 28 percent in 1992 due to political instability and the suspension of the donor's funds between 1991-93. To control this, the government raised the interest rate which left the government with huge domestic debt that rose from Ksh.40 billion to Ksh.160 billion in 1998 to finance government investment (O'Brien and Ryan, 1999). This period was marked with high domestic and external debt with poor infrastructure development. By the turn of the new millennium Kenya was characterized by dilapidated transport system, low

power connectivity, poor telecommunication and lack of technological advancement as public investment in infrastructure was not a priority (Republic of Kenya, 2003).

After 2002, the new political administration embarked on a structural change in the economy. In 2003, the administration formulated an economic recovery strategy for economic transformation in order to reduce unemployment and increase the national income. Heavy investment was channeled towards physical infrastructure development as a perquisite to support the private sector investment (Republic of Kenya, 2003). The capital expenditure within this period increase from 54 billion in 2003/04 to 142 billion in 2006/07. The total government investment on roads increased three-fold from 10.7 billion in 2002/03 to 36.7 billion in 2006/07 financial year (Republic of Kenya, 2007).

In 2008, the government drafted its long term plan of development under the name vision 2030 to enable growth sustainability capable of improving the country's standard of living. Government investment in infrastructure is expected to be a key factor of growth in the plan. Some of the key infrastructural projects to be given priority include; The LAPSSET project that will connect Kenya with South Sudan and Ethiopia for trade at a cost of 24.5 billion US dollars and the standard gauge railway with an initial cost of 3.2 billion US dollars (Republic of Kenya, 2014).

The second MTP, which covered the period between 2013-2017 experienced a slowdown in public investment but still there were some remarkable achievements in this epoch with respect to infrastructural investment. It saw a total of 1,304 km of new roads constructed, power generation capacity increased by 38%, the completion of some mega projects including; the standard gauge railway first face, the second container terminal at Kilindini Harbor and Terminal 1A at the Largest International Airport in Kenya (Republic of Kenya, 2017).

The third MTP 2018-2022 is underway aiming at structural changes in the manufacturing and exporting sector of the economy which have declined by 1.5 and 5.8 per cent respectively for the period 2011-2015. Investment in oil and mining sector will be prioritized as the key driver of growth over the five years' period. The government intends to increase the budget allocation in development expenditure to finance the key infrastructure projects planned for implementation. To facilitate the implementation, the government plans to attract private investment and also utilize the private-public partnership initiative (Republic of Kenya, 2017).

The proportion of investment in GDP decreased by about a percentage from 2017 to 2018. In the same period the development expenditure decreased by about 21.32 percent. The financing of investment in the net acquisition of non-financial assets by government also fell by about 14.22 percent (Republic of Kenya, 2019). This explains the decline in the public investment between 2017-2018.

1.2 Problem Statement

In the second MTP 2013-2017, the government expected growth rate was about 10 percent. However, the economy only managed to grow at about 5.5 percent on average between 2013 and 2017. One major reason for the non-attainment of the target was attributed to the high lending rate that averaged 16 per cent between 2013-2017. This was caused by the increase in demand of domestic government debt which negatively affected the private investment.

Currently the third MTP is being implemented and it will elapse in the year 2022 and still the projected growth rate is 10 percent (Republic of Kenya, 2017). For the second MTP it was projected that the private investment will increase to 22.9 percent of GDP by 2013 but its actual figure was 10.6 percent of GDP. Currently it is projected to reach 24 percent of GDP by 2020 in the third MTP (Republic of Kenya, 2012). To make this attainable, the government will mostly focus on increasing public investment in infrastructure, which is mainly financed through borrowing, and providing investment incentives to the private sector investors.

Therefore, understanding the private and public investment relationship is critical because public investment can either complement or substitute private investment. Compliments whenever there is a crowding in effect and substitutes whenever there is a crowding out effect. If investment is directed towards infrastructural development it will spur growth in the economy by improving the private investment efficiency (Sundararajan &Thakur, 1980).

If public investment is financed through borrowing, then the loanable funds accessible to the private investors will be constrained, therefore, slowing down private investment hence the crowding out effect (Mitra,2006). This was evident in Kenya in the 80s and 90s when the government depended on the domestic debt to finance its expenditure, in the process private investment was crowded out (Rono, 2002). Therefore, it is of much importance to understand the net effect through empirical evidence.

1.3 Research Questions

The overall research question is: Does public investment have any effect on Private investment in Kenya?

The specific research questions are:

1. Does public investment crowd in or crowd out private investment in Kenya?
2. Does bilateral causality exist between public and private investment in Kenya?

1.4 Research Objectives

The general objective of the study is to analyze if public investment affects private investment in Kenya.

The specific objectives are:

1. To investigate whether public investment crowds in or crowds out private investment in Kenya.
2. To determine the nature of causality between public and private investment in Kenya.
3. To recommend appropriate policies that address the issue on how public investment affects private investment in Kenya.

1.5 Justification of the study

The empirical results provide policy makers with relevant information that enables them to make objective decisions concerning the net effect of public investment on private investment. According to Khan and Reinhart (1989) private investment has a crowding in effect on economic growth. Therefore, this study has generated an empirical evidence that the policy makers can utilize to make objective decision for the purpose of improving the investment climate to attract private investors.

In addition, studies done on private investment and how it relates to public investment in Kenya are limited. Some studies have looked at the general factors that influence private investment (Mbaye, 2012; Mundia, 2014) and others on output growth and private investment (King'ang'i, 2003; Okisai, 2018). Hence this study is an addition to the existing literature and it helps in bridging the research gap that exist on the relationship between public and private investment.

1.6 Organization of the study

This segment has set the foundation of this study. Chapter two discusses the literature, both theories of investment and empirical analysis. Chapter three focuses on the research method to be employed including theoretical and empirical models. The fourth chapter conducts data analysis and results discussion. Summary, conclusion and recommendations are incorporated in chapter five.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents existing literature that is relevant to the study. First is the theoretical literature that reviews various theories of investment and the criterion for investment decision. Second is the empirical literature which focus on the previous studies that are relevant to this study.

2.1 Theoretical Literature

2.1.1 Criterion for investment decision

The theories of investment begin with the maximization assumption of a firm's present worth or the stream of net returns. But the accelerator model assumes this implicitly. We first discuss the rationale of the present value criterion employed by the three theories in the firm's maximization behaviour and then compare it to the marginal efficiency of capital criterion as was suggested by Keynes (1936) as an alternative approach.

a. Present value criterion for investment

The focus of a firm, is to maximize its net returns by drafting an investment plan that maximizes its net present value (NPV) of its income stream from combining all its investment projects-in a competitive market. Thus, for a firm to maximize its net returns, it should invest in projects with positive NPV. Therefore, the NPV is given by;

$$NPV_t = -C + NR_t + {NR_{t+1}}/{(1 + r)} + {NR_{t+2}}/{(1 + r)^2} + \cdots + {NR_{t+n}}/{(1 + r)^n} \qquad (1)$$

Where, C represents cost of the project, r is interest rate and $NR_t, \ldots, NR_{t+n}$ are the stream of net returns from time period t to $t + n$.

Under this criterion, firms rank their investment projects based on their net present value. The NPV of each investment project reduces when interest rate increase and rises when the expected returns of each period increases (Branson, 1989).

b. Marginal efficiency of capital (MEC)

MEC, denoted by m, was suggested by Keynes (1936) as a creation for ranking investment projects. m is the interest rate that will discount the NPV to zero. This is shown in equation (2),

$$NPV_t = -C + NR_t + {NR_{t+1}}/{(1+m)} + {NR_{t+2}}/{(1+m)^2} + \cdots + {NR_{t+n}}/{(1+m)^n} = 0 \quad (2)$$

Where, C represents the cost of project, $NR_t, \ldots, NR_{t+n}$ are the stream of net returns from the time period t to t + n. In equation (2) m has replaced r from equation (1) then the NPV is discounted to zero.

Equation (2) can be used to generate m given that C and NR are known and we have the interest rate that discount the NPV to zero. In this way, m can be used to rank investment projects. For a project to have high net returns, its NPV should be high. This requires a high m to enable the stream of net returns to be discounted to zero (Branson, 1989).

The Keynesian theory links investment to the MEC, also referred to as the demand price for capital. For the level of investment to be at equilibrium, the prices of demand and supply for marginal investment should be equal. The demand price of investment depends on capacity utilization. Therefore, investment plan is linked with demand projections relative to the capacity at current period (Fazzari and Mott, 1987).

2.1.2 Neoclassical investment theory

The foundation of this theory is based on the theory of optimal capital accumulation. It begins with the microeconomic concept of maximization, where its assumed that a firm's present worth is maximized subject to neoclassical production function and replacement investment constraints. The present worth of a firm is given as the integral of the difference between the future discount value of revenue and expenditure, less discounted direct taxes. The production function takes the Cobb Douglas form of two inputs of labour and capital with positive marginal productivity of inputs while the replacement investment is assumed to be proportionate to actual capital stock. Therefore, the actual stock of capital is derived from the replacement investment.

From the marginal productivity condition of the neoclassical production function we can derive the desired capital stock. Incorporating both the time factor and the marginal productivity condition, the desired capital stock is given as;

$$K^d = \delta \frac{\rho Y}{c} \tag{3}$$

Where, K^d is optimal stock of capital, δ is output elasticity, Y is output, ρ is price of output and C is capital rental price. To enable the actual capital stock to adjust to its optimal level, an initiation of new projects is essential at each time period until all investment projects are completed (Jorgenson, 1963).

To compute the formal neoclassical investment theory, we sum the theories of investment outlay for capital expansion with the replacement investment theory. The former includes projects that were initiated in the past time periods, while the latter relates to the previous gross investment, both presented in weighted average (Jorgenson and Stephenson, 1967).

2.1.3 General accelerator theory of investment

The origin of this model is associated with the early works of (Clark,1917). He relates investment to changes in output. This theory was later advanced by (Chenery, 1952) to include flexibility in the model. Unlike the neoclassical model which assumes that prices are flexible, the strict accelerator model assumes that prices are fixed. Therefore, at any given time period the association between optimal stock of capital and output is given by;

$$K^d = \varphi Y \qquad\qquad (4)$$

Where K^d represents optimal stock of capital, Y is output level and φ is a constant.

Firm normally aims at attaining the optimal level of capital through adjusting its current levels of capital. This adjustment can occur instantly only if there are no extra cost incurred in the process. The strict model assumes that the fluctuations in the current stock of capital, results from output variations. The variations in output leads to high volatile changes in net investment which enables an instantaneous process of adjustment from the present to the optimal level of capital stock (Clark *et al*,1979).

In reality this assumption by the strict accelerator model are unlikely to occur as net investment is less volatile than the strict model implies and the reaction of capital to changes in output is slow. Hence, the flexible accelerator model was introduced to factor in the time variation of capital stock by including the time lags (Chenery, 1952; Lucas, 1967). In this way, the variations of capital stock resulting from output changes is distributed over different time periods (Clark *et al*,1979).

2.1.4 Tobin's q investment theory

Tobin (1969) postulates that investment can be linked with the fluctuations experienced in the stocks market. For an investment project to be undertaken, the net benefits should be positive. In this way the shares of the company will appreciate and the shareholders will receive a higher return on their investments. If equity is issued to a project with an appreciated market value, its share price will increase. A company's investment rate can be related to q (Tobin and Brainard, 1977).

In general terms, the expression q is a ratio of two components; capital at market price and its replacement cost.

$$q = \frac{\text{Capital at market value}}{\text{Capital replacement cost}} \qquad (5)$$

q is usually presented as marginal q, measured as an additional capital per unit at market value relative to its replacement cost. This version of q is unobservable and its usually proxy by an observable average q. The average q incorporates existing capital at market value in place of additional capital. Under a perfect competitive market with a CRS production function, the marginal q and average q are equivalent (Hayashi, 1982).

All the future information that a firm requires to facilitate its investment decision making process, is summarized in q and the firm does not need to worry about the future expectations. If q is high, a firm increases its stock of capital, if q is low, the firm decreases it. At equilibrium the value of q is 1. When the value of q is less than 1 investment is discouraged and when its greater than 1 investment is encouraged (Tobin and Brainard, 1977). As long as there are stock adjustments, the actual and desired stocks will always be equal and real investment will be at equilibrium. If q is not equal to 1, then this can be linked to factors like taxation and presence of redundant capital. (Tobin and Brainard, 1990).

2.2 Empirical Literature

Hyder and Qayyum (2002) estimated a VECM for the period 1964 and 2001 in Pakistan to examine the crowding out hypothesis. The empirical model estimates relied on the neoclassical investment theory. The empirical results failed to support the crowding out hypothesis, indicating that public and private investment are compliments. They further established that public investment Granger cause private investment after conducting a Granger causality test.

Rashid and Ahmad (2005) using a multivariate co-integration technique, established that in Pakistan public and private investment are compliments. They employed a neoclassical theory of investment and their analysis covered the period 1964/65 to 2004/05. Contrary Majeed and Khan, (2008) found out that they are substitutes for each other in Pakistan. They utilized annual from 1970-2006 to estimate a modified accelerator model of investment. This implied substitutability between the two investments components.

Rath and Bal (2014) studied whether private investment can be influenced by Public investment and FDI in India from 1978/79 to 1991/92. They employed the structural vector autoregressive (SVAR), from which they found that, public investment has no effect while FDI has a negative effect. Therefore, public investment does neither compliment nor substitute private investment. On the contrary Mitra (2006) employed a similar SVAR model for India with an annual data taken for 35 years and found that public investment has a crowding out effect, but with a probability of crowding in over time.

Dash (2016) used the annual data from 1970-2013 to estimate an ARDL model to determine how public investment affects private investment in India. The author incorporated the structural break, where the results showed that they are substitutes in the short run and compliments in the long run. Real deposit rate, bank credit and investment price in relative terms have positive effect in the long run, while the effect of lending rate is negative.

Nguyen and Trinh (2018) employed the neoclassical investment theory in determining how public investment affected private investment between 1990-2016 in Vietnam. They used the ARDL model in their estimation from which they found a positive effect between public investment with two periods lag and private investment, but with a one period lag, the effect was negative. In the long run, the effect was similarly negative as was with the one period lag alongside with real interest rate and capital stock owned by the state with the impact of economic growth being positive.

Augustine (2014) analyzed private investment in Ghana and the factors that influence it using an annual data between 1970-2011. The author employed an ARDL model where the results indicated that the short term effect for interest and exchange rates were significant. Public investment, GDP, military regime, and inflation were insignificant determinants over the same period. Inflation and exchange rate effects were positive, while those of public investment, GDP, military regime and

real interest rate were negative. In the long term, GDP and exchange rate were the significant determinants. The effect of all variables in the long run was negative except for real output and exchange rate.

Ajide and Lawanson (2012) used annual data to examine the factors influencing investment in the private sector in Nigeria between 1970 and 2010. They employed an ARDL model where, in the long term, the variables terms of trade, rate of interest, exchange rate, output, external debt, private sector credit and reforms were significant factors in determining private investment. Terms of trade and real GDP were the significant in the short term. Public investment had a negative and significant effect in both time periods indicating a crowding out effect.

Makuyana and Odhiambo (2018) evaluated the linkage between economic growth, public and private investment in Zambia for the time period 1970-2014. The estimates from the ARDL methodology established that, private investment complements public investment but the effect of infrastructural investment was insignificant in the long run. On other variables, terms of trade and economic growth had a positive effect while inflation and domestic credit had a negative effect in the long term.

Mataya and Veeman (1996) estimated the flexible accelerator model using the two stage least square approach to determine the investment behaviour in Malawi. They established an existence of bilateral causality between public and private investment between 1967-1988 and they were treated as endogenous variables during estimation. Capital flow, domestic credit, lagged output, lagged money balance and dummy variables were used as instrumental variables for the model. The result of the estimated model showed the effects of public investment, monetary and fiscal policies and expected output to be positive, while that of interest rate was negative.

Moshi and Kilindo (1999) adopted a flexible accelerator model to estimate three equations for private investment in Tanzania between 1967 and 1996. The explanatory variables included in equation one were; import capacity, credit, GDP and public sector investment, all of which are significant. The public sector investment has a positive sign indicating a crowding in effect. In equation two public investment is disjointed into parastatal sector and central government investment variables where both are significant with the latter having a negative effect. For the third equation, investment in infrastructure was significant with a positive effect, while for non-infrastructure it was insignificant.

Mbaye (2012) estimated the private investment model for Kenya using an annual data from 1970 to 2010. The author employed a flexible accelerator model. The estimates from Engle-Granger test and ECM showed a crowding in effect between private investment and broad supply of money, exchange rate and real GDP growth rate. Political regime and private sector credit are negatively correlated to private investment with all variables being significant. The effect of public investment is positive but insignificant. Other variables including, real deposit rate, savings, foreign aid, lending rates, inflation, trade policy, foreign exchange reserves and public debt were also insignificant.

Blejer and Khan (1984) used a pooled annual data, cross section model for 24 developing nations in analyzing public policy and private investment between 1971 and 1979. They estimated the modified flexible accelerator model and the results indicated that, as public investment increase it affects private investment negatively but at level the effect is positive. Though insignificant, this shows that public investment at level has a crowding in effect, but its change has a crowding out effect, but they both become significant when the time period is separated between long and short run. Therefore, the level of public investment complements private investment whereas its change acts as a substitute.

Greene and Villanueva (1991) analyzed data for 23 developing nations for the period 1975-1988 in determining the factors affecting private investment. They used a pooled time series, cross-section approach, where they concluded that public investment, external debt, interest rate, inflation rate, economic growth rate are significant factors that influence private investment with public investment, output growth and per capita GDP having a positive effect.

Erden and Holcombe (2006) utilized a panel data for 19 developing nations between 1980 and 1997 to study the public-private investment linkage. The study employed a neoclassical investment model in its reduced form. Their findings indicated that public investment compliments private investment. On other factors; uncertainty and GDP were significant in the long term with real credit was significant in the short term.

2.3 Overview of the Literature

Previous studies have shown that the most preferred theory of investment by developing countries is the flexible accelerator model (Blejer and Khan, 1984; Mataya and Veeman, 1996; Mbeya, 2014). This is because the flexible accelerator model captures the institutional and structural

attributes of the developing nations (Blejer and Khan, 1984). The reduced form of neoclassical model of investment has also been employed for developing countries by (Rashid and Ahmad, 2005; Erden and Holcombe, 2006).

From empirical literature of previous studies done on developing nations, there is no convergence of results that can lead to a unanimous conclusion with regards on how public investment affect private investment in developing nations. First, one group of studies has shown a crowding out effect (Majeed and Khan, 2008; Ajide and Lawanson, 2012). Another group has shown a crowding in effect (Moshi and Kilindo, 1999; Hyder and Qayyum, 2002; Rashid and Ahmad, 2005), and there is also a group of studies that has established the effect to be insignificant implying that neither crowding in nor out effect exists (Mbaye, 2012; Augustine, 2014; Rath and Bal, 2014).

Other factors including, interest rate, real GDP, external debt, exchange rate, savings, private sector credit, inflation rate and uncertainty affects private investment but their effect on private investment vary between countries. This study will include the afore-mentioned variables as controlled variables in order to correctly specify the empirical model to be estimated.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter comprises of the theoretical model, empirical analysis, description of variables, data source and finally the estimation technique to be employed in analysis.

3.2 Theoretical Framework

The study employs the modified flexible accelerator model advanced by Blejer and Khan (1984). The modified model is preferred as it includes factors that are unique to developing countries. It assumes that in the long run, the optimal stock of capital is proportionate to the expected output as shown in equation (6);

$$K_t^* = \theta Y_t^e \tag{6}$$

Where K^* is the expected private sector capital that changes with the prevailing economic conditions, Y^e is expected output level, θ is a constant and t represents time period. The actual capital stock is adjusted to this desired level over time through the change of gross private investment (GPI).

Equation (7) show the function of GPI for adjustment mechanism;

$$\Delta GI_t = \beta(GI_t^* - GI_{t-1}) \tag{7}$$

Where Δ is change, GI represents Gross private investment (GPI), ΔGI is the change in GPI, GI^* represents the optimal level of GPI, GI_{t-1} is the previous period GPI, β is the adjustment coefficient and t represents time period. Coefficient β measures the private investment response to the gap between the optimal and actual investment levels. Its assumed that β is systematic with economic determinates of the optimal level of private investment. The factors include; availability of finance for private investment, output level and public investment. If public investment causes a crowding out effect, β will become smaller implying that the private investment response is slower. If it crowds in private investment, private investment response will be faster.

Different empirical studies have introduced more macroeconomic variables to the modified flexible accelerator model to fit for a specific developing country (Erden and Holcombe, 2005;

Majeed and Khan, 2008; Kaputo, 2011). From equation (7), the adjustment coefficient β can be presented in general as a linear function of various economic variables as shown in equation (8);

$$\beta_t = b_0 + \frac{1}{I_t + I_{t-1}} \left(\sum b_i X_{ti} \right) \tag{8}$$

Where, β is coefficient of adjustment, b_0 is a constant parameter, $b_i's$ are coefficients for various economic factors, I and I_{t-1} are current and previous period investment respectively and X_i is a set of economic variables.

3.3 Empirical Model Specification

Following the modified flexible accelerator model and empirical evidence from literature for developing countries, the economic model for private investment is given as;

$$IPRV = f\left(IPRV_{(-1)}, IPUB, PDC, GGDP, LIR, DS, EXD \right) \tag{9}$$

Where;

IPRV = Private investment

$IPRV_{(-1)}$ = Lagged private investment

IPUB = Public investment

PDC = Private Domestic credit

GGDP = Growth rate of Gross domestic product

LIR = Lending interest rate

DS = Domestic savings

EXD = External debt

For the economic model to be estimated it is transformed into an econometric model, which is a multiple linear regression model as shown in equation (10);

$$\ln IPRV_t = \beta_0 + \beta_1 \ln IPRV_{t-1} + \beta_2 \ln IPUB_t + \beta_3 \ln PDC_t + \beta_4 \ln GGDP_t + \beta_5 \ln LIR_t + \beta_6 \ln DS_t + \beta_7 \ln EXD_t + \mu_t \tag{10}$$

Where β's are parameters to be estimated, µ represents the residual term and its independently and identically distributed, subscript t is time period.

3.4 Variables definition and the expected signs

The dependent variable under study is private investment and its proxy by fixed capital formation. Its measured as a ratio of GDP in real terms.

Public investment is defined as the expenditure by government on capital goods necessary for its development projects (OECD, 2012). This is the explanatory variable of interest and its proxy by public sector's gross fixed capital formation. When its channeled towards infrastructure development, it has an impact of improving the productivity of private investment. The expected sign in this case is positive. It causes a crowding out effect if its financed through domestic borrowing hence, its expected sign is negative. The private investment net effect is dependent on which of the two effects has a greater magnitude. Therefore, to predetermine its expected sign prior to estimation is not easy.

Other dependent variables are introduced into the model as controlled variables which are equally important as this will ensure that the model specified is correct. The variables description with their expected sign are discussed below;

Credit availability to the private sector ensures that there are no financial constraints to investment project. Financial institutions mobilize savings from which they generate the loanable found for private investors. Therefore, this variable will be proxy by the private domestic credit and its expected coefficient sign is positive.

Real GDP is the total amount of commodities produced within the border of an economy in a specified time frame, usually one year. A positive growth of real GDP causes a rise in aggregate demand for commodities which rises the profit expectations of firms. This will incentivize the private sector investors to increase their level of production. Hence, the GDP growth rate expected sign is positive.

Lending interest rate is the capital cost for investment. Its measured as nominal interest rate less inflation. Its expected sigh is negative. This is because, when interest rate is high it discourages borrowing and when its low it encourages borrowing for investment.

Domestic savings are used for financing investment which positively affects economic growth. Therefore, the effect of domestic savings is expected to be positive and the more people save in a country the more investment will be made. It's calculated as a percentage of GDP and its expected sign is positive.

External debt is amount due to foreigners and it can be repaid in monetary or non-monetary terms. Its presented as a ratio to gross national income (GNI). When the debt repayment is high, the expected sign of external debt on private investment is negative.

Table 3:1 Variables definition and their expected signs

Variable	Notation	Measurement	Expected sign and literature source
Private Investment	IPRV	Measured in terms of fixed domestic assets by public sector to GDP ratio.	
Public Investment	IPUB	Measured in terms of fixed domestic assets by private sector to GDP ratio.	+ve (Hyder and Qayyum, 2002)
Gross domestic product growth	GGDP	Annual percentage growth rate of GDP at market price.	+ve (Nguyen and Trinh, 2018)
Lending interest rate	LIR	It's the Bank rate measured in percentage.	-ve (Dash, 2016)
Private domestic credit	PDC	Calculated as a ratio of GDP	+ve (Moshi and Kilindo, 1999)
Domestic Savings	DS	Computed as a ratio of GDP less total consumption	+ve (Mbaye, 2014)
External debt	ED	Calculated as a ratio of the GNI.	-ve (Ajide and Lawanson, 2012)

3.5 Estimation Technique and procedure

Stationarity is usually assumed in the empirical analysis of time series data. Whenever the variables used for regression are non-stationary, the results obtained will be spurious. Spurious results have a very high value of R^2 and the coefficients obtained are significant even in the absence of correlation between the response variable and its regressors. Therefore, it is advisable to first carry out a stationarity test for a time series variable before estimation (Gujarati, 2004).

3.5.1 Unit root test

It's used to determine the nature of stationarity for time series data. The method that is mostly used for this test is the Augmented Dickey-Fuller (ADF) test (Gujarati, 2004). This technique is useful when correlation exists between error terms from different time period. It ensures validity of the unit root test by introducing a lagged value of the response variable. This ensures that the error terms are serially uncorrelated. The null hypothesis to be tested using the ADF test is; unit root exists in the annual data (nonstationary).

3.5.2 Cointegration test

This test is used to determine the existence of a long run equilibrium among economic variables. If non-stationary series are used in regression analysis where one series is regressed against the another, they will result into a spurious regression. Although the series can be individually non-stationary, they can be paired in such a way that they become stationary, that is, through linear combination. This will act to ensure that meaningful results are produced (Gujerati, 2004).

3.5.3 ARDL approach

Over the years, various techniques have been applied in testing for co-integration in time series analysis. Engle and Granger (1987) where the first to formulate the co-integration test procedure. Later on, other procedures were developed including the Johansen and Juselius (1990) which has been the model of choice for most researcher when the order of integration for variables used is one I(1). Recently, Pesaran et al. (2001) developed the bound cointegration approach and it has gained popularity among researchers due to its advantages over the other methods.

One merit of the ARDL technique is that it permits the inclusion of variables with different integration order in the model unlike the other methods that requires the regressors to have the same order of integration. Secondly, when a single long run equilibrium among economic variables exists and the sample size is small, this technique becomes more efficient compared to others.

Similarly, the problem of endogeneity is accounted for since its residuals are not correlated, thus is, it assumes all variables are endogenous. Additionally, each variable contains different number of optimal lags which is not permitted in other models and lastly the parameters of the dynamic and long run models are simultaneously estimated (Nkoro and Uko, 2016).

Equation (10) can be presented in the general conditional ARDL form as follows;

$$\Delta lnIPRV_t = \alpha_0 + \sum_{n=1}^{p} \alpha_{1n} \Delta lnIPRV_{t-n} + \sum_{n=1}^{p} \alpha_{2n} \Delta lnIPUB_{t-n} + \sum_{n=1}^{p} \alpha_{3n} \Delta lnGGDP_{t-n}$$

$$+ \sum_{n=1}^{p} \alpha_{4n} \Delta lnLIR_{t-n} + \sum_{n=1}^{p} \alpha_{5n} \Delta lnPDC_{t-n} + \sum_{n=1}^{p} \alpha_{6n} \Delta lnDS_{t-n}$$

$$+ \sum_{n=1}^{p} \alpha_{7n} \Delta lnED_{t-n} + \phi_1 lnIPRV_{t-1} + \phi_2 lnIPUB_{t-1} + \phi_3 lnGGDP_{t-1}$$

$$+ \phi_4 lnLIR_{t-1} \phi_5 lnPDC_{t-1} + \phi_6 lnDS_{t-1} + \phi_7 lnED_{t-1} + \mu_t (11)$$

Where, Δ = first difference operator, p = maximum lag order, α_0 = drift component, α_{jn} are the coefficients of the dynamic model, ϕ_j are the coefficients of the long run model, μ_t is the error term.

To establish the existence of an equilibrium between the variables under study, the bound test based on F-statistics is conducted. Under the F-Statistics, the null (H_0) and alternative (H_1) hypotheses are defined by:

$H_0: \phi_j = 0$ for; $j = 1,2,...,7$ (No Cointegration)

$H_1: \phi_j \neq 0$ for; $j = 1,2,...,7$ (Cointegration)

The number of regressors introduced in the model will determine the F-statistics critical values for the upper and lower bound and are presented in Pesaran et al. (2001). The former assumes all variables are $I(1)$ while the latter assumes all variables are $I(0)$. If the lower bound value is greater than the F-calculated, H_0 cannot be rejected and if upper bound value is lower than the F-calculate, H_0 is rejected. If the F-calculated lies between the two bounds, then the inference from the result is inconclusive.

3.5.4 Granger Causality test

This test is used in analyzing the nature of causality between two variables. Considering that causality test is not incorporated in the cointegration test, it then becomes important to conduct this test. The number of lags that are included in the model to be tested for causality, mostly influences the outcome of the estimated equation.

The following steps are followed when conducting the causality test. First is obtaining the restricted residual sum of squares by regressing the current private investment on the lagged private investment without the lagged public investment. Next we obtain the unrestricted residuals sum of squares by including the lagged public investment in the model. From this information obtained, the F calculated can be derived after which the null hypothesis(H_0) of non-causality can be tested. If the value of F critical value is less than F-calculated then H_0 is rejected otherwise we do not reject the H_0 (Gujerati, 2004).

3.6 Diagnostics test

Diagnostic test was done to ensure that the assumptions made by the ARDL approach are intact. This was to ensure a correctly specified model that is consistent and the estimates are unbiased estimators of the population parameters. The diagnostic tests included: Jarque-Bera test, Breusch-Pagan-Godfrey test, the Breusch-Godfrey test, Ramsey RESET test and lastly the cumulative sum of squares (CUSUMSQ) test derived from the cumulative sum (CUSUM). This was to test for, normality, heteroscedasticity, autocorrelation, model specification and model stability respectively.

3.7 Data sources

The annual data chosen for econometric analysis was between 1980-2017. The data was obtained from secondary sources. Data on public and private investment was acquired from the IMF database on investment and capital stock and various economic surveys. Data on GDP growth rate, lending interest rate, private domestic credit, domestic savings and external debt was sourced from World Bank database.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction

This chapter analyzes and discuss the results obtained from the collected data. They include the following: Unit root tests, Granger causality test, ARDL model estimates and the diagnostic and stability test results.

4.1 Stationarity test

In the ARDL model, the stationarity test is not a necessary condition but it's important for it to be conducted for conformation purpose. That is, the order of integration should not be above I(1). To test weather each variable is stationary at level or through differencing, we make use of the ADF unit root test.

Table 4:1 ADF unit root test results

	Level		1st Difference		I(d)
Variable	**Lag**	**ADF-Statistic**	**Lag**	**ADF-Statistic**	
Private Investment	0	0.040621 (0.9561)	0	-4.863488*** (0.0003)	I(1)
Public Investment	0	-1.238293 (0.6474)	0	-4.873605 (0.0003)***	I(1)
Lending Interest Rate	0	-1.792581 (0.3783)	0	-5.038510 (0.0002)***	I(1)
GDP growth rate	0	-5.478916 (0.0001)***	-	-	I(0)
Domestic credit to Private sector	2	-0.208513 (0.9282)	1	-5.90352 (0.0000)***	I(1)
Domestic Savings	0	-1.191394 (0.6679)	0	-5.746403 (0.0000)***	I(1)

External Debt	2	-1.380046 (0.5807)	0	-4.812101 (0.0004)***	I(1)

Note: I(d) represents order of integration   *** represents 1% significance level

      p-values are in parenthesis   Source: Author's analysis, EViews9

Table 4:1 shows that at level, only GDP growth rate is stationary. The remaining variables become stationary after first differencing as they were insignificant at 1%, 5% and 10% significant levels whereas GDP growth rate was significant at 1%. Since no variable is integrated of order 2, they are all eligible to be included in the ARDL model.

4.2 Causality test

Table 4:2 results suggests that neither private investment nor public investment granger cause the other. This is shown by their respective insignificant probability values at 5 percent significance, hence the null hypothesis (H_0) of non-causality cannot be rejected.

Table 4:2 Granger test for causality Results

H_0:	Obs	F-Statistic	Prob.
D(LNIPUB) cannot Granger Cause D(LNIPRV)	35	2.00966	0.1517
D(LNIPRV) cannot Granger Cause D(LNIPUB)		0.24500	0.7843

Source: Author's analysis, EViews9

4.3 Bound test

The optimal lag length selection was based on AIC because it provided the smallest value compared to the other information criterions. From the bound test results, the F-statistic obtained is 6.89 which is higher than the 1% significance level for both critical value bounds of 3.15 and 4.43. Hence, the F-statistic falls in the rejection rejoin implying that cointegration is present.

Table 4:3 Bound Test Results

Test Statistic	Value	p
F-statistic	6.889148	6
Critical Value Bounds		
Significance	I(0)	I(1)
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

Note: p = number of regressors   Source: Author's analysis, EViews9

After establishing the existence of cointegration between variables, the parameters of ARDL model was estimated.

4.4 Long run model

Results from table 4:4 are long run estimates, including the coefficients of variable of interest, public investment, and the controlled variables.

Table 4:4 Long run ARDL estimates

ARDL (1,2,2,0,0,1,0) Selected based on AIC				
Response variable: LNIPRV				
Variable	Coefficient	Standard Error	T-Ratio	P-Value
Constant	-3.902583	2.146916	-1.817762	0.0827*
LNIPUB	-0.255348	0.191417	-1.333992	0.1959
LNPDC	2.009527	0.600448	3.346714	0.0029***
LNGGDP	0.012576	0.023883	0.526582	0.6038
LNLIR	-0.036191	0.097770	-0.370168	0.7148
LNDS	0.324714	0.149941	2.165607	0.0415**
LNED	-0.206332	0.083386	-2.474419	0.0215**

Note: * (**) *** represent 10%, 5% and 1% level of significance respectively

Source: Author's analysis, EViews9

The effect of public investment is negative and insignificant. Though insignificant, it's an indication of a crowding out effect. Therefore, government investment can displace private investment overtime as they compete for the same financial and physical resources. For instance, the SGR project, even though it has some positive impact on private investors over its contraction period, it also has an effect of replacing the existing private business mostly in the transport sector. Due to its efficiency and cost effectives it has become the preferred means of transport by passengers and cargo owners hence diminishing private transportation businesses leading to loss of income to the owners. Additionally, the towns and market centers dependent on this mode of transport are in danger of collapsing over time. Secondly when the government borrows from the domestic market, the rate of interest will increase and the loanable funds available for private investors will reduce (Rono, 2002) leading to a crowding out effect overtime. Consistent findings were found by Mbaye (2014) for Kenya and Augustine (2014) for Ghana.

The effect of private domestic credit is positive and significant at 5 percent. A percentage increase in private domestic credit will cause private investment to increase by 2 percent, all other factors being constant. This implies that domestic savings are usually channeled to productive investment. This results confirms the findings by Kaputo (2011) for Zambia and Ajide and Lawanson (2012) for Nigeria. This indicates that the availability of credit is critical in boosting private sector investment. Makuyana and Odhiambo (2018) found a contradicting result for Zambia.

The coefficient of GDP growth rate is positive but insignificant. though insignificant the positive sign indicates that as income increase, consumption also increases and this will impact the production of commodities positively. For production to increase it requires an additional capital stock if the existing stock is depleted. Similar result of a positive coefficient was obtained by Makuyana and Odhiambo (2018) but in their case it was significant.

The lending interest rate has a negative sign indicating a crowds out effect. This implies that, when the lending interest rate is high the private investors are discouraged from borrowing and when the lending rate are low they are encouraged to borrow for investment. Though its coefficient is insignificant. Dash (2016) found similar results but significant for India. On the contrary Ajide and Lawanson (2012) found it to be positive for Nigeria.

The effect of domestic savings variable is significant at 5 percent with a positive coefficient. This shows that, if domestic savings increase, more investment will be made in the private sector. Comparable findings were also obtained by Mbaye (2012) for Kenya. The results from table 4:4 show that, holding other factors constant, when domestic saving change by a percentage, the private investment will rise by 0.33 percent. This indicates that when the savings rate is high, more private investments will be made.

Lastly, external debt negatively affects private investment and when it increases by 1 percent, private investment decline by 0.21 percent, other factors being equal. Therefore, it's important for the government to limits its level of borrowing from external sources. Equivalent results were arrived at by Ajide and Lawanson (2012) for Nigeria.

4.5 Short run model

Table 4:5 presents the outcome of the estimated coefficients for the dynamic ARDL model and the ECM equation.

Table 4:5 The Dynamic ARDL model estimates

ARDL (1,2,2,0,0,1,0) Selection based on AIC				
Response variable: LNIPRV				
Variable	Coefficient	Standard Error	T-Ratio	P-Value
D(LNIPUB)	0.011940	0.086287	0.138378	0.8912
D(LNIPUB(-1))	0.182586	0.078751	2.318512	0.0301**
D(LNPDC)	0.392767	0.169124	2.322357	0.0299**
D(LNPDC(-1))	-0.246776	0.159696	-1.545288	0.1365
D(LNGGDP)	0.006983	0.012552	0.556349	0.5836
D(LNLIR)	-0.020096	0.057190	-0.351393	0.7286
D(LNDS)	0.054754	0.059028	0.927597	0.3637
D(LNED)	-0.114572	0.053491	-2.141892	0.0435**
ECM(-1)	-0.555282	0.172202	-3.224590	0.0039***
$ECM = LNIPRV + 0.2553 * LNIPUB - 2.0095 * LNPDC - 0.0126 * LNGGDP + 0.0362$ $* LNLIR + 0.3247 * LNDS + 0.2063 * LNED + 3.9026$				
R^2	0.736875		Mean dependent variable	0.012348

Adjusted R^2	0.593352	S.D. dependent variable	0.090021
S.E. of regression	0.057405	AIC	-2.598808
S. Sq. residuals	0.072498	Schwarz criterion	-2.021107
Log likelihood	58.47914	Hannan-Quinn criterion.	-2.399386
F-statistic	5.134197	DW statistics	2.304132
Prob(F-statistic)	0.000463		

Note: *** (**) denote 1% and 5% significant level respectively

From the short run estimates, public investment has a positive sign but it contradicts the long run effect of a negative effect and its only significant at its one period of lag. This implies that, next year private investment will be positively affected by the current period public investment. This indicates a crowding in effect in the short and medium term, thus public investment compliments private investment. This can be attributed to the public private partnership especially in mega government projects. The government contracts the private investors to undertake the mega projects which are resource intensive. As in the case of SGR phase one, private investors were contracted to supply construction materials and do the civil works of which 40 per cent was locally sourced. In this way, private investors were able to receive returns of their investment for the entire period of construction which was about four years. Most of these mega projects are usually short and medium term and this is the reason for positive and significant sign of public investment in its one period lag. Nguyen and Trinh (2018) and Augustine (2014) also found the same results but on the contrary Blejer and Khan (1984) found that public investment acts as a substitute in the short run and a compliment in the long run.

Domestic credit has a positive coefficient and its effect is significant at 5 percent level. Private investment will increase by 0.4 percent if the domestic credit changes by 1 percent, other factors being constant. Makuyana and Odhiambo (2018) found similar positive results in the short run. Though its lag of one period has a negative coefficient but its insignificant.

The coefficient sign for domestic savings is similar to that of its long run but it's not significant. The effect of GDP growth rate, just as in its long run, is positive and insignificant. Similar results were obtained by Dash (2016) and Makuyana and Odhiambo (2018) for Zambia.

External debt has a negative effect on private investment and its significant at 5 percent level. Private investment will reduce by 0.11 percent if external debt increases by 1 percent, other factors remaining constant. Ajide and Lawanson (2012) also found similar results of negative effect but insignificant.

The ECM$_{-1}$ term is the adjustment coefficient that determines the adjustment speed to equilibrium for the dynamic model. Its coefficient is negative (-0.56) as expected, indicating a convergence to equilibrium and its significant at 1 percent. This is a confirmation that the system is cointegrated as was implied by the bound test. Therefore, about 56% of disequilibrium in previous years, as a result of shocks, is being corrected in the current period.

The diagnostics statistics in table 4:5 supports the chosen model specification. The R squared is used to determine the estimated model goodness of fit. R squared shows that about 74 percent of variations in private investment is explained within the model. The F-statistic value is significant at 1 percent an indication that the independent variables are jointly significant. The Durban-Watson statistics is 2.3 and its closer to 2 an indication of no autocorrelation in the estimated ARDL model.
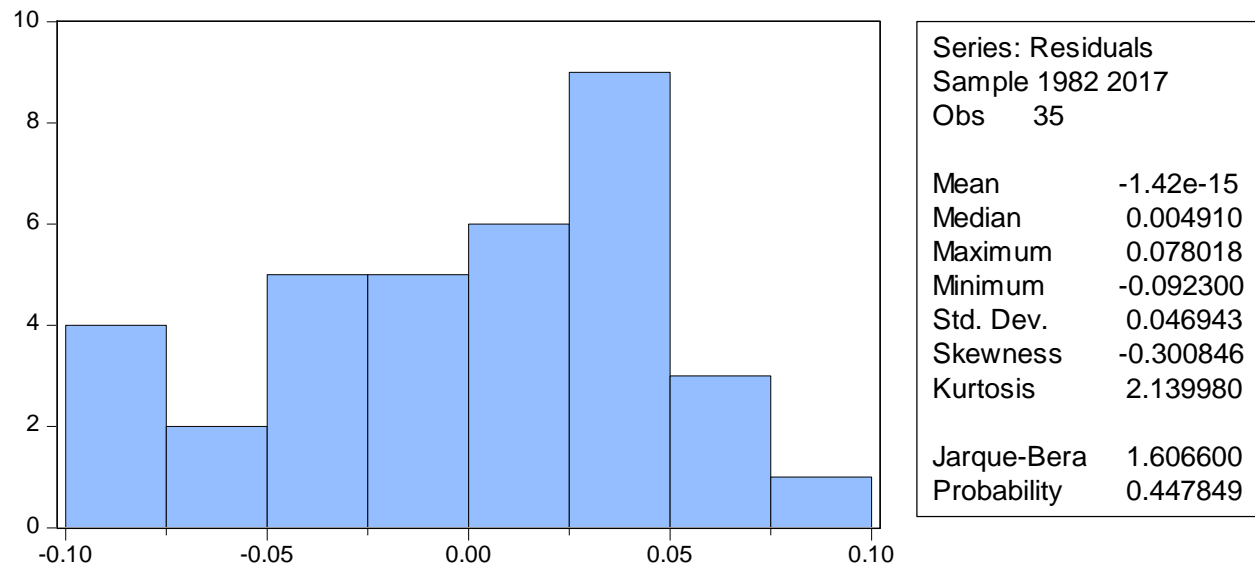
4.6 Diagnostic tests

To ensure that the estimated model is consistent, prior assumptions made by the estimated model must hold. Therefore, its impotent to conduct the diagnostics test to ensure that there is no violation on any prior assumptions made.

4.6.1 Normality test

To check if the estimated model error terms have a normal distribution or not, the Jarque-Bera test is conducted to test the null hypothesis of normality. Its statistics value obtained from figure 4.1 is 1.607 with an insignificant p-value of 0.448 at 0.05 chosen significance level. Therefore, we cannot reject the null hypothesis, implying that the residuals are distributed normally and the normality assumption is not violated.

Figure 4:1 Histogram-Normality Test

Series: Residuals	
Sample 1982 2017	
Obs	35
Mean	-1.42e-15
Median	0.004910
Maximum	0.078018
Minimum	-0.092300
Std. Dev.	0.046943
Skewness	-0.300846
Kurtosis	2.139980
Jarque-Bera	1.606600
Probability	0.447849

4.6.2 Serial correlation test

This is a test of whether the residuals are serially correlated. The Breush-Gogfrey a langrange multiplier test is used for testing for the presence or absence of serial correlation. If the calculated p-value is greater that the chosen significance level, serial correlation is absent. The p-value from table 4:6 is 0.3368 and its greater than the chosen 0.05 significance level an indication of no serial correlation.

Table 4:6 Langrange Multiplier Test Results

F-statistic	0.663144	Prob. F(2,20)	0.5262
Obs*R-squared	2.176659	Prob. Chi-Square(2)	0.3368

Source: Author's analysis, EViews9

4.6.3 Heteroskedasticity test

This is used to check whether the variance of the residuals is constant. The rejection criterion of H_0: homoskedasticity is; if the p-value is less than the chosen significance level its rejected. Table 4:7 reports a 0.4206 p-value which is not less than 0.05 significance level. Hence, the assumption of homoskedasticity is not violated, an indication of constant variance in the residuals.

Table 4:7 Breusch-Pagan-Godfrey Test Results

F-statistic	0.995453	Prob. F(12,22)	0.4835
Obs*R-squared	12.31654	Prob. Chi-Square(12)	0.4206
Scaled explained SS	2.773736	Prob. Chi-Square(12)	0.9969

Source: Author's analysis, EViews9

4.7 Model specification and stability test

4.7.1 Ramsey RESET test

The null hypothesis for this test is: the model has not omitted any important variables; thus the model is well specified. If some important variables are omitted, then the test statistic will be significant. The F-statistic value from table 4:8 is 1.8218 with a p-value of 0.1915 when number fitted is one. This is greater than 0.05 significant level (insignificant) an indication of no specification error.

Table 4:8 Ramsey RESET Test Results

	Value	df	Probability
t-statistic	1.349749	21	0.1915
F-statistic	1.821823	(1, 21)	0.1915

Source: Author's analysis, EViews9

4.7.2 Recursive residual test

The recursive residual test is undertaken to determine the structural stability by plotting the CUSAM and CUSUMQ statistics. The null hypothesis states: all the estimated parameters are stable. Figure 4.2 and 4.3 represents the plots of CUSAM and CUSUMQ statistics at 5 percent significant level. The twosome straight lines represent the boundaries of the 5 percent significance. Since the plotted CUSUM and CUSUMQ statistics fall between these boundaries thus the null hypothesis is within the acceptance region. Therefore, its concluded that the model is stable over time.
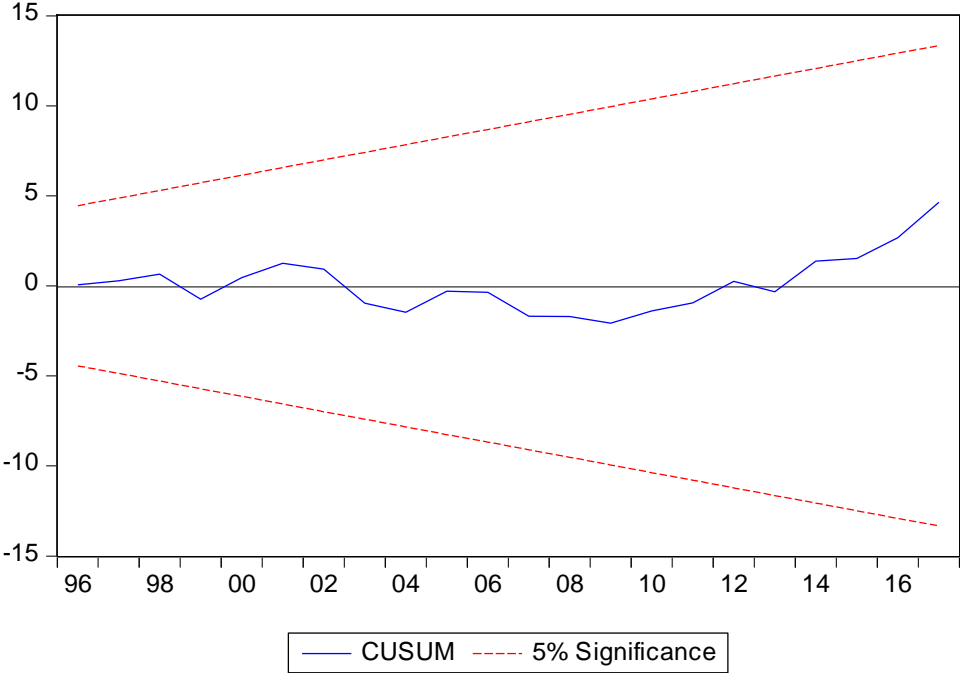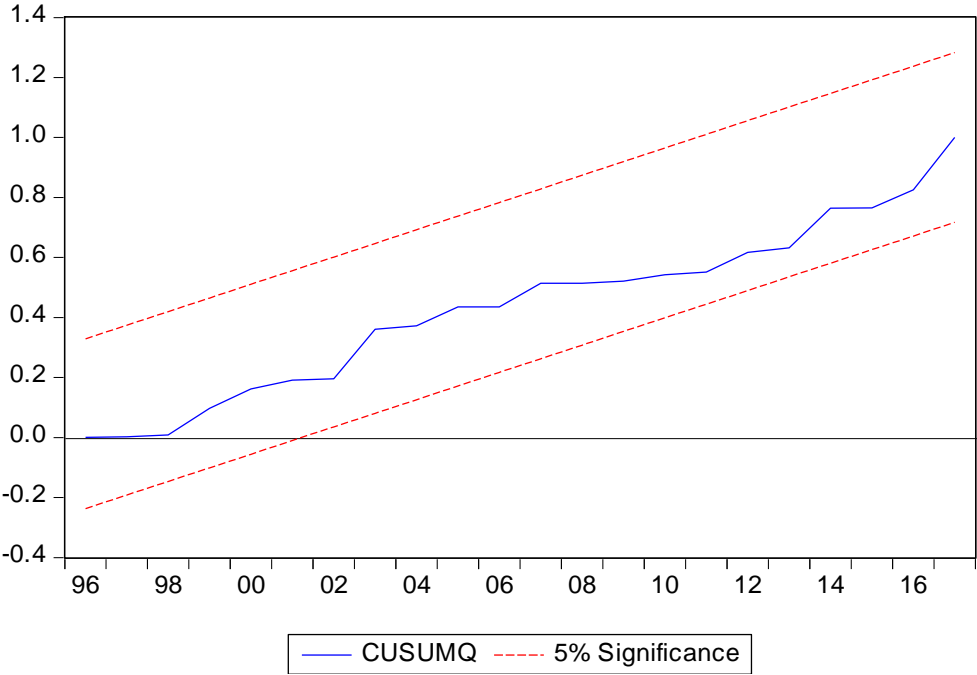
Figure 4:2 A plot of CUSUM statistic

Figure 4:3 A plot of CUSUMQ statistics

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter is organized as follows: summary of findings, conclusions, recommendations and areas to be considered in further studies.

5.2 Summary

This paper aimed at finding out whether private investment is affected by private investment in Kenya between 1980-2017. The ARDL model was employed in estimating the empirical model. ADF test for stationarity was initially conducted where at level, only GDP growth rate was stationary and other variables became stationary after first differencing. The nature of causality between public and private investment was determined by the Granger causality test and the result indicated non-existence of causality on either direction. The result from the bound test showed that the variables were cointegrated, implying that the variables have a long run equilibrium amongst themselves. The ECM equation was then used to determine the dynamic ARDL model coefficients.

From the long run ARDL model, domestic credit, GDP growth rate and domestic savings positively affects private investment while public investment, lending interest rate and external debt have a negative effect. The effects of domestic credit, domestic savings and external debt are significant while that for public investment, lending interest rate and GDP growth are insignificant.

In the short run, current and one period lag public investment, GDP growth, domestic credit and domestic savings affects private investment positively, whereas the effects of domestic credit one period lag, lending interest rate and external debt was negative. The significant variables were domestic credit, external debt and one period lag public investment. The diagnostic tests done confirmed that none of the assumption made by the ARDL model were violated, hence the results obtained are reliable.

5.3 Conclusions

From the findings, public and private investment are compliments in the short run. This was shown by the positive sign which was significant in its one period lag, an indication of a crowding in effect. This is become in the construction of mega projects; the government mostly involves the private sector. In the long run, public investment is a substitute of private investment as shown by

the negative coefficient. This implies that the public and private sector compete for the same physical and financial resources over time. Likewise, there is some form of inefficiency in resource utilization, wastage and corruption by the government which leads to poorly executed and ineffective projects over time.

Though the results have shown a crowding in and crowding out effect in the short run and long run respectively, it does not mean that every public investment is synonymous with this finding. Some public investment may depict either a crowding out or crowding in effect in both time periods. However, these results infer that, the government mostly acts to support the business environment in the short run but they end up distorting these gains in the long run.

5.4 Recommendations

Since public investment ends up displacing investments done by the private investors in the long run, the government should consider involving them when formulating policies that relates to the distribution and allocation of scarce investment resources. These policies should be able to factor in the possible negative externalities that might arise from the government investment. This will caution the government from competing with the private sector for the same investment resources in the long run ensuring that both investments act as compliment for each other.

The positive short run effect of public investment can be attributed to the public private partnership which facilitates the infrastructure base at the same time enhancing the industries and businesses linked with infrastructural development. The government should therefore reconsider reinstating the financial and risk guarantees in its policy because it acts as a risk-incentive for private sector investors to uptake risky infrastructural projects.

The government should also consider giving the private sector an opportunity of managing its investment resources as opposed to managing it by itself because public sector is considered to be less efficient and less cost effective compared to the private sector. The government should focus more on formulating laws and regulations that will guide the private sector on their managerial role so that they don't overstep their mandate. This will ensure a conducive investment climate necessary for economic development.

5.5 Areas of further studies

This study has looked at the effect of public investment on aggregate investment done in the private sector. A disaggregated data can equally be utilized to analyses how public investment affects a specific private sector. The private sector can be divided into various categories e.g. agricultural, manufacturing and service sectors. An analysis can then be done to determine which sector does public investment impact the most. This will provide an insight on which sector should more investment resources be allocated to by the government.

This study has used year by year data for analysis. Consequently, a quarterly data can also be examined to test the crowding out hypothesis for the different political regimes Kenya has had since independence.

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