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DEPARTMENT OF ECONOMICS

A DISSERTATION PROPOSAL IN APPLIED ECONOMICS (ECO 719)

TOPIC: A DYNAMIC PANEL DATA ANALYSIS OF THE IMPACT OF PUBLIC SECTOR INVESTMENT ON PRIVATE SECTOR INVESTMENT GROWTH IN SUB-SAHARAN AFRICA

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APPROVAL

This dissertation has been examined and approved as meeting the requirement of the Masters of Arts in Economics degree.

DECLARATION

This study was carried out from August 2018 through May 2018. The study has not been submitted or undertaken before for award of any degree program at any university. Therefore, the contents of the study are the author's original work.

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DEDICATION

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ABSTRACT

The present sought to analyze the impact of public sector investment on private sector investment in Sub-Saharan Africa. The study utilized panel data from 2005-2015 across forty-five Sub-Saharan African economies. To estimate the results, the study employed the Two-Step System GMM model as developed by (Arelano & Bover, 1995). In the presence of endogeneity, GMM is one of the robust estimation techniques that produces unbiased, efficient, and consistent estimators. For the validity of the instruments and presence of second-order serial correlation, the study used the Difference-in-Hansen and the Arrellano-Bond specification tests, respectively. The results from the study reflect that public sector investment negatively and significantly impacts private sector investment in Sub-Saharan Africa. Therefore, public sector investment crowds-out private sector investment. To account for the heterogeneous nature of countries in the region, the study conducted a sub-sample analysis by dividing the sample into low-income countries and lower-income and upper-middle income economies. Results from the sub-sample analysis showed that public sector investment bore no significant effect on private sector investment in low-income countries sample. As regards lower-income and upper-middle income economies, public sector investment crowds-out private sector investment. To minimize the crowding-out effects of public sector investment on private sector investment, the study recommends four policy interventions: proliferation and mobilization of domestic resources; inclusive models of public sector investment; strengthening of public sector financial managements systems, and regional integration of public infrastructure development.

Keywords: Investment, GMM, Difference-in-Hansen, Public Sector, Private Sector, Arrellano-Bond, Low-Income, Lower-Income and Upper-Middle Income

LIST OF ACRONYMS

EAP	East Asia and the Pacific
ECM	Error Correction Mechanism
GDP	Gross Domestic Product
GLS	Generalized Least Squares
GMM	Generalised Method of Moments
IMF	International Monetary Fund
IV	Instrumental Variable
LAC	Latin America and the Caribbean
MA	Moving Average
OLS	Ordinary Least Squares
PPP	Public Private Partnerships
SAP	Structural Adjustment Programs
SEZ	Special Economic Zones
SSA	Sub Saharan Africa
WDI	World Development Indicators

CHAPTER 1 INTRODUCTION AND BACKGROUND OF THE STUDY

1.0 Background of the study

Dating as far back as the late 1970s and the 1980s, many developing countries, especially Sub-Saharan-African (SSA) economies, experienced a pronounced slowdown in economic growth (Oshikoya, 1994). During the period 1973-80, GDP grew by 0.4 % on average, but slowed down to a negative 1.2 % between 1980-89. Low aggregate investment was cited as a central factor explaining the plunge in output growth in SSA (International Monetary Fund, 2000). In actual fact, during the above stated periods, the slowdown in economic growth was concurrently met by a 4% decline in the average investment growth. In light of these developments, it can be said that a direct relationship exists between aggregate investment and economic growth.

Over the years, broad consensus has emerged highlighting the importance of investment in SSA. In particular, promotion of private sector investment has been identified as a sustainable way of stimulating aggregate investment and subsequently economic growth. This led to the introduction of the Structural Adjustment Programs (SAPs) in SSA in the 1980s. SAPs were partly geared towards promoting private investment, and ultimately scaling down the share of the public sector in SSA economies (Noorbakhsh & Paloni, 1999). More recently, there has been a plethora of private investment initiatives such as: Group of Twenty's (G20) Compact with Africa; China's Belt and Road Initiative; Special Economic Zones (SEZ); and Public-Private-Partnerships (PPP), all aimed at promoting private investment in SSA. Notwithstanding these attempts, private investment growth in SSA has been sluggish.

Compared to other developing or emerging economies, private investment growth in SSA is relatively low. For example, during the period 2000-2015, private investment growth in SSA

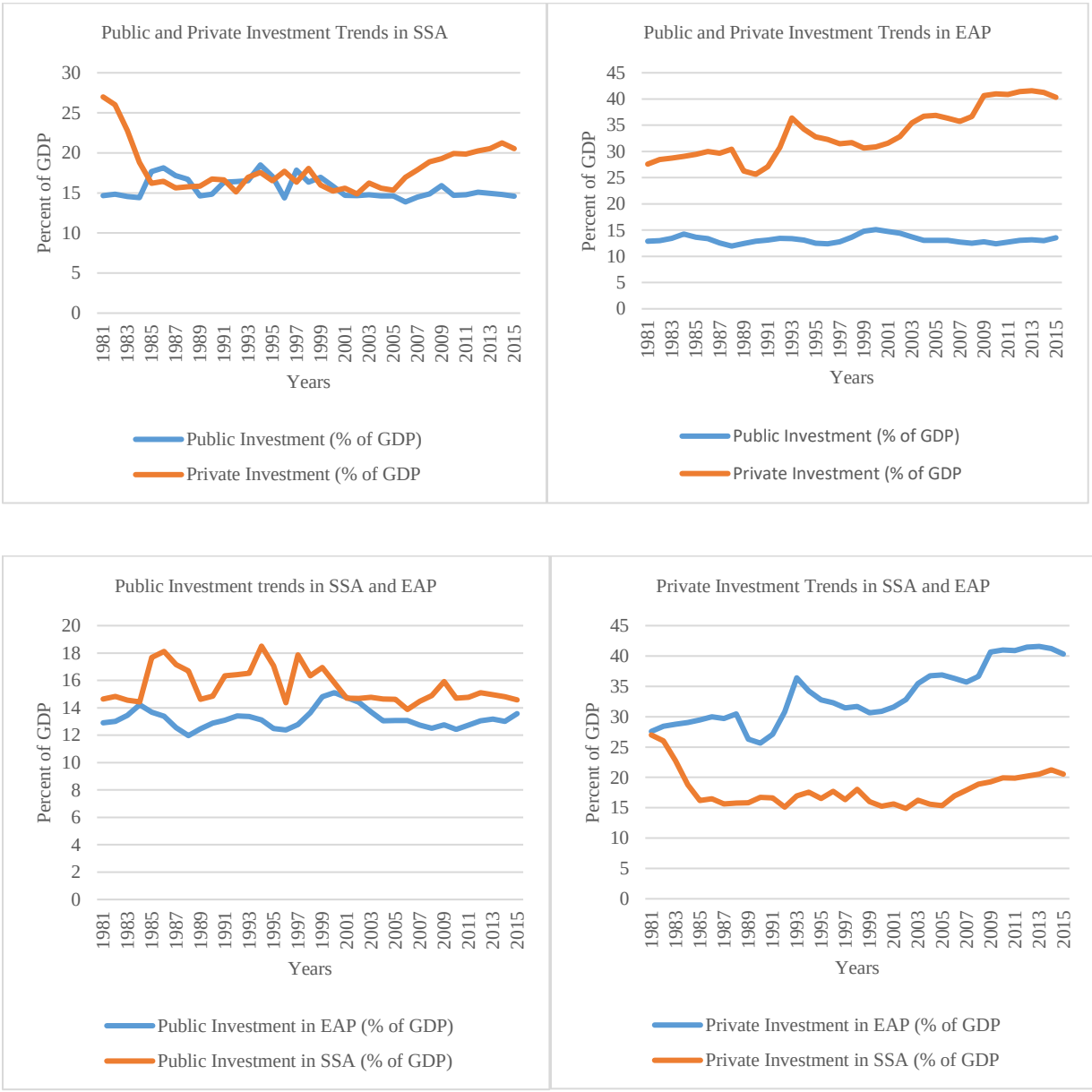
averaged 18.02 % compared to 37.51% and 19.54% in East Asia and Pacific (EAP) and Latin America and the Caribbean (LAC), respectively. The sluggish growth of private investment in SSA has among other factors, been attributed to: inadequate public infrastructures and facilities that supports private investment growth; low credit supply to the private sector; macroeconomic instability; low labour productivity; unsustainable external debts; and other structural and institutional factors such as unfriendly business environment i.e. ease of doing business (International Monetary Fund, 2018).

One of the important determinants of private sector investment is investment in the public sector. If directed towards infrastructural and human capital development, public investment may act as a catalyst on the marginal productivity of private capital, and subsequently stimulate output (Khan & Kumar, 1997). Thus, public investment may not only stimulate economic growth directly but, also indirectly by promoting private investment. This is known as complementarity or crowding-in effect of public investment. It occurs when increased spending on public services increases the returns to private capital and/or reduces the costs of private investment. A less desirable outcome is when public investment is a substitute for private investment, the crowding-out effect. This comes about when public investment usurps resources that would otherwise go to the private sector. As a result, public investment harms the private sector via taxation, inflation or risk premia (Naqvi & Tsoukis, 2003).

In comparison to other developing or emerging economies, EAP region for example, public investment in SSA is much higher, whereas private investment is relatively lower (See Figure 1). Furthermore, in EAP, private investment noticeably exceeds public investment continuously and by a margin of about 25%. On the contrary, in SSA the two are mostly at par with only a small margin in the earlier and later years. Having observed that a large amount of resources are

expended in public services in SSA, this incites a very pertinent question this study seeks to address, "Does public sector investment support private sector investment in SSA." The aim of this study therefore, is to investigate the effect of public sector investment on private investment in SSA.

Figure 1a Trends in Private and Public Investment in SSA and EAP



Source: Author's computations using the World Bank Development Indicators

Through both theoretical and empirical approaches, it has been shown that public investment can either promote or depress private investment. As a result, efforts to rationalize and prioritize public investment expenditures on efficient and productive infrastructural projects that raise the marginal productivity and reduce the costs of production for the private investors have recently been heightened by policymakers in SSA (International Monetary Fund, 2018). Such efforts are especially important because the impact of public investment on private investment bears important implications for economic growth. Given that the private sector has been identified as an avenue for achieving long-term sustainable growth in SSA, it is important to determine how it is impacted by public investment. If public investment crowds-in private investment, this will tend to increase aggregate investment in the economy and in turn stimulate economic growth in the process. If however public investment crowds-out private investment, this will lead to a decline in both aggregate investment and economic growth.

Statement of the problem

There exists two schools of thought behind the public-private investment nexus. The complementarity hypothesis or the crowding-in effect postulates that public investment directed towards infrastructural and human capital development catalyzes the marginal productivity of private capital thereby increasing output (Khan & Kumar,1997). Government outlays on infrastructural amenities such as railway and road networks, transportation and communication systems, water and energy provision facilitates private sector activities thus resulting in output growth (International Monetary Fund, 2018). In addition, the provision of such amenities reduces the cost of production for private firms, consequently leading to private investment growth.

The other view posits that public investment crowds-out private investment. Khan & Kumar (1997) advance two channels through which public investment could crowd-out private

investment. First, public investment exerts a negative impact on private investment through budget deficits. A fiscal deficit implies that public investments are financed either through increments in taxes or debt. Higher taxes introduce distortions to the economy and inflate the cost of inputs. Moreover, where public investment is financed through borrowing from the financial markets, it escalates the user cost of capital and incentivise financial intermediaries to ration credit (Sundararajan & Thakur, 1980). Financial repression is another conduit through which crowding-out occurs. In most developing countries, governments purposely cap interest rates below the inflation rate. As a result savings mobilization are consrained. Consequently credit supply to private firms contracts.

Predicated on the preceding analysis, it is clear that the question of how public investment impacts private investment cannot be answered with certainty. However, this could impede the formulation of appropriate policy prescriptions and conclusions with regard to public investment. Hence the present study aims to clear the ambiguity that currently exists in the literature.

1.2 Objectives of the study

The overall objective of the present study is to assess the impact of public investment on private investment growth in SSA.

1.2.1 Specific objectives

i. To analyse the impact of public investment on private sector investment growth in SSA.
ii. Analyse the effect of total government debt on private sector investment growth in SSA.
iii. Draw empirically-informed policy recommendations based on the findings of the study.

1.3 Statement of Hypothesis

The hypotheses to be tested are:

- Public investment does not significantly and positively impact private investment in SSA.
- Total Government debt does not significantly and positively impact private investment in SSA.

1.4 Significance of the study

The present study forms an important contribution to the already existing body of empirical literature on the impact of public sector investment on private sector investment. Obtaining a clear understanding of the relationship between public and private investment remains elusive yet the impact of public investment on private investment bears important implications for economic growth in SSA. If public investment crowds-in the participation of the domestic private investors, then the relevant policy question becomes how to maximize on this complementarity so as to stimulate economic growth in SSA. By contrast, if public sector investment crowds-out private investment, then the relevant policy question is what can be done to reduce this crowding-out effect, so that SSA countries can realize the potential benefits from higher public investment and subsequent economic growth.

1.5 Outline of the study

The rest of the paper is organised out as follows: Chapter two is dedicated to the theoretical framework of private investment. It discusses the theoretical framework of the determinants of private investment. Moreover, the chapter discusses the empirical literature on the impact of public

investment on private investment. Chapter three addresses the methodological direction that the study adopts. It contains the estimation technique, empirical model, justification and measurement of the variables, expected signs of the estimated coefficients, and data sources.

CHAPTER 2 OVERVIEW OF ECONOMIC GROWTH AND INVESTMENT TRENDS IN SUB-SAHARAN AFRICA

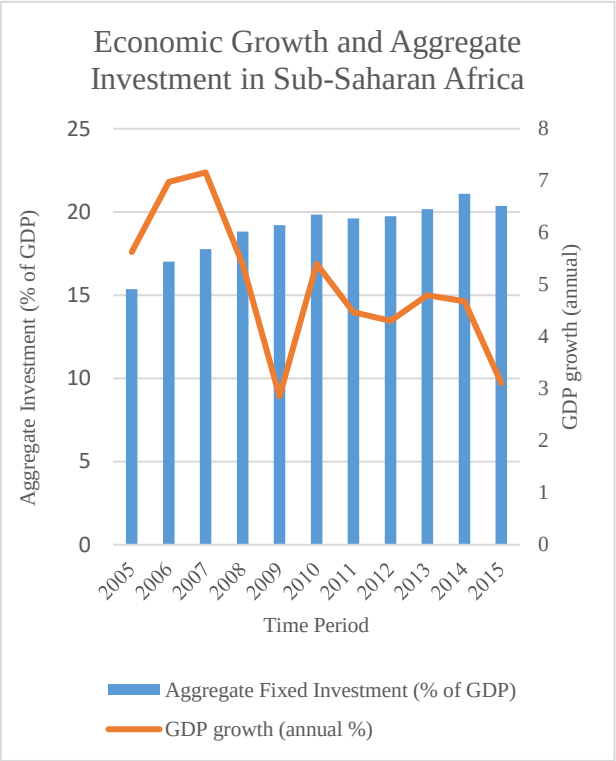
2.0 Introduction

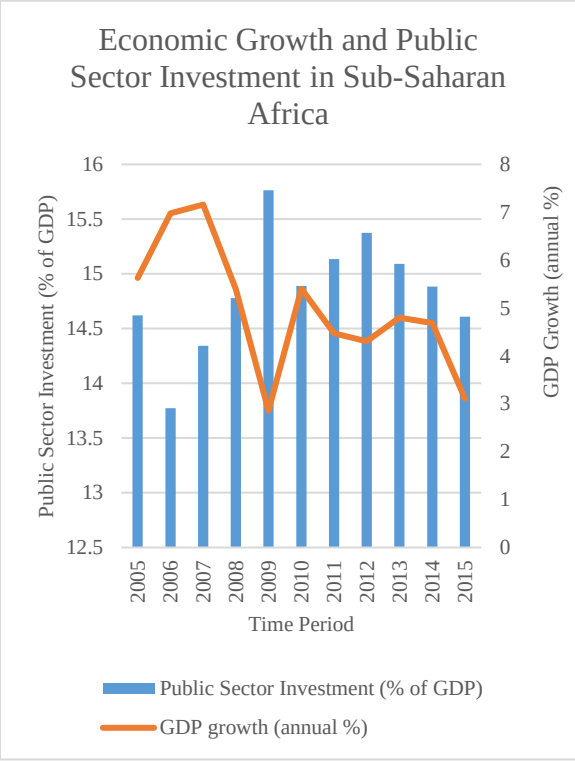
This chapter provides an account of the trends in economic growth and aggregate investment in sub-Saharan Africa. Section 2.1 explicitly deals with the analysis of economic growth and aggregate investment in sub-Saharan Africa. Section 2.2 dwells on the analysis of the trend between public sector investment and private sector investment growth in sub-Saharan Africa. Section 2.3 provides an analysis of some of the factors that impact private sector investment growth.

2.1 Economic Growth and Aggregate Investment in sub-Saharan Africa

An adequate level of investment has long been recognized as a key ingredient for economic growth, but Sub-Saharan Africa ranks at the bottom of all developing regions in virtually all types of investments i.e. private and public investment. The subdued economic growth that has been experienced in the region is in part attributable to the slowdown in aggregate investment. Investment growth in the region slowed from nearly 8 percent in 2014 to a marginal 0.6 percent in 2015 (World Bank, 2017). This investment growth was far below the 1990-2008 average growth rate of 6 percent and the 2003-08 economic growth rate of 11.6 percent. The sharp plunge in investment growth recorded in 2015 (see Figure 2a) was evident across public and private investment. The deceleration in investment growth cut down the ratio of investment to GDP by 1.05 percentage points, thus reversing the cumulative gains in this measure over the three previous years.

Figure 2a Trends in Economic Growth and Aggregate Investment in Sub-Saharan Africa





Source: Author's computations using the World Bank Development Indicators

Given the large investment needs of the Sub-Saharan African region, most of which emanate from the large infrastructure gap presently besetting the region, increasing public sector investment will be a priority. Public sector investment directly boosts overall investment in the economy and can foster private investment. But few countries in the region are well positioned to ramp up public sector investment. Most countries have little fiscal space to increase public sector investment, because of their high debt-to-GDP ratios and the need for fiscal consolidation. External financing conditions have tightened with increased uncertainty in the United States and Europe (Brexit), which makes tapping debt markets increasingly difficult and risky (World Bank, 2019). At the same time, in many countries, low tax revenues and underdeveloped capital markets limit the share of domestic resources that can be allocated to public sector investment. Moreover, regulatory and

implementation capacity constraints pose key obstacles to scaling up public sector investment in infrastructure development (World Bank, 2013).

Table 2.0 Top Ten SSA Economies in With the Highest Public Sector Investment

Countries	Average Public Sector Investment (% of GDP)	Average Private Sector Investment (% of GDP)
Angola	20.60%	5.30%
Equatorial Guinea	19.10%	7.50%
Sao Tome and Principe	18.30%	18.10%
Ethiopia	12.40%	8.10%
Mozambique	10.90%	9.30%
Botswana	10.40%	21.30%
Lesotho	9.80%	12.90%
Cabo Verde	9.10%	21.80%
Niger	8.70%	17.10%
Burkina Faso	7.90%	11.00%

Source: Author's computations using the World Bank Development Indicators

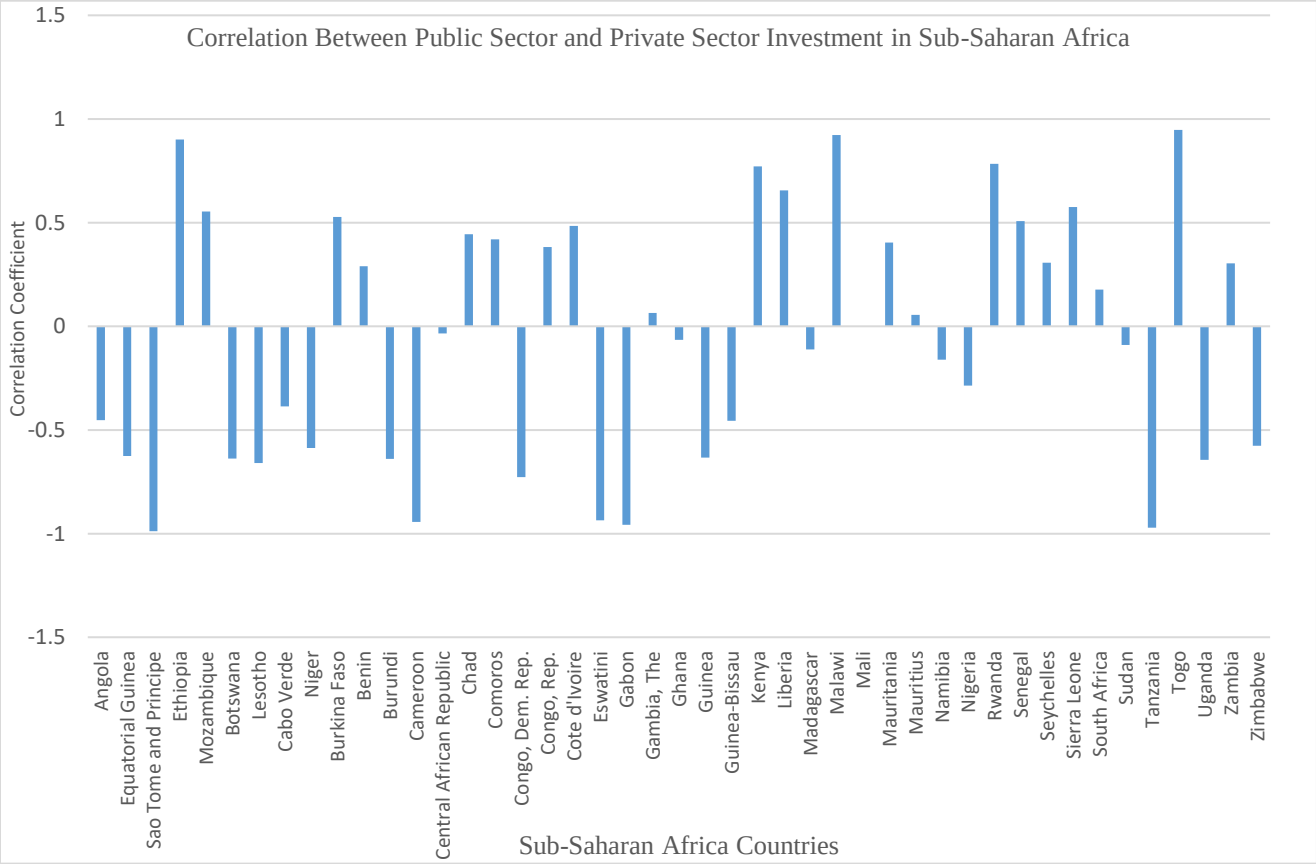
Table 2.0 shows the top ten Sub-Saharan African countries with the highest average public sector and private sector investment.

2.2 Public Sector Investment and Private Sector Investment in sub-Saharan Africa

Figure 2c depicts the correlation between public sector investment and private sector investment in Sub-Saharan Africa for the period 2005 through 2015. The figure covers forty-five economies. From Figure 2c, it is apparent there exists evidence of substitutability among twenty-three economies. The negative correlation coefficient indicates that public sector investment in these countries public sector investment does crowd-out private sector investment. On the other hand, there are twenty-one countries that exhibits evidence of a positive relationship between public sector investment and private sector investment. Therefore, the evidence from Figure 2c suggests

that public sector and private sector investment are substitutes in twenty-three countries, and complements in twenty-one countries. The evidence on the nexus between the two types of investments, based on the analysis of Figure 2c, is tilted towards the substitutability hypothesis. Moreover, it is important to note that in all of the region's leading economies- Angola, Nigeria, and South Africa- public sector investment crowds-out the participation of the private sector.

Figure 2c Correlation between Public Sector Investment and Private Sector Investment in Sub-Saharan Africa



Source: Author's computations using the World Bank Development Indicators

Sub-Saharan Africa lags other developing regions in virtually all dimensions of investment performance, particularly private sector investment. Public sector investment spending has been

relatively high compared to other economic regions although trends vary across key sectors. Investment has been inadequate in the power sector, were electricity-generating capacity per capita has changed little over the past two decades. That notwithstanding, access to electricity more than doubled during 1990 through 2014 (International Monetary Fund, 2018). Sub-Saharan Africa also has the lowest road and railroad densities among developing regions, and road density declined during 1990–2011. By contrast, the region has been made substantial progress with respect to telecommunications infrastructure which has improved dramatically. For instance, the number of fixed and mobile phone lines per 1,000 people increased from three in 1990 to 736 in 2014, and the number of Internet users per 100 people increased from 1 3 in 2005 to 16 7 in 2015. Access to safe water has also risen, from 51 percent of the population in 1990 to 77 percent in 2015 (World Bank, 2017). This shows that the region still lags behind with the provision of key infrastructural projects.

Empirical evidence reflects that the growth benefits of closing Sub-Saharan Africa's infrastructure quantity and quality gaps are potentially large. Catching up to the median of the rest of the developing world, would stimulate growth in GDP per capita by 1.7 percentage points per year, and closing the gap relative to the best performers would spur growth by 2.6 percentage points per year. Closing the gap in electricity–generating capacity yields the largest potential growth benefit, and substantial gains also arise from narrowing the gap in the length of the road network. Private sector firms in the region stands to gain the most from closing the infrastructural gap as it will increase the marginal productivity of private investors, and thus reduce the cost-per-output.

The impact of public investment on private sector investment growth can be enhanced by implementing policies that foster the efficiency of public investment. For instance, improving the institutions and procedures governing project appraisal, selection, and monitoring can render

considerable economic dividends (International Monetary Fund, 2018). Evidence suggests that countries with sound public investment management systems tend to have lower but more efficient levels of public investment; crowd in more private investment, and exhibit higher growth rates (International Monetary Fund, 2000).

2.3 Factors Impacting Private Sector Investment in sub-Saharan Africa

Sub-Saharan Africa needs to have a robust institutional and regulatory framework in order to attract private investment through public sector investment. Evidence shows that Sub-Saharan Africa performs below the global average in the regulatory arrangements for public-private partnerships, especially in public sector projects selection, appraisal, and performance (International Monetary Fund, 2018). Increasing private investment is critical for the region to achieve sustainable strong growth over the medium term. Raising private investment requires reforms, which include a sound business environment (ease of doing business), well-developed public sector investment, high real GDP per capita and macroeconomic stability (International Monetary Fund, 2018).

Because these reforms take time, countries are pursuing other avenues to jump start private investment, such as public-private partnerships, creating special economic zones, and implementing mechanisms to target foreign direct investment. Country experiences also show that, while increases in private investment can follow commodity price booms or conflict resolutions, episodes of continued private investment growth are typically associated with macroeconomic stability, including low public debt and inflation, and maintaining the momentum for structural and institutional reforms (International Monetary Fund, 2009).

CHAPTER 3 LITERATURE REVIEW

3.0 Introduction

Overtime a vast body of literature, theoretical and empirical, have been attempting to explain the impact of public investment on private investment. This chapter presents the three mainstream investment theories, with a detailed emphasis on the adopted theoretical framework. Section 2.2 deals with the dynamic flexible accelerator investment theory; Section 2.3 the empirical evidence on the impact of public investment on private investment.

3.1 Theoretical Literature Review

There are three major theoretical approaches to analyzing private investment. These are the Neo-classical theory of investment, Tobin's q theory of investment and the Dynamic flexible accelerator model. However, owing to data limitations on key variables such as capital stock, replacement cost of capital, real financial rates on debt and equity, as well as some strict assumptions such as the absence of government participation in the economy and perfect capital markets, application of both the standard Neoclassical and Tobin's q investment theories/models to SSA is implausible. The current study therefore adopts the dynamic flexible accelerator model.

3.1.1 Dynamic Flexible Accelerator Investment Model

The theoretical exposition of how public investment impacts private investment is anchored on the dynamic flexible accelerator model of investment developed by Blejer & Khan (1984). The model is not a strict version of the standard accelerator model. It begins by assuming that, in the long-run, the desired stock of capital is proportional to expected output:

$$K_t^* = \alpha Y_t^e \qquad (1.0)$$

Where K^* is the capital stock that the private sector desires to acquire in the long-term whereas Y^e represents the expected output. In the above specification, factor input prices bear no influence given that the underlying production function has fixed proportions among factor inputs. Moreover, the parameter α is assumed to be fixed. Due to the time it takes to plan, build, and install new capital the actual capital stock adjusts to the difference between the desired capital stock in period *t* and the actual capital stock in the previous period through lags. These lags are captured by a partial adjustment mechanism.

$$\Delta K_t = \beta(K_t^* - K_{t-1}) \tag{1.1}$$

Alternatively:

$$K_t = \beta K_t^* + (1 - \beta)\, K_{t-1} \tag{1.2}$$

Where K is the actual capital stock, ΔK_t is the net private investment, and β is the coefficient of the partial adjustment mechanism, $0 \leq \beta \leq 1$. Due to data constraints relating to net private investment and the capital stock variable, equations (1.1) and (1.2) are adjusted to incorporate gross private investment which has data readily available. Blejer & Khan (1984) defines gross private investment as the sum of net private investment and the depreciation of the previous period's capital stock.

$$PRINV_t = \Delta K_t + \delta K_{t-1} \tag{1.3}$$

Where δ is the depreciation rate, $PRINV$ is gross private investment. Applying the lag-operator to (1.3) yields:

$$PRINV_t = [1 - (1 - \delta)L]\, K_t \tag{1.4}$$

Where L is the lag operator i.e. $LK_t = K_{t-1}$. Re-arranging (1.4) to relate private capital stock to gross private investment:

$$K_t = \frac{PRINV_t}{[1-(1-\delta)L]} \tag{1.5}$$

Using equation (1.5) to substitute for K_t and K_{t-1} into (1.2) to derive:

$$\frac{PRINV_t}{[1-(1-\delta)L]} = \beta K_t^* + (1-\beta)\frac{PRINV_{t-1}}{[1-(1-\delta)L]} \tag{1.6}$$

Multiplying both sides by$[1-(1-\delta)L]$:

$$PRINV_t = [1-(1-\delta)L]\beta K_t^* + (1-\beta)\, PRINV_{t-1} \tag{1.7}$$

Substituting K_t^* from (1.0) into (1.7) yields the basic dynamic accelerator model which can be applied to gross investment data available in developing countries.

$$PRINV_t = \beta\alpha\,[1-(1-\delta)L]Y_t^e + (1-\beta)\, PRINV_{t-1} \tag{1.8}$$

The response of private investment to the gap between the desired and the actual investment is captured through the partial adjustment coefficient. For empirical considerations, the partial adjustment mechanism can be specified in terms of gross investment as:

$$PRINV_t - PRINV_{t-1} = \beta\,(PRINV_t^* - PRINV_{t-1}) \tag{1.9}$$

According to Blejer & Khan (1984), the impact of public investment on private investment is captured through its effect on the coefficient of adjustment. Therefore, equation (2.0) expresses public investment as a regressor.

$$\beta = \theta_0 + \frac{1}{(INV_t^* - INV_{t-1})}(\theta_1 PUINV_t + \theta_2 X_t) \tag{2.0}$$

Where θ_0 is the intercept, $PUINV$ is the gross public investment, and X is a vector of other relevant explanatory variables.

Substituting (2.0) into (1.9):

$$PRINV_t - PRINV_{t-1} = \theta_0\ (INV_t^* - INV_{t-1}) + (\theta_1 PUINV_t + \theta_2 X_t) \quad (2.1)$$

In the steady state, desired private investment is given by:

$$PRINV_t^* = [1 - (1 - \delta)L]K_t^* \quad (2.2)$$

Substituting (1.0) into (2.2):

$$PRINV_t^* = [1 - (1 - \delta)L]\alpha Y_t^e \quad (2.3)$$

Substituting (2.3) into (2.1) and re-arranging:

$$PRINV_{i,t} = \alpha\theta_0[1 - (1 - \delta)L]Y_{i,t}^e + \theta_1 PUINV_{i,t} + \theta_2 X_{i,t} + (1 - \theta_0)PRINV_{i,t-1} + \varepsilon_{i,t} \quad (2.4)$$

Where the subscripts i=1. . . N and t = 1 . . . T represents the cross-section and time-series dimension, $PRINV_{i,t-1}$ is the lagged dependent variable, $\varepsilon_{i,t}$ is the overall random disturbance term. In essence, the dynamic accelerator investment theory advance that private investment is positively related to the expected changes in income (Serven & Solimano, 1992). Unlike the neoclassical theory, the demand for capital under the dynamic accelerator investment theory is independent of the user cost of capital (Abel, 1988).

3.1.2 Neoclassical Theory of Optimal Capital Accumulation

One theory that explains investment behaviour is the neoclassical theory of investment. Jorgenson (1967) is the main proponent of this theory. The theory is based on optimal capital accumulation. Capital stock accumulation is determined by the relative prices of factors of production. The theory

holds that the rate of investment is to a large extent determined by the speed with which firms adjust their present capital stocks towards the long-term desired capital. However, adjustment to the long-run desired capital occurs with a lag (Serven & Solimano, 1992). The lag is due to the time it takes to build and install new capital. Therefore, firms ought to decide on the speed of adjustment at which they adjust their present stock of capital to the desired level of capital.

The neoclassical theory of investment holds that new additions to the stock of capital are determined by the marginal product of capital together with the user cost of capital. The marginal product of capital measures the additional output resulting from the use of an additional unit of fixed capital input, holding labour and technology constant. Under the neoclassical theory, firms are profit-maximizing; therefore if the marginal product of capital exceeds the user cost of capital, the firm will proceed to make new additions to its capital stock. According to Abel (1988) the thrust of the neoclassical theory of investment is that a firm's demand for fixed capital is positively related to the level of output, and inversely related to the user cost of capital

3.1.3 Tobin's q theory of investment

An alternative theory that seeks to explain investment is the q theory. The q theory is attributed to (Tobin, 1969). The theory is based on financial markets. Tobin (1969) advanced that the investment undertaken by a firm depends on the ratio of the present value of an additional unit of the installed fixed capital to its replacement cost. A firm will only make new additions to its capital stock when the market value of the additional unit exceeds the replacement cost. Owing to delivery lags and installation costs, the ratio of market value of an additional unit of installed capital to replacement may differ from unity (Serven & Solimano, 1992). The greater is the ratio from unity the greater would be the likelihood and incentive for the firm to acquire an additional unit of capital. And as a result investment will surge. However, when the ratio is less than unity, firms

will move to scale down on their investment expenditure on new additions of capital stock (Abel, 1988).

3.2 Empirical Literature Review

The question of how public investment affects private investment is a long-standing one, which dates as far back as the 1970s during which time the US private sector experienced a dramatic slowdown in productivity. Through his pioneering paper on the productivity of public expenditure, Aschauer (1989a) utilised Ordinaty Least Squares (OLS) to study the productivity movements of US private firms from 1949-85. The study uncovered that public capital, especially nonmilitary public capital outlays, bears strong positive impact on the productivity of the private sector. Moreover, this study attributed the annual decline in productivity growth during the 1970s to the drop in public capital expenditures. In a similar study on whether public capital crowds out private capital, Aschauer (1989b) found that core public infrastructure such as roads, ports, and railway networks supports private sector activities.

Even in recent times the relationship between public and private investment has been subjected to empirical analysis. In a bid to avoid simultaneity bias and most importantly capture the dynamic structure of private investment, Erden & Holcombe (2005) utilised a system two-stage least squares estimator to draw a comparative analysis of the impact of public investment on private investment for a sample of nineteen developing and twelve developed countries from 1980-96. The study found out that, in contrast to developed economies, public investment in developing countries complements private investment. In another study, based on the neoclassical investment framework, Erden & Holcombe (2006) analysed the linkage between public and private investment in a sample of nineteen developing countries. In contrast to their previous study, they instead utilised an error correction mechanism (ECM) to account for the short and long-run dynamic

nature of private investment. Notwithstanding the different estimation technique, the results were consistent with their earlier study, thereby lending support to the complementarity hypothesis.

Equally, another strand of empirical literature has been trickling in supporting the substitutability hypothesis. Coutinho & Gallo (1996) used a dynamic generalized Instrumental Variable (IV) estimation technique to study whether public capital crowds out private investment across thirty-three developing countries from 1970-88. Their results supported the substitutability hypothesis. However, their results ought to be treated with caution as their study modelled public investment at an aggregate level due to data constraints on disaggregated public investment data. In an effort to bridge this gap, Wang (2005) disaggregated government expenditure from 1961-2000 into five categories on a study about the effects of government expenditure on private investment in Canada. Utilising an ECM, the study found out that public infrastructure crowds out private investment whereas human capital expenditure turned out to crowd-in private investment.

Therefore, based on the aforementioned empirical studies, it is apparent that the impact of public investment on private investment is uncertain. This makes the study of the relationship between the two variables even more relevant. Moreover, it is apparent that, besides public investment, there are other explanatory variables that explain private investment. Greene & Villanueva (1991) and Oshikoya (1994) through their studies on the macroeconomic determinants of private investment in developing countries and Africa, respectively, found real GDP per capita growth to have a positive effect on private investment. Moreover, the authors found out that inflation rate, and debt-ratio to GDP are all statistically significant in explaining private investment in Africa.

Given that financial markets in developing countries are relatively underdeveloped and that one of the main constraints on investment is the quantity of credit supply, rather than the user cost of capital, Blejer & Khan (1984), basing their study on the accelerator framework, observed that

domestic bank credit exhibited a positve relationship with private investment. Similar results were obtained by Erden & Holcombe (2006), notwithstanding the fact that they based their study on the neoclassical framework and used an ECM. Moreover, Oshikoya (1994) grouped African countries according to their income-levels and discovered that the impact of bank credit was largest in low-income African countries.

It has also emerged more recently that the ease of doing business is an important institutional and structural determinant of private investment. Especially in developing countries, there are plenty of business regulations that may impede private investment. Some of these regulations include: protracted and costly startup procedures to register a business; protection of property and intellectual rights; and enforcement of business contracts. In an empirical study to investigate the effect of business regulation on private investment in emerging market economies, Korutaro & Biekpe (2013) utilised random effects Generalised Least Squares (GLS) across a sample of eighty-five emerging economies from 2003-07 and, they found excessive business entry regulations to have a negative and significant effect on private investment. These results are consistent with the findings of Klapper, et al. (2004) who found that heavy entry regulations hamper private investment across Western and Eastern Europe.

From the foregoing discussion of the empirical literature, it is clear that the effect of public investment on private investment is indeterminate. Many empirical studies have experimented with different estimation techniques, samples, theoretical framework and, time-dimensions, however, the results appear imprecise as to how public invesment impacts private investment. The present study makes a departure from the previous studies by experimenting with a different estimation technique and a bigger sample i.e forty countries. Moreover, despite the vast body of

empirical literature on the subject, no single study has explicitly investigated the impact of public investment on private investment in SSA.

CHAPTER 4 METHODOLOGY

3.0 Introduction

The present chapter provides the theoretical framework and the estimation technique utilized by the study. The chapter also presents the variables used, how they are measured and the priori expectations of the signs of the coefficients to be estimated. Section 3.1 provides the estimation technique; Section 3.2 the empirical specification of the model; Section 3.3 justification and measurement of variables used in the empirical model; and Section 3.4 data sources.

3.1 Estimation Technique

The empirical model adopted for the present study is based on the dynamic flexible accelerator model of investment developed by Blejer & Khan (1984). The model captures the dynamic structure of private investment through the lagged dependent variable. Given the dynamic nature of private investment, the study adopts the System Generalized Method of Moments (GMM) estimation technique proposed by Arellano & Bond (1991) and later modified by Arellano & Bover (1995) and (Blundell & Bond, 1998). Due to poor finite sample properties, differenced GMM produces weak instruments that are correlated with regressors thus yielding biased estimators (Blundell & Bond, 1998). The correlation between the lagged dependent variable and the overall error disturbance terms renders the OLS, Random Effect, and Fixed Effects estimators biased and inconsistent (Baltagi, 2005). The present study adopts a two-step system GMM because of a larger sample of cross-section units. The number of cross-section units are greater than the

time-series observations. The dynamic structure of economic relationships are characterized by the presence of a lagged dependent variable such as:

$$PRINV_{it} = \rho PRINV_{i,t-1} + X'_{it}\,\beta + \mathrm{u}_{it} \quad (2.5)$$

Where ρ is a scalar, X'_{it} is 1 × K vector of explanatory variables, β is K × 1 vector of coefficients, u_{it} is the overall error term, and $PRINV_{i,t-1}$ is a lagged dependent variable, u_{it} follows a one-way error component model such as:

$$\mathrm{u}_{it} = \mu_i + \upsilon_{it} \quad (2.6)$$

Where μ_i is the country-specific effects and υ_{it} is the remainder error term. Equations (2.5) and (2.6) suffer from simultaneity bias due to the presence of a lagged dependent variable among the explanatory variables and the country-specific effects. Arellano & Bond (1991) advance that to circumvent the problem of endogeneity/simultaneity bias, one can utilise orthogonality conditions between lagged dependent values and the error terms to obtain instruments. Formally showing this with a simple autoregressive model with no explanatory variables:

$$PRINV_{it} = \rho PRINV_{i,t-1} + \mu_i + \upsilon_{it} \quad (2.7)$$

To derive a consistent estimate of ρ as N∼∞ with T fixed, equation (2.7) is first-differenced to remove the country-specific effects (μ_i):

$$\Delta PRINV_{it} = \rho \Delta PRINV_{i,t-1} + \Delta\upsilon_{it} \quad (2.8)$$

Note that $\Delta\upsilon_{it}$ is a moving average (MA) of order 1 and it is nonstationary. Considering t=3:

$$\Delta PRINV_{i3} = \rho \Delta PRINV_{i2} + \Delta\upsilon_{i3} \quad (2.9)$$

$$PRINV_{i3} - PRINV_{i2} = \rho(PRINV_{i2} - PRINV_{i2}) + (\upsilon_{i3} - \upsilon_{12}) \quad (3.0)$$

In the above specifications, $PRINV_{i1}$ is a valid instrument since it is correlated with the series that is causing endogeneity i.e. $\Delta PRINV_{i2}$ and it is uncorrelated with the error term. Beyond t=3, the iterative process yields ($PRINV_{i2}, PRINV_{i3}, \ldots, PRINV_{i,T-2}$) valid instruments. Therefore, these intruments are employed to deter the problem of endogeneity arising because of a lagged dependent variable being included as a regressor. Even though the GMM gives consistent and efficient estimators, Arelano & Bover (1995) suggested two diagnostic/specification tests for the GMM estimator. These are the Difference-in-Hansen Test and the autocorrelation test.

Difference-in-Hansen Test

This test is undertaken to analyse whether the instruments are jointly valid. It is specified as follows:

H_0 = The additional instruments are jointly valid

H_1 = The additional instruments are jointly invalid

Autocorrelation Test

This test is undertaken to ensure that the disturbance terms are not serially correlated with the instruments. It is speficied as:

H_0 = There is no second order serial correlation

H_1 = There is second order serial correlation

3.2 Empirical Model Specification

$$PRINV_{it} = \beta_0 + \beta_1(PRINV_{i,t-1}) + \beta_2(PRINV_{i,t-2}) + \beta_3(PUINV_{it}) + \beta_4(BC_{it}) + \beta_5(CBS_{i,t}) + \beta_6(RGDPPC_{it}) + \beta_7(EXGDP_{it}) + \beta_8(HDE_{it}) + \beta_9(INF_{it}) + \varepsilon_{it} \quad (3.1)$$

Where $PRINV_{it}$ is private investment (% of GDP), $PRINV_{i,t-1}$ is the lagged dependent variable. The regressors are defined as follows: $PUINV$ is the ratio of public investment (% of GDP), BC is the bank credit to the private sector (% of GDP), CBS is the cost of business startup procedures (% of GNI), RGDPPC is the Real GDP Per capita growth (annual %), $EXGDP$ is the External Debt (% of GDP), HDE is total Government expenditure on education (% of GDP), INF is the consumer price index (annual %)

3.3 Sub-sample Analysis

Following the theory of the second best, it is important to make a caveat that there is no golden rule for government action (Lipsey & Lancaster, 1956). In other words the appropriate course of action by government should depend on specific circumstances. This implies that, in examining empirical evidence on public and private investment, it should be kept in mind that the results possibly depend on unique factors specific to the country being studied (Kenny & Williams, 2001). Indeed countries in the SSA region are vastly diverse in terms of income levels, geographical location, population size etc. Therefore the study will account for the difference in the levels of income by conducting a sub-sample analysis of the SSA countries based on their income levels.

3.4 Justification and Measurement of Variables

Public Sector Investment

Public sector investment, measured as a percentage of GDP, involves additions to capital stock such as road infrastructure, energy and water provision, transportation and communication

systems. Public finance theory posit that the government undertakes to provide these goods and services because private economic agents may be unwilling to undertake such (Aschauer,1989b). At a theoretical level the impact of public investment on private investment is not obvious. On the one hand public investment on infrastructures mentioned above tend to raise the marginal product of private capital, therefore complementing private investment. Conversely, when state owned enterprises are producing goods that directly compete with private sector output, or when the government fund its projects through borrowing from the financial markets, which exerts an upward pressure on the user cost of capital thus leading to credit rationing and an imminent tax increase, all these factors impede private sector activities. At an empirical level, the effect of public investment on private investment is indeterminate. Greene & Villanueva (1991) and Erden & Holcombe (2005) found a complementary relationship between the two series. On the other hand, Wang (2005) and Coutinho & Gallo (1996) discovered that public investment crowds out private investment.

Bank Credit

The quantity of bank credit available to the private sector is also pointed out as an important determinant of private investment, especially in developing countries. The rudimentary nature of capital markets in developing countries confines private investment funding to mostly bank credit. An increase in the volume of bank credit to the private sector would spark an upward surge in the activities of the private sector. Numerous empirical studies have found bank credit to have a positive impact on private investment.[1] The study defines bank credit as domestic credit to private sector by banks as a percentage of GDP.

[1] See for example Blejer & Khan (1984); Greene & Villanueva (1991); Oshikoya (1994).

Ease of doing business

Cost of business startup procedures, as a percentage of GNI per capita, is used to proxy the ease of doing business. Complex and prolonged business startup procedures impose an additional cost on a prospective firm. Heavy entry costs serve to dissuade establishment of new firms thus constraining private investment. Alesina, et al.(2005) and Korutaro & Biekpe (2013) found strong empirical support that burdensome startup procedures impedes private investment. Therefore, the coefficient of the cost of startup procedures variable is expected to be negative.

Real GDP Per Capita

Real GDP per capita can be used as a proxy for the income level in an economy. Greene & Villanueva (1991) advances that high income countries are better able to mobilize financial resources towards domestic savings which can subsequently be used to finance private investment. Given the rudimentary nature of capital markets in developing countries, it is expected that most investments will be funded through credit generated by savings mobilization. The study measures real GDP per capita in terms of annual percentage growth . It is expected that real GDP per capita will have a positive impact on private investmment. Greene & Villanueva (1991) found a positive relationship between private investement and real GDP per capita.

Total Government Debt to GDP ratio

Huge debt to GDP ratio has been identified in several empirical studies as a factor that hampers private investment. Three mechanisms through which debt affects private investment have been identified. First, existence of large debt disincentivise private investors because a significant share of their future investment returns would be used to repay the existing debt through a higher tax in future (Borensztein, 1989). Second, excessive debt service payments on existing debt lessens

financial resources available for investment. Third, failure to meet debt obligations may worsen relations with both bilateral and multilateral credit institutions. This may ultimately lead to a decline in external finance to the debtor country. It is against this backdrop that large government debt to GDP will have a negative impact on private investment. In the present study, government debt is defined as central government debt as a percentage of GDP. Consistent with the abovementioned channels through which debt hampers private investment, Oshikoya (1994); Coutinho & Gallo (1996); Borensztein (1989); Greene & Villanueva (1991) all found external debt to impede private investment.

Inflation rate

Inflation rate in the present study is measured as the annual percentage change in consumer price index. High inflation rates are an indicator of macroeconomic instability and the country's inability to control macroeconomic policy. Greene & Villanueva (1991) and Oshikoya (1994) asserts that high inflation rate increases the riskiness of longer-term investment as it erode investment returns. Therefore, it is expected that high inflation rate will have a dampening effect on private investment.

3.5 Data Sources

The data utilised for the study will be extracted from the World Bank Development Indicators (WDI), International Monetary Fund Fiscal affairs Department and World Economic Outlook (WEO) Database. Based solely on data availability, the study draws a panel sample of 45[2] countries out of 48 SSA countries to analyse the impact of public investment on private investment. Moreover, the time-dimension of the study spans from 2005 through 2015. The time-dimension is

[2] Angola, Botswana, Equatorial Guinea, Sao Tome, Ethiopia, Mozambique, Lesotho, Cabo Verde, Niger, Burkina Faso, Benin, Burundi, Cameroon, Central African Republic, Chad, Comoros, Congo, Dem. Republic., Congo, Rep., Cote D Voire, Eswatini, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Namibia, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe

informed by the availability of data and the need to maintain a large sample size, which is a pre-condition for using the Two-Step System GMM estimation technique.

CHAPTER 5: EMPIRICAL RESULTS AND FINDINGS

5.0 Introduction

The present study adopted Dynamic Panel Data Two System GMM estimation technique to estimate the impact of public sector investment on private sector investment growth in SSA. The estimation was developed by (Arellano & Bond, 1991) and later modified by (Arelano & Bover, 1995). Due to the dynamic process of adjustment of investment, the study included two lags of the dependent variable as regressors thus making the model dynamic. The inclusion of the two lags of the dependent variable implies that the current private sector investment growth is dependent on the previous two years of private sector investment growth. The present adopted the two lags because of the prolonged dynamic adjustment process of previous private capital investment to its optimal current level. Moreover, the inclusion of two lags is supported by both economic theory and empirical evidence, which shows that the optimal number of lags normally lies between two and four (Blejer & Khan, 1984). The study estimates four models, namely: population averaged model, random effects model, fixed effects model, and two-step system GMM model. Due to endogeity arising from having an endogenous dependent variable, the study adopts the two-step system GMM model. There are two sections contained in this chapter. Section 5.1 presents the post-estimation results of the specification tests of the two-step system GMM model.. Section 5.2 deals with the results and their interpretation.

5.1 Specification Tests

The two specification tests undertaken by the study are derived from the two-step system GMM model.The results corresponding to the specification tests are contained in Table 5.2 b.

5.1.1 Difference-in-Hansen Test

The present study utilizes the difference-in-hansen test to check for the overidentification of the subset of instruments. This test is undertaken to analyse whether the instruments are jointly valid. The hypothesis is specified as follows:

H_0 = The additional instruments are jointly valid

H_1 = The additional instruments are jointly invalid

It holds that for the instruments to be jointly valid, the p-value has to be statistically insignificant. A statistically insignificant p-value results in the failure to reject the null hypothesis, implying that the instruments are jointly valid. On the other hand, a statistically significant p-value leads to the rejection of the null hypothesis, thus indicating the invalidity of the instruments. The p-value corresponding to the difference-in-hansen test is 0.956, which is statistically insignificant. In this instance, the null hypothesis cannot be rejected. This therefore implies that the instruments are jointly valid.

5.1.2 Autocorrelation Test

The necessary condition for the GMM estimator to be consistent is to ensure that there is no second order correlation. Correlation between the disturbance terms and the instruments renders the GMM inconsistent. The present study utilises the Arellano-Bond test for AR (2) in first differences. The hypothesis for the test is specified below:

H_0 = There is no second order serial correlation

H_1 = There is second order serial correlation

A statistically insignificant p-value will result in the failure to reject the null hypothesis and therefore implying that there is no second order correlation. In contrast, a statistically significant p-value leads to the rejection of the null hypothesis, thus confirming the presence of second order serial correlation. The results from the Arellano-Bond test for AR (2) in first differences indicate a p-value of 0.454 implying that we fail to reject the null hypothesis, and thus conclude that there is no presence of second order serial correlation between disturbance terms and the instruments.

5.1.3 Joint Significance Test

The present study employed the F test to analyze whether or not the coefficients of the variables in the model are jointly significant. The null hypothesis under the the F test is that the coefficients are not jointly significant. A statistically significant p-value will result in the rejection of the null hypothesis. The results from the F test indicate a p-value of 0.000. The highly significant p-value implies a rejection of the null hypothesis, thus concluding that the coefficients of the variables are jointly significant.

Table: 5.1a Analysis of the descriptive statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
T	462	6	3.166	1	11
prinv	462	12.356	6.762	0.936	36.584
puinv	462	6.628	5.053	0.535	29.754
prinv (-1)	420	12.344	6.752	0.936	36.584
prinv (-2)	378	12.223	6.622	0.936	29.966
dcpriv	458	19.691	17.565	1.09364	106.26
edb	461	113.282	161.861	0.3	1314.6

gdppc	462	2.248	4.204	-36.830	18.876
govdebt	462	50.56	44.63854	0.488	419.057
Inf	462	6.90839	6.849613	-35.8367	46.101

Source: Author's computations using Stata 14
Where T is the time-dimension, prinv is private sector investment, puinv is public sector investment, prinv (-1) and prinv (-2) is first lag and second lag of the dependent variable, dcpriv is domestic credit to the private sector, edb is the ease of doing business, gdppc is the real GDP per capita, and inf is inflation.

An analysis of the descriptive statistics shows that all of the variables included in the model have more than 400 observations which bodes well for the degrees of freedom. A good degrees of freedom implies that the estimator will have minimal variance between itself and the population parameter. The distribution of the mean shows that the ease of doing business has the highest mean value of 113.28 whereas the inflation rate has the lowest mean value of 6.91. Turning to the standard deviation, which relates to by how much observations on variables differ from the group ,ease of doing business has the highest standard deviation of 161.861 and public sector investment has the lowest value 5.053.

5.2 Estimation Results and Interpretation

The present study estimated four models: Poupulation Averaged Model, Random Effects Model, Fixed Effects Model[3], and Two-Step System GMM model.However, due to endogeneity arising from having a lagged dependent variable as an explanatory variable, the study adopted Dynamic Panel Data Two System GMM estimation technique to estimate the impact of public sector investment on private sector investment growth in SSA. The estimation was developed by (Arellano & Bond, 1991) and later modified by (Arelano & Bover, 1995). Due to the dynamic

[3] For results on Population Averaged Model, Random Effects, and Fixed Effects model refer to appendices A, B, and C.

process of adjustment of investment, the study included two lags of the dependent variable as regressors thus making the model dynamic. The inclusion of two lags of the dependent variable is informed by both economic theory and empirical evidence. According to Blejer & Khan (1984), the optimal lag inclusion for private investment is between one and three. The two lags implies that current private sector investment growth is dependent on the previous two years of private sector investment growth.

Table 5.2b Dynamic Panel Data Analysis of the Impact of Public Sector Investment on Private Sector Investment Growth in SSA

Estimation Technique: Two Step System GMM									
Dependent Variable: Private Sector Investment	Constant	Lagged Dependent Variable (-1)	Lagged Dependent Variable (-2)	Public Sector Investment	Government Debt	Real GDP Per Capita	Ease of Doing Business	Domestic Credit to the Private Sector	Inflation
Coefficient	19.069 (6.29) ***	0.136 (-1.77)*	0.149 (-2.41)**	-0.412 (-2.92)***	-0.021 (-3.37)***	0.064 (2.61)**	-0.000 (-0.08)	-0.026 (0.46)	0.0195 (1.04)
Specification Tests:									
Difference-in-Hansen Test (p-value)		Sargan Test (p-value)		Second Order Correlation (p-value)		F Test (P-value)		Total Panel Observations	
0.96		0.956		0.454		0		374	

Source: Author's computations using Stata 14
Notes 1. ***, ** and * denote the 1 percent, 5 percent and 10 percent level of significance, respectively.
2. t-statistics in the parenthesis

The lagged dependent variable, private sector investment, both the first and second lag are significant at 10 and 5 per cent level, respectively. The result is consistent with the model being dynamic and confirms that investment adjusts to its optimal level through a dynamic adjustment process dependent on the previous levels of investment. Both the first and second lag display positive signs. These results indicate that the previous levels of private sector investment growth have a positive effect on the current stocks of private sector investment. Given that most of the private capital investments in Sub-Saharan Africa are lagging behind the planned schedule, it is important that policymakers come up with strategies and initiatives to expedite the completion of these projects as they bear a positive impact on current investment growth. Thus all backlog private

investment projects should be accelerate in order to realize the potential gains from the previous stock.

From Table 5.2b, the variable of interest, public sector investment, displays a negative and significant impact on private sector investment growth across the forty-four SSA countries. This gives evidence that public sector investment across SSA economies crowds-out private sector investment growth. Thus the study fails to reject the null hypothesis that, " Public Sector Investment does not significantly and positively impact private sector investment in SSA", and therefore clearly answers the overall objective of the study and the first specific objective. Public sector investment has a negative coefficient of 0.412, and it is highly significant at 1 per cent level. This denotes that, on average, a 1 per cent increase in public sector investment generates a 0.412 percentage decrease in private sector investment growth. The study results are consistent with Coutinho & Gallo (1996) and Wang (2005), who both, despite utilising a different estimation techniques, found public sector investment substituted or crowded private sector investment growth across thirty-three Less Developed Countries (LDCs) and Canada, respectively.

This result bears important implications for Sub-Saharan Africa's goal of having a private-sector led economy. More disquitieng, is the exorbitant public sector investment spending in the region which clearly indicates that it fails to crowd-in the participation of the private sector. This could be due to the inefficient resource allocation, corruption and implementation capacity constraints. Efficient resource resource allocation entails having a systematic public financial management systems that emphasize on projects selection, appraisal, monitoring and performance. Most of the public infrastructural projects in the regions are lagging behind and some have no positive spillover effects that draw on private investors (International Monetary Fund, 2018). As a result, most economies are confronted with huge project overrun costs.

Another factor that usurps the potential benefits from the region's high public sector spending is corruption. Corruption is the deliberate deviation of resources from their intended utilization for unwarranted personal gain. According to the 2018 Corruption Perceptions Index, only three countries in the region- Seychelles, Botswana, Cabo Verde, and Rwanda-rank in the top fifty of the least corrupt countries (Transparency International, 2018). Most of the public resources intended for public infrastructural developments diverted. Therefore, as a result, despite the high public capital spending, the region is still plagued by a huge infrastructural gap especially in sectors such as energy and power generation, transport and communications, and roads. All these sectors are important for the efficient operation of the private sector.

Consistent with a priori expectation that real gdp per capita bears a positive and significant impact on private sector investment, the results from the estimation corresponds to the theoretical expectation. Between the period 2005 through 2015 real GDP in the region has been on a positive territory recording an annual average growth of 2.156 percent (International Monetary Fund, 2018). Equally, gross domestic savings as a ratio of GDP correspondingly increased with real GDP per capita during the abovementioned period, reaching an average 21.822 percent. High income economies are able to mobilise domestic savings which are used to fund investment (Greene & Villanueva, 1991). Similar to the findings by Greene & Villanueva (1991), the results from this study suggest that a one per cent increase real GDP per capita will effect a 0.064 percentage upturn in private sector investment growth.

Public debt in sub-Saharan Africa has been steadily increasing, with 18 countries at high risk of debt distress – a number that has more than doubled since 2013 – and eight countries already in distress (Mustapha & Prizzon, 2018). Since 2009 public debt in the region has been on the rise. Currently, the median public debt stands at 52.6 percent of GDP with total public debt at 47.6

percent (International Monetary Fund, 2018). Both economic theory and empirical research have identified prohitive and unsustainable government debt as one major factor that retards private sector investment growth. SSA is one region that has huge debt. Therefore, in line with theory and substantive empirical evidence on the impact of government debt, the result from Table 5.2b reveals that total governmnet debt has a diminishing effect on private sector investment growth in SSA. The coefficient of total government debt is both negative and statistically significant at 1 per cent level. The result is such that, a percentage increase in total governmnet debt will effect an average decrease of 0.021 in the investment growth of the private sector. The study's results in relation to the impact of government are parallel with the findings of: Coutinho & Gallo (1996); Borensztein (1989); Greene & Villanueva (1991); and Oshikoya (1994). Thus predicated on the foregoing result, the present study fails to reject the null hypothesis that government debt has no significant and negative impact private sector investment growth. Moreover, the result also addresses the second specific objective of the study.

One result that was unanticipated is the ease of doing business on private sector investment growth. The 2018 World Bank's ease of doing business report ranks the region lowly with only Mauritius, Rwanda, Kenya, Botswana, South Africa and Seychelles making the top hundred in the ease of doing business ranking (World Bank, 2018). Therefore, given stringent processes and procedures required to start a business enterprise in many SSA economies and their low ranking on the World Bank's ease of doing business index, a significant and negative effect on private sector investment growth was expected. Though the sign of the coefficient of the cost of business startup procedures is negative as theory dictates, it has no significant impact on private sector investment growth. However, the insignificant does not herald that the business environment in the region is conducive. Policymakers needs to work on promoting regulatory reform that

strengthens the ability of the private sector to increase growth which is centred on lifting people out of poverty through the creation of more job opportunities. Some of the cumbersome regulatory processes that have been cited as impeding private sector investment in the region include: protection of minoriity investors, starting a business and trading across borders, registering property and enforcing contracts, and lastly the protracted and complicated processes around filling corporate tax (World Bank, 2018).

Another notable result, which is rather peculiar, is the impact of domestic credit to firms by commercial banks. Considering that capital markets in SSA are underdeveloped, the study conjectured that domestic credit by commercial banks will thus become an important source of funding private sector investment. However, the observed result contradicts this expectation, as the sign of the coefficient is negative and statistically insignificant. The period post-2002 witnessed a noticeable slump in credit growth in the region. The situation was compounded by the 2008-09 economic and financial crisis that resulted in 2.5 percentage decline in credit to the private sector (International Monetary Fund, 2009). Moreover, the stringent central bank regulations around commercial banks capital adequacy, such as exorbitant required reserve ratios, impose a significant implicit tax on the commercial banks thus impeding commercial credit growth to the private sector (International Monetary Fund, 2002).

5.3 Sub-sample analysis

Sub-Saharan African economies economies are heterogeneous in many respects such as: population, geographical location, democratic and political arrangements, institutional and structural arrangements and income levels. All these factors have potential to influence the results of the present study. Therefore it is important to account for these. Unfortunately, the study cannot

account for all these factors. Based on a methodologically well-defined categorization of SSA economies, and to take into account the difference in the income levels of SSA countries, the study conducted a sub-sample analysis by dividing the fourty-four SSA countries in the sample into lower-income economies and lower-middle and upper-middle economies. The sub-sample analysis aims to find out whether income level of an economy bears any impact on private investment growth through public sector investment.

Results from Table 5.2c present the sub-sample analysis of the impact of public sector investment on private sector investment in Low-income and lower and upper middle income economies of Sub-Saharan Africa. Public sector investment, which is the study's variable of interest, has no significant impact on private sector investment growth in low-income SSA economies countries. By contrast, in comparison to low-income countries of SSA, public sector investment exerts a negative and significant impact on private sector investment growth of lower-middle and upper-middle economies of SSA. The results reflects that lower-middle and upper-middle income economies of the expends a large amount of their fiscal resources on public sector investment with little value to the private sector investment. For example, a comparative analysis of public capital spending between low-income and lower-income and upper-income SSA economies reflects that the latter spends two as much as the former (International Monetary Fund, 2018). To reduce on the crowding-out, lower-income and upper-income SSA economies needs to streamline their public capital expenditure on investments that crowds-in the participation of the the private sector. Moreover, the results, as regards low-income countries, can be largely attributable to the income status of the countries. Low income countries are hampered to mobilize enough financial resources for public sector investments. Other institutional and structural factors, such as rent seeking among

public officials may also have a bearing on the the efficiency of public sector investment on private investment (Transparency International, 2018).

Domestic credit to private firms by commercial banks bears significant and positive impact on private sector investment growth for low-income economies in SSA[4]. The coefficient is both positive and statistically significant at 5 per cent level. On average, a percentage increase in domestic credit advanced to private firms by commercial banks is associated with a 0.118 percentage increase in investment growth of the private sector. The result is in contrast with one obtained for lower-middle and upper-middle income SSA economies. This result could be explained by the high bank non-performing loans as a ratio of gross loans in lower-income and upper-middle income economies. In lower-income and upper-middle income SSA economies commercial banks non-performing loans average 12.3 per cent compared to 5.8 registered by low-income SSA economies (Overseas Development Institute, 2017). In conclusion, it thus shows that accounting for the heterogeneity of the SSA countries, by taking into account the income level status bears an impact on how public sector investment affects private investment growth.

Table 5.2c Dynamic Panel Data Analysis of the Impact of Public Sector Investment on Private Sector Investment Growth in Low-income and lower-middle and upper-middle income SSA countries

Estimation Technique: Two Step System GMM

Low-Income Countries (Without Control Variables)					**Low-Income Countries (With Control Variable)**				
Dependent Variable: Private Sector Investment	Constant	Lagged Dependent Variable (-1)	Lagged Dependent Variable (-2)	Public Sector Investment	Government Debt	Real GDP Per Capita	Ease of Doing Business	Domestic Credit to the Private Sector	Inflation

[4] Blejer & Khan (1984); Greene & Villanueva (1991) and Oshikoya (1994) all found bank credit to be an important variable that influences private investment especially in developing economies.

Coefficient	10.99 (6.09) ***	0.064 (0.39)	-0.256 (-1.52)	-0.168 (-0.70)	-0.007 (-1.32)	0.061 (2.34)**	-0.001 (-0.50)	0.118 (2.29)**	0.043 (1.69)
lower-middle and upper-middle (Without Control Variables)					**lower-middle and upper-middle (With Control Variables)**				
Dependent Variable: Private Sector Investment	Constant	Lagged Dependent Variable (-1)	Lagged Dependent Variable (-2)	Public Sector Investment	Government Debt	Real GDP Per Capita	Ease of Doing Business	Domestic Credit to the Private Sector	Inflation
Coefficient	24.268 (4.92) ***	-0.205 (-3.30)***	-0.084 (-1.71)	-0.404 (-1.80)*	-0.006 (-0.26)	0.090 (1.96)*	-0.001 (-0.16)	-0.025 (-0.20)	-0.002 (-0.03)

Source: Author's computations using Stata 14

Notes 1. ***, ** and * denote the 1 percent, 5 percent and 10 percent level of significance, respectively.
2. t-statistics in the parenthesis

CHAPTER 6: SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

6.1 Intoduction

The overall objective of the study was to analyze the impact of public sector investment on private sector investment growth in sub-Saharan Africa. The present chapter proceeds as follows: section 6.2 presents summary and conclusions drawn from the study; section 6.3 presents the policy recommedations; and section 6.4 deals with the limitations of the study and additional arears of research that can modify the present study.

6.2 Summary and conclusion

The role of public sector investment cannot be under-emphazised in promoting aggregate investment and subsequet economic growth. Public sector investment can directly impact aggregate investment and lead to growth. Alternatively, public sector investment can indirectly spur aggregate investment by its effect on private sector investment. The impact of public sector investment on private sector investment has important ramifications for whether private sector investment grows or shrinks. This is known as the crowding-in/out hypothesis. Public sector investment prioritised on infrastructural developments of high quality and that has positive spillovers are known to crowd-in private sector investment. On the other hand, public sector investment on projects that have little value and financed through unsustainable debts, are detrimental to private sector investment growth (Coutinho & Gallo, 1996). In particular, sub-Saharan African economies have large public investment expeditures compared to other economic regions on the same level of development. What is disqueiting is that the sizable public expenditures are not consistent with the level of private sector investment in SSA. The levels of private sector investment in sub-Saharan African are low.

The overarching objective of this study is to analyse the impact of public sector investment on private setor investment growth in sub-Sahara Africa. To achieve this, the study draws a panel sample of forty-four countries from forty-eight sub-Saharan African economies. The time period of the study spans from 2005 through 2015. Given the adoption of the dynamic panel data, the study appropriately uses the two-step system GMM estimation technique to obtain the empirical results of the relationship between public sector and private sector investment.

The study adopted the two-step sytem GMM that gives ubiased, efficient and consistent estimates in the presence of lagged dependent variables. Moreover, to account for country-specificities, the study segmented the sample into low-income economies and lower-middle and upper-middle income economies and estimated separate models for the two sub-samples. The results from the empirical analysis reflects evidence of public sector investment crowding-out or substituting private sector investment growth in sub-Saharan Africa. Pertaining to low-income sub-Saharan countries, the study found public sector investment to have no effect on private sector investment growth. This is in contrast to the result obtained for the lower-middle and upper-middle income economies of sub-Saharan Africa, were public sector investment significantly dented the growth of private sector investment.

Other significant variables that proved to have a significant bearing on private sector investment growth in sub-Saharan African are real GDP per capita and total government debt. Real GDP per capita supports private sector investment whereas total government debt is detrimental to private sector investment. As a result of the underdeveloped nature of capital markets in sub-Saharan Africa, domestic credit to the private firms by commercial banks is an important source of private investment funding. In low-income sub-Saharan African countries, domestic credit to the private

sector by commercial banks bears a positive and significant impact on private sector investment growth.

6.3 Policy recommendations

Three pertinent areas of policy recommendations to reduce the crowding-out effect of public sector investment on private sector investment growth in Sub-Saharan Africa have been identified. First, sub-Saharan African governments should come up with inclusive models of public sector investment development. For example, encouraging and fostering private sector participation in the region's infrastructural development. SSA governments needs to efficiently select and appraise infrastructural projects that can meet the financial capacities of private sector investors. Public-private partnerships (PPPs) are a tested strategy that can be applied to many sectors. To have well-functioning PPPs, governments ought to establish independent institutions that can regulate and oversee private sector actors so as to ensure that the PPPs do not deviate from their intended mandate and purpose.

The second policy option involve strengthening public investment management systems. Effective public financial management capacity is central to ensuring that resources are expended on public sector investments that promote private sector investment. Policymakers in SSA should strengthen the capacity for project selection and appraisal, and enhance the monitoring and evaluation of project implementation to slash project overrun costs. This will also be instrumental in ensuring that Sub-Saharan Africa has the appropriate quantity and quality public infrastructure that can support private sector investment growth (crowd-in). Third and last, to address the crowding-out effect of public sector investment, efforts to promote regional integration of infrastructure should be increased. A regional approach to the provision of public sector investment is needed to overcome the crowding-out phenomenon in the region. However, this will require effective and

functional institutional and regulatory arrangements in the region, setting priorities for regional investments so as to mobilize resources, synchronizing regulatory frameworks and administrative procedures, and enabling cross-border infrastructure sharing.

Policymakers need to also slash the total government debt as it impedes private sector investment growth. Borrowing levels of sub-Saharan Africa needs to be capped to sustainable levels. This can be done by introducing fiscal rules which limits both internal and external borrowing to a certain percentage of GDP. Enforcement of the fiscal rules and regulations will also be imperative. Moreover, when countries borrow, the debt should be expended only on projects with high marginal returns that can spur both aggregate investment and subsequent growth. Promotion of growth will also lead to an increase in real GDP per capita. A countriy with higher real GDP per capita can better mobilise savings resource which can be channeled toward funding private sector investment. Policymakers can draw on already-existing empirical studies explaining the growth process and determinants in sub-Saharan Africa.

Domestic credit to the private sector (firms) by commercial banks is particularly important in a context where capital markets are relatively underdeveloped compared to advanced economies. The empirical results confirms that domestic credit to private firms is an imperative for private investment. Therefore, to spike private investment growth, policymakers need to adopt an accomodative monetary policy stance that will increase credit growth. This can be achieved through a combination of alternatives such as lowering the bank/policy rate which will result in the banks lending rate declining. Moreover, some of the stringent statutory capital requirements imposed on commercial banks, such as the excessive reserve requirements ratios ought to be relaxed so as to promote credit growwth which will be channled through to private sector investment.

6.4 Limitations of the study and areas of further research

The primary limitation of the study was lack of disagregated data relating to public sector investment. There may be some components of public sector investment that promotes private sector investment, however, because of aggregated data these components cannot be identified with ease. This outturn also hampers the policy prescriptions as policymakers fails to pinpoint the exact optimal components that can be prioritised. In effect, this compromises the efficient allocation of fiscal resources. This is an area of further research. Prospective research who would like to explore these area can utilise the individual country data sources to glean disaggregated public sector investment data. Given the time constraint, the author could not use individual country data sources.

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APPENDICES

Appendix A: Dynamic Panel Data Analysis of the Impact of Public Sector Investment on Private Sector Investment Growth in SSA countries

Dependent Variable: Private Sector Investment Growth	*Population Averaged Model*	*Random Effect Model*	*Fixed Effect Model*
Constant	0.464 (1.28)	1.379 (2.62) ***	8.058 (7.12)***
Lagged Private Sector Investment (-1)	0.915 (18.02)***	0.821 (15.88) ***	0.525 (9.72)***
Lagged Private Sector Investment (-2)	0.0553 (1.05)	0.068 (1.27)	-0.128 (-2.39)**
Public Sector Investment	-0.030 (-1.39)	-0.040 (-1.29)	0.038 (0.93)
Domestic Credit to Private Firms by Banks	0.007 (1.12)	0.016 (1.57)	0.018 (1.87)*
Cost of Business Startup Procedures	-0.001 (-0.75)	-0.002 (-1.34)	-0.001 (-0.80)
Real GDP Per Capita	0.0504 (1.42)	0.050 (1.31)	0.086 (2.27)**
Government Debt	0.003 (0.67)	0.000 (0.07)	-0.001 (-0.08)
Inflation	-.007 (-0.40)	0.025 (1.03)	0.021(0.71)
Total Panel Observations	374	374	374
Difference-in-Hansen Test (p-value)	_	_	_
Wald Test	0.000	0.000	_
Sargan Test (p-value)	_	_	_
Arellano Bond Test Serial Correlation 2nd order (P-value)	_	_	_
F Test (P-value)	0.000	_	0.000
Adjusted R-squared	_	0.804	0.693
Pooling F-statistic	_	_	_

Source: Author's computations using Stata 14

Notes 1. ***, ** and * denote the 1 percent, 5 percent and 10 percent level of significance, respectively.

2. t-statistics in the parenthesis

Appendix B: Dynamic Panel Data Analysis of the Impact of Public Sector Investment on Private Sector Investment Growth in lower income SSA countries

Dependent Variable: Private Sector Investment	*Population Averaged*	*Random Effect*	*Fixed Effect*
Constant	-0.029 (-0.08)	0.420 (0.62)	3.134 (3.03)***
Lagged Private Sector Investment (-1)	1.124 (15.10)***	0.974 (13.16) ***	0.737 (10.03)***
Lagged Private Sector Investment (-2)	-0.137 (-1.80)*	-0.119 (-1.58)	-0.290 (-3.96)***
Public Sector Investment	0.091 (2.35)**	0.147 (1.95)*	0.157 (1.52)
Domestic Credit to Private Firms by Banks	0.002 (0.19)	0.016 (1.57)	0.075 (1.40)
Cost of Business Startup Procedures	0.001 (1.44)	-0.000 (-0.11)	-0.002 (-1.17)
Real GDP Per Capita	-0.020 (-0.53)	-0.006 (-0.13)	0.041 (0.97)
Government Debt	-0.005 (-1.32)	-0.009 (-1.44)	-0.001 (-0.09)
Inflation	-0.023 (-1.80)*	0.056 (1.99)**	0.081 (2.54)**
Total Panel Observations	197	197	197
Difference-in-Hansen Test (p-value)	_	_	_
Wald Test	0.000	0.000	
Sargan Test (p-value)	_	_	_
Arellano Bond Test Serial Correlation 2nd order (P-value)	_	_	_
F Test (P-value)	_	_	0.000
Adjusted R-squared	_	0.816	0.766
Pooling F-statistic	_	_	_

Source: Author's computations using Stata 14

Notes 1. ***, ** and * denote the 1 percent, 5 percent and 10 percent level of significance, respectively.
2. t-statistics in the parenthesis

Appendix C: Dynamic Panel Data Analysis of the Impact of Public Sector Investment on Private Sector Investment Growth in lower and upper middle income SSA countries

Dependent Variable: Private Sector Investment	*Population Averaged*	*Random Effect*	*Fixed Effect*
Constant	0.532 (0.72)	2.909 (2.62)***	14.860 (6.26)***
Lagged Private Sector Investment (-1)	0.801 (11.58)***	0.677 (9.31) ***	0.348(4.65)***
Lagged Private Sector Investment (-2)	0.176 (2.42)**	0.180 (2.44)	-0.006 (-0.08)
Public Sector Investment	-0.061 (-2.13)**	0.147 (1.95)*	-0.372 (-4.46)
Domestic Credit to Private Firms by Banks	0.003 (0.36)	0.003 (0.25)	-0.023 (-0.37)
Cost of Business Startup Procedures	0.002 (0.31)	-0.004 (-0.66)	-0.005 (-0.57)
Real GDP Per Capita	0.087 (1.45)	0.098 (1.54)	0.127 (2.03)**
Government Debt	0.009 (1.67)*	0.001 (1.13)	-0.002 (-0.09)
Inflation	-0.034 (-1.16)	-0.039 (-0.94)	-0.071 (-1.32)
Total Panel Observations	197	180	180
Difference-in-Hansen Test (p-value)	_	_	_
Wald Test	0.000	0.000	
Sargan Test (p-value)	_	_	_
Arellano Bond Test Serial Correlation 2nd order (P-value)	_	_	_
F Test (P-value)	_	_	0.000
Adjusted R-squared	_	0.733	0.448
Pooling F-statistic	_	_	_

Source: Author's computations using Stata 14

Notes 1. ***, ** and * denote the 1 percent, 5 percent and 10 percent level of significance, respectively.
2. t-statistics in the parenthesis