Empirical Investigation of the Effect of Public Investment on Private Investment in Tanzanian Context

Mnaku Honest Maganya, (PhD)

Senior Lecturer Institute of Finance Management (IFM) Faculty of business and Economics (FBE) Department of Economics and Tax Management P.O. Box 3918 Dar es Salaam, Tanzania
Email: mnaku.maganya@ifm.ac.tz

Abstract

This paper sought to investigate empirically the effect of public investment on private investments in Tanzania. The literature gives inconsistent empirical findings on whether public investment crowds-in or crowds-out private investment either in the short-run or in the long-run. The measures undertaken in Tanzania to raise public investment overtime had surely affected key economic indicators especially investment in the private sector. This provides a rationale for a study of this nature being designed to investigate the crowd-out hypothesis of public investment in Tanzanian context. Quantitative technique is being employed which involves uses of time series data. Using the Vector Error Correction Model approach, findings suggest that public investment significantly crowds-out private investment. On the other hand, Gross Domestic Product was found to have positive significant impact on private investment. Based on this findings, it is recommended that the complementary developmental roles in public-private partnership, the government should emphasize on developing and maintaining of infrastructural services, quality education system and research development, industrialization, good governance and institutional framework at the expense of any spending which are being driven politically with no economic valuation or justification.
Keywords: Public Investment, Private Investment, Crowding-out Effect, Crowding-in Effect, Vector Error Correction Model.

Introduction

Investment in the private sector is necessary for sustainable economic progress, and how public policy affects private sector investment is an important but unsettled question (Nguyen & Trinh, 2018). Public investment in infrastructure development is widely believed to impact positively on private investment. If this is what is happening in the real world, then public investment may not only promote economic growth directly but also indirectly by spurring investment in the private sector (Merga, 2022). However, from the literature point of views some it has been suggested that public investment crowds out private investment,

as a result would lead to substantially different policy implications with regard to public investment. This is unsettled and important policy issue, which rationalize and motivates this current empirical analysis of the effects of public investment on private investment in developing countries and Tanzania in particular. Private investment is an important channel for the efficiency and effectiveness of fiscal policy and promoting economic growth (Fournier, 2016). Expansionary fiscal policy such as reducing taxes and increasing public expenditure affects private investment positively and can lead to economic growth. This link can explicitly be shown simply by considering massive government investment in infrastructure which will lead to increase in private investment many consumers can be reached at a given point in time. However, it can also crowd out private investment by increasing the interest rates in the primary and secondary financial markets (Dreger & Reimers, 2018).

Public capital stock is the main conduit as far as public investment is concern. Sufficient and adequate level of public capital has a positive impact on overall economic activity and productivity (Nguyen & Trinh, 2018). This positive effect on growth is in part brought about by the capacity of capital in the public sector to attract or crowd-in capital from the private sector. Researches for prospective foreign investors in developing countries show that the availability and quality of infrastructure is important factor in ranking favorable and potential sites for the location of direct investment (Makuyana & Odhiambo, 2019). Normally, the crowd-in effect occurs when public investment forges such capital stock in the public sector that complements and increases the rate of return of capital in the private sector. The crowding-out effect has traditionally been the focus of attention by researchers in economic arguments concerning the effect of public investment on private investment (Bahal *et al.,* 2018).

On the other hand, the possibility that public investment may promote private investment has been suggested by researchers, directing attention to the rise in the productivity of private capital stock as a result of the accumulation of capital in the public sector through public investment expenditure (Okisai, 2018). In the Aschauer's model public investment affects private investment largely through the following two ways. The first is the positive effect that appears in the profit function through the productivity effect of capital stock in the public sector, which is called the crowding-in effect. The other is the negative effect of public investment expenditures that appears in the private investment function, and this effect is mainly comprises of the so-called crowding-out effect as against the crowding-in effect (Aschauer, 1989).

The main purpose of this study is to empirically examine the effect public investment on private investment in Tanzanian context. The findings of the study of this nature have vital policy implication for economic growth and development of the economy. The fiscal policy adjustments impact upon investment in the private sector, hence it becomes crucial looking into such dynamics for development of relevance for policies in both developed and developing countries. This study has overcome some of the difficulties posed by uses of normal econometrics techniques such as OLS with non stationary variables, among other techniques that are not suitable for time-series data analysis by adopting the Vector Error Correction Model (VECM) approach which is a more robust technique.

Literature Review
Theoretical Framework
For the purpose of this study Keynes' general theory of employment, Interest and money is being employed, which was propounded in 1936. Two main assumptions of which

underline the theory is price rigidity and non neutrality of money. Keynes' intervention in macroeconomic issues provided origins for most of investment theories, by arguing that investment project depends on the marginal efficiency of capital, relative to the price of capital which is interest rate. Keynes emphasis was on the volatility of investment in the private sector given that domestic and foreign investors cannot forecast with certainty their returns on investment. The significant feature of Keynesian theory is that, although investment and saving must be identical ex-post, investment and saving decision are taken by different decision makers and there is no reason why ex-ante investment should equal ex-ante savings in the steady state. The Accelerator model predicts that the larger the difference between the existing and desired capital stock the greater will be the rate of investment. The idea is that corporations plan to lower the gap between the desired capital stock, K*, and the actual capital stock at the beginning of year one, K_{t-1}, in each period. Hence the net investment equation is given as:

$$I = \delta(K^* - K_{t-1})$$

Where I= net investment, K*= desired capital stock, K_{t-1}= capital stock during the previous period and δ= partial adjustment coefficient.

From the literature it has been argued that variables such as internal funds, output cost of external financing and other variables may be included as determinants of desire capital stock. It has been noted that the accelerator model may be transformed into a theory of firms' investment behavior by adding a specification of K* and a theory of replacement investment. In the accelerated model, K* is proportional to output, but in alternative models, K* depends on other variables such as internal and external funds (Mankiw, 1998).

Empirical Literature Review

Theoretically, spending on public investment can have two effects on private investment. It can either crowd in or crowd out private investment. Public investment can play a catalytic role in private sector capital growth when focused on infrastructural projects such as education, transport systems, energy generation and distribution, health and water systems (Huang *et al.,* 2018). The presence of such core infrastructures reduces the costs facing private sector firms and creates an enabling environment for new and higher private sector capital formation and output growth. Alternatively, spending on public investment in economic infrastructure can reduce the start-up cost for a private business. A private enterprise can quickly set up operations when the prerequisite public infrastructure is well available (Manda, 2019). The presence of well-developed public infrastructure would reduce start-up cost of the private firms. For instance, the availability of an extensive railway network such as SGR can enable a private firm to transport the heavy plant and machinery needed in setting up a new factory. Private enterprises can also lower their unit production costs in the use of the railway line through reaping the economies of scale in the bulk transportation of raw materials and output (Thilanka & Ranjith, 2018).

Crowding in Effects of Public Investment

Literature about the crowd-in effect is less abundant. The conclusions obtained by Islam *et al* (2018); Eden & Kraay (2016); Merga (2022); Pronce and Navarro (2016); Dash (2016); Barbosa *et al* (2016); Gatatwa & Bello (2010); Dreger and Reimers (2016); Abiad *et al* (2016); Carrillo *et al* (2018) indicate that public investment has a significant and positive impact on private investment, thus according to the referred authors, spending on public investment crowds in private investment. Public investments in infrastructures were cited as

the main cause of crowd in effects identified by the several authors. Following their ideas, infrastructures such as airports, seaports, schools, highways, hospitals, and other social infrastructures can stimulate private investment by increasing the private sector productivity, thereby creating sustainable business. The construction of these infrastructures ensures the availability of public goods and services such as health, education, telecommunications, water supply, sewerage system, all factors that contribute to promote private activities in the economy.

Crowding out Effects of Public Investment

On the downside, spending on public investment can crowd out private investment when it is: (i) Financed by borrowing with limited available resources; (ii) Undertaken in commercial activities even though it is established that private investment is more efficient than public investment; and (iii) undertaken in inefficient industries that need to be state subsidized by the state (Omitogun, 2018). The conclusions obtained by Huang *et al* (2018); Manda (2019); Thilanka & Ranjith (2018); Ahmed (2021); Nguyen & Trinh (2018); Okisai (2018); Bahal *et al* (2018); Fournier (2016); Ouedrago *et al* (2019) indicate that public investment has a significant and negative impact on private investment, thus according to the referred authors, spending on public investment crowds out private investment. Obtained results by authors suggests that public investment financed by borrowing can increase capital costs beyond the reach of the private sector enterprises, which lowers the expected rate of return on private capital. Private investment will thus be negatively affected. Public investment also inhibits private investment growth when it produces commodities in direct competition with the private sector. This can be the case when the state participates in commercial activities in which the private sector has higher and growing marginal productivity than its counterpart (Nguyen & Trinh, 2018).

Synthesis of the Literature Review and Research Gap

The studies above show that the effect on public investment on private investment by country. Overall, the majority of research concluded that public and private investment had a crowding-in and crowding-out connection, with just a few studies finding no clear evidence to support these hypotheses. However, there is a growing amount of empirical evidence supporting either a public investment-led or a private investment-led economic growth process. On the other hand, some argue that public investment should be used in conjunction with private investment. On the basis of these mixed findings, it is inappropriate to draw any conclusions about the effect of public investment on private investment in Tanzania.

For sure the literature reviewed gave conflicting accounts on how spending on public investment affects private investment. The present study did not seek to solve the controversy surrounding the impact of public investment on private investment. It however used a different methodology to enlighten on the relationship between the two variables and employ time-series data on Tanzanian context. The use of VECM in this study is more superior approach than OLS and also enabled the study not only to know the relationship between them but also gave information on how long it took for the impact of spending on public investment on private investment to fizzle out.

Data and Methodology

Data

The variables of interest selected in this study based on the availability and reliability of data includes; Private Investment, Public Investment, GDP growth and Interest Rate. The data were obtained from Tanzania National Bureau of Statistics (NBS) and International Financial Statistics (IFS) Data Stream published by International Monetary Fund (IMF). The study use quantitative research design in which time series data are being used over a period of 1985 to 2022, the period has been chosen because of existence of policy changes particularly following new regime and adoption of different structural adjustment programmes.

Econometric model

The used model in this paper is the augmented investment model developed in section 2.1 (theoretical framework) which is build out of the partial adjustment mechanism which explains private capital formation as;

$$\Delta K_t = \beta(K_t^* - K_{t-1}) \text{ with } \Delta K_t^* > K_{t-1}; \text{ But } \Delta K_t = 0 \text{ when } K_t^* \leq K_{t-1};$$

Where ΔK_t is the net investment, K_t^* is the desired capital stock, K_{t-1} is the capital stock of the economy at the beginning of period t and β is the adjustment speed coefficient. The K_t^* and β are being determined endogenously. From the above given equation, is being observed that actual private capital stock adjusts to the difference between desired private capital in time t and actual private capital in the previous years. It follows therefore that private capital formation can be expressed as follows;

$$PI = (GI, IR, GDP) \dots \text{Eq (1)}$$

Where PI is private capital formation, GI is public capital formation, IR is the real interest rate, and GDP is growth rate of real GDP. In developing countries like Tanzania, public investment in crucial sectors like transport, communication, education, health and energy can complement private investment because such projects tend to reduce production costs and raise the rate of returns on private capital stock (Gatatwa & Bello, 2010). However, based on the neo-classical view public investment which results in large fiscal deficits raises interest rates and this is expected to have a negative impact on the speed of adjustment, hence crowds-out private investment. This shows that the effect of GI on PI can be positive or negative depending on which effect is greater complementary or substitution. Following the Keynesians hypothesis, a rise in rate of interest increases the capital costs which discourages investment hence a decline in desired stock of capital. The implication is that there is an inverse relationship between interest rate and desired capital stock. Based on this explanation the model in this study is specified as;

$$PI_t = \beta_0 + \beta_1 GI_t + \beta_2 IR_t + \beta_3 GDP_t + \varepsilon_t \dots Eq(2) \quad \beta_0 \neq 0, \beta_1 \neq 0, \beta_2 < 0, \beta_3 > 0$$

The Vector Error Correction Model (VECM) has been employed in this paper, which is basically an extension of the Granger Causality test and allows going beyond the analysis of bivariate framework. The VEC equation contains lagged values of all the series in the system. The aim of the analysis is to provide good statistical representation of the past interaction between the variables of interest. Since the VAR involves series of equations, it is assumed that each equation contains K lagged values as such the equation could be estimated using the OLS approach. Based on the specification in Eq(2) above, VEC models in this study is presented as:

$$PI_t = \beta_0 + \sum_{j=1}^{k} \beta_{1j} GI_{t-1} + \sum_{j=1}^{k} \beta_{2j} IR_{t-1} + \sum_{j=1}^{k} \beta_{3j} GDP_{t-1} + \beta_4 EC_{t-1} + \varepsilon_{1t}$$

$$GI_t = \beta_0 + \sum_{j=1}^{k} \beta_{1j} PI_{t-1} + \sum_{j=1}^{k} \beta_{2j} IR_{t-1} + \sum_{j=1}^{k} \beta_{3j} GDP_{t-1} + \beta_4 EC_{t-1} + \varepsilon_{2t}$$

$$GDP_t = \beta_0 + \sum_{j=1}^{k} \beta_{1j} GI_{t-1} + \sum_{j=1}^{k} \beta_{2j} IR_{t-1} + \sum_{j=1}^{k} \beta_{3j} PI_{t-1} + \beta_4 EC_{t-1} + \varepsilon_{3t}$$

$$IR_t = \beta_0 + \sum_{j=1}^{k} \beta_{1j} GI_{t-1} + \sum_{j=1}^{k} \beta_{2j} PI_{t-1} + \sum_{j=1}^{k} \beta_{3j} GDP_{t-1} + \beta_4 EC_{t-1} + \varepsilon_{4t}$$

From the given equations, EC_{t-1} is error-correction term lagged one period. And its coefficient expected to have a negative sign. The estimated εs are the stochastic error terms also called impulse or shocks elements. This helps to provide a clear distinction between causality and correlation in the study as the impulse responds function in the system.

Results and Discussions
The Unit Root Test
    Variables in the study were tested for a unit root using an Augmented Dickey-Fuller test (ADF). The results of the stationarity tests at level show that all of the variables have a unit root. Since the p value for all variables found to be greater than 0.05, we accept null hypothesis that means variables are not stationary. It can also be confirmed that values of computed Z statistics are less theoretical Z statistics at 5 percent level of significance. Having found that the variables are not stationary at level, the next step is to difference the variables once in order to perform stationarity tests on differenced variables (Dickey-Fuller, 1981). The results of the stationarity tests on differenced variables confirmed stationarity. The ADF test results are being presented in Table 1 variables at levels suggests that at the one, five and ten percent significance levels we cannot reject the null hypothesis. In order to avoid spurious regression results, the unit root test was conducted at first difference of variables were p values was found to be less than 0.05 hence rejecting the null hypothesis of non stationarity.

Table I
Unit Root Test Results at Levels

	Z statistic	Interpolated Dickey-Fuller		
		1% Critical Value	5% Critical Value	10% Critical Value
PI	-0.257	-3.702	-2.980	-2.622
GI	0.814	-3.702	-2.980	-2.622
IR	-3.956	-3.702	-2.980	-2.622
GDP	3.615	-3.702	-2.980	-2.622

Table II
Unit Root Test Results at First Difference

	Z statistic	Interpolated Dickey-Fuller		
		1% Critical Value	5% Critical Value	10% Critical Value
PI	-0.021	-3.750	-3.000	-2.630
GI	0.032	-3.750	-3.000	-2.630
IR	-0.045	-3.750	-3.000	-2.630
GDP	0.019	-3.750	-3.000	-2.630

The ADF test results with variables at first differenced are shown in Table II above; from the table it's clear that unit root problem does not exist for all variables for which have absolute Z values which are less than 0.05.

Cointegration Test

Following the confirmation that all variables included in the analysis are integrated of order one, the next step is to test for the existence of a cointegration relationship among the variable series using the Johansen-Juselius. The cointegration test results for all variables in the study are reported in the Tables III below. Test results suggest that there are two cointegrating equations, since trace statistics are less than critical values at 5 percent level of significance and two lags were found. Trace statistics is used to test null hypothesis that rank is zero against alternative hypothesis that rank is positive.

Table III
Johansen Cointegration Test Results for PI and GI

Maximum Rank	Parms	LL	Eingen Value	Trace Statistics	5% Critical Value
0	20	-2292.06		31.10	47.21
1	27	-2281.99	0.4780	10.96	29.68
2	32	-2277.52	0.2508	2.01	15.41
3	35	-2276.51	0.0628	0.00	3.76
4	36	-2276.59	0.0000		

NB: Number of observations 35, number of lags 2.

Estimation of long-run relationship

After establishing that the residual of the regression as provided in equation two (2) is stationary, so the variables are cointegrated as such the regression output at first difference are not spurious (Engle & Granger, 1987). The estimation results obtained representing long-run relationship amongst the selected variables are presented in Table IV. Public investment (GI) found with a negative sign (-0.8089) and statistically significant at one percent level which means public investment crowd-out private investment in Tanzania. The implication is that one unit increase in public investment decreases private investment by 0.81.Similarly, interest rate found with negative sign as it was expected (-0.3551) and statistically significant at five percent level. Interest rate should be inversely related with the level of investment undertaken whether public or private since it add to the cost of borrowings. GDP and private investment were found to be positive related (4.8052) and statistically significant at one percent level. This implies that one unit increase in GDP of the country increases private investment by 4.8 times. These variables in the model generally explained the total changes of the private investment by 85.55% according to adjusted R-squared obtained and the rest of the percentage can be determined by other variables which are not included in this model.

Table IV
Long-Run Coefficient Estimation Results

Source	SS	DF	MS	Number of observations = 37	
Model	82.5990	27.5330	27.5330	F(3, 9) = 229.79	
Residual	3.4747	0.1198	0.1198	Prob > F = 0.0000	
				R-Squared = 0.8596	
				Adj. R-Squared = 0.8555	
				Root MSE = 0.3461	
PI	**COEFF.**	**STD. ERR**	**t statistic**	**P > [t]**	**[95% Confid. interval]**
GI	-0.8089*	0.2787	-2.90	0.0070	-1.3790	-0.2389
IR	-0.3551**	0.1370	-2.56	0.0160	-0.6320	-0.0710
GDP	4.8052*	0.5846	8.22	0.0000	3.6096	6.0007
CONS	-68.1983*	7.9799	-8.55	0.0000	-84.5191	-51.8778

NB: * and ** statistically significance at 1% and 5% respectfully.

Estimation of the Vector Error Correction Model (VECM)

VECM methodology superficially resembles simultaneous-equation modeling in that several endogenous variables are being considered together. But each endogenous variable is explained by its lagged, or past, values and the lagged values of all other endogenous variables in the model; usually, there are no exogenous variables in the model. However, estimating a model with first differenced variables leads to loss of long-run information. Therefore, an error correction model is used to bridge both short-run and long-run relationship within the context of a single equation (Sims, 1980). Before estimation of the specified regression model, the optimal lag length of each variable in the model have to be determined in order to ensure that the model is well specified. Final Prediction Error (FPE), the Akaike Information criterion (AIC), Hannan and Quinn Information Criterion (HQIC) and the Schwartz Bayesian Information Criterion (SBIC) were used in this study in order to determine the optimal lag length. Ultimately, the optimal lag length were selected basing on which lag was mostly selected by four specified criteria. Table V below summarizes test results of lag selection criteria.

Table V
Optimal Lag Selection Test Results

Variables	Lags	FPE	AIC	HQIC	SBIC
PI	2	0.0214	-1.0082	-0.9787	-0.9139
GI	1	0.0247	-0.8648	-0.8352	-0.7705
IR	1	25.7448	6.0859	6.1154	6.1802
GDP	2	0.0003	-5.4472	-5.3882	-5.2586

The estimation results of VEC model when lagged in one period, and error correction term (ECT) is included for every variable is presented in Table VI. As can be seen from ΔPI equation in Table VI, public investment (PI) has an insignificant negative effect on public investment (PI). Negative relationship confirm neoclassical theory that government expenditure crowds out private investment. Keynesian approaches project that government expenditure strictly crowds in private investment, a result which is shown in the work of some previous studies in the developing countries such as (Omojolaibi *et al.,* 2016). However, from ΔGI equation, real GDP is having a positive effect on public investment (PI) which is

statistically significant at five percent level. It can also be observed from the ΔPI equation below that the one year lagged of interest rate (IR) has an insignificant negative impact on private investment. Hence, current year interest rate has no significant impact on the previous values of private investment. This is in line with the study of (Kollamparambil and Nicolaou, 2011; Forgha and Mbella, 2013). The coefficient of real GDP shows that one year lagged of real GDP positively influence current private investment in Tanzania. This implies that for private investment to increase in the current year, the total volume of goods and services produce within the country in the previous period should increase.

Table VI
Vector Error Correction Model Test Results

ΔPI	Coefficients	Std. Error	Z	P > [Z]	[95% Conf. Interval]	
EC_{t-1}	-0.0325	0.0208	-1.55	0.122	-0.0731	0.0086
PI_{t-1}	-0.1030	0.2333	-0.44	0.659	-0.5602	0.3542
ΔGI_{t-1}	-0.3705	0.2477	-1.50	0.135	-0.8559	0.1149
ΔIR_{t-1}	-0.0035	0.0062	-0.57	0.570	-0.0158	0.0087
ΔGDP_{t-1}	0.4465	1.2881	0.35	0.729	-2.0783	2.9713
Constant	0.1256	0.0843	1.49	0.136	-0.0396	0.2908
ΔGI	Coefficients	Std. Error	Z	P > [Z]	[95% Conf. Interval]	
EC_{t-1}	-0.0405	0.0202	-2.01	0.044	-0.7991	-0.0009
PI_{t-1}	-0.1427	0.2253	-0.63	0.527	-0.5844	0.2989
ΔGI_{t-1}	0.0166	0.2392	0.07	0.945	-0.4524	0.4855
ΔIR_{t-1}	0.0091	0.0060	1.51	0.131	-0.0027	0.0208
ΔGDP_{t-1}	2.4897	1.2444	2.00	0.045	0.0508	4.9286
Constant	-0.0919	0.0814	-1.13	0.259	-2.2516	0.0676
ΔIR	Coefficients	Std. Error	Z	P > [Z]	[95% Conf. Interval]	
EC_{t-1}	-1.7380	0.8044	-2.16	0.031	-3.3146	-0.1615
PI_{t-1}	-2.0385	9.0046	-0.23	0.821	-19.6872	15.6103
ΔGI_{t-1}	5.3214	9.5603	0.56	0.578	-13.4163	24.0592
ΔIR_{t-1}	0.2092	0.2404	0.87	0.384	-0.2604	24.0592
ΔGDP_{t-1}	-64.4545	49.7283	-1.30	0.195	-161.4114	0.6804
Constant	-0.0002	3.2538	-0.00	1.000	-6.3776	33.0025
ΔGDP	Coefficients	Std. Error	Z	P > [Z]	[95% Conf. Interval]	
EC_{t-1}	0.0013	0.0033	0.40	0.691	-0.0052	0.0079
PI_{t-1}	-0.0125	0.0373	-0.34	0.737	-0.0857	0.0606
ΔGI_{t-1}	0.0435	0.0396	1.10	0.272	-0.0341	0.1212
ΔIR_{t-1}	0.0008	0.0009	0.79	0.428	-0.0011	0.0027
ΔGDP_{t-1}	0.2849	0.2060	1.38	0.167	-0.1189	0.6886
Constant	0.0385	0.0135	2.84	0.005	0.0118	0.0647

The Cumulative Sum (CUSUM) Test for Structural Break

The CUSUM test was introduced by Brown *et al* (1975) as a test for structural breaks in the coefficients (parameter stability) of a linear regression model. Statistical inference conducted is based on a sequence of sums, or sums of squares, of recursive residuals (standardized one-step-ahead forecast errors) computed iteratively from nested subsamples of the data under consideration. The CUSUM test bases its result on whether the time-series

data set abruptly changes in ways not predicted by the formulated model of the study. Said more technically, it tests for structural breaks in the residuals.

Table VII
Cumulative Sum Test Results for Parameter Stability.

Sample: 1985 – 2020 H0: No structural break		Number of obs = 37		
	Test	Critical value		
Type	Statistic	1%	5%	10%
Recursive	2.0281	0.0330	0.0479	0.0599

These results accept the null hypothesis of no structural break at five percent level of statistical significance. Selected sample of the study it does track the data over time, and hence obtained regression results is not bias.

Concluding Remarks

The main objective of this study was to empirically investigate the effect public investment on private investments, specifically whether public investment crowd-in or crowd-out private investment. During period in which the country was experiencing the declining economy, the government of Tanzania had to use different measures to control expenditures and raising tax base. These measures affected key economic indicators in country especially investment in the private sector which share the same source of internal funds with government. These facts provide rationale for the study of this nature being designed to empirically investigate the relationship between public investment and private investment including the nature of the causality between those variables of interest. This study uses the Vector Error Correction Model (VECM) technique of estimation, which is being designed for use with non-stationary series that are known to be cointegrated.

Obtained findings of the study suggest GDP have positive statistically significant impact on public investment. Public investment is reported to be more important than private investment in the growth process. There is also a complementary relationship between the two components of investment in the long run. Thus, it is crucial for policy makers not to cut back on efficient component of public investment, but, raising the infrastructural public investment to a level that promotes investment in the private sector in the long run thereby it indirectly boost economic growth. Then, private sectors invest more resources in those profitable business environments. Government should have to pay attention in formulating policies in the provision of more financial resources for the private sectors, so that it is important to stimulate private sectors investment directly and boost output growth indirectly through activities in the private investment.

Based on the findings of these study, it is also recommended that there should be a complementary developmental roles in public-private partnership, the government of Tanzania should focus on emphasizing development and maintenance of transport and telecommunication services, quality education system and health centers, good governance and institutional framework at the expense of any spending which are being driven politically with no economic valuation or justification. Once these issues are put on place, then private sector should be crowded-in by any increases in public expenditure towards short-term or long-term investment.

This paper corroborates some of the results of the previous literature by providing evidence of a strong crowding-out effect, which appears significant and large in the medium and long term. It further contributes to the literature by illustrating the role of institutional factors and public policy areas in Tanzanian context. Moreover, the study had methodological contribution by employment Vector Error Correction (VECM) model which is more superior to Ordinary Least Square (OLS) method.

There are two possible ways for continuing the research on the causation between public and private capital. First, different types of private investment can respond to a shock to public investment in a different manner. Obtaining data on private investment and the stock of capital by categories and assessing the differences in their responses would facilitate practical importance of the results. Second, public and private investment should be analyzed together with other factors including GDP, interest rates, exchange rate, inflation, indebtedness, etc. to understand potential second-round effects of the crowding-out effect and the impact of public and private investment on the economy.

References

Abiad, A., Furceri, P., & Topalova, P. (2016). The Macroeconomic Effects of Public: Evidence from Advanced Economies. *Journal of Macroeconomics*, 50(5), 224-240.

Ahamed, F. (2021). Macroeconomic Impact of Covid-19: A Case Study on Bangladesh. *IOSR Journal of Economics and Finance*, 12(1), 24-29.

Aschauer, D. A. (1989) "Does Public Capital Crowd Out Private Capital?". *Journal of Monetary Economics,* 24(2): 171-188.

Bahal, G., Raissi M., & Tulin, V. (2018), Crowding-out or Crowding-in? Public and Private Investment in India, *World Development. Elsevier*, 109(9), 323-333.

Barbosa, D., Carvalho, V. M., & Pereira, P. J. (2016). Public Stimulus for Private Investment : An Extended Real Options Model. *Economic Modelling*, 52(5), 742-748.

Brown, R. L., Durbin, J., & Evans, J.M. (1975). Techniques for Testing the Constancy of Regression Relationships over Time. *Journal of the Royal Statistical Society*, 37(2), 149-192.

Carrillo, A. L. B., Pino, V. M. V., & Heredia, L. C. A. (2018). Analysis of the Relationship Between Private Investment and Public Investment in Mexico. *International Journal of Economic, Finance and Management Sciences*, 6(4), 174- 184.

Dash, P. (2016). The Impact of Public Investment on Private Investment: Evidence from India, *The Journal for Decision Makers*, 41(4), 288-307.

Dickey, D., & Fuller, W. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica,* 49(4), 1057-1072.

Dreger, C., & Reimers, H. E. (2016). Does Public Investment Stimulate Private Investment? Evidence for the Euro Area. *Economic Modelling*, 58(5), 154–158.

Eden, M. & Kraay, A. (2016). Crowding-in and the Returns to Government Investment in LowIncome Countries. *Policy Research Working Paper 6781*, World Bank.

Engle, R. F., & Granger, C. W. (1987). Cointegration and Error Correction: Representation, Estimation, and Testing., *Econometrica*, 55(2), 252-276.

Forgha, N. G., & Mbella, M. E. (2013). Public Expenditure and Private Investment in Cameroon: A Vector Autoregressive Approach. *Journal of Emerging Issues in Economics, Finance and Banking*, 2(4), 818-832.

Fournier, J. (2016). The Positive Effect of Public Investment on Potential Growth.*Economics Department Working Paper No. 1347*, Organization for Economic Co-operation and Development.

Gatatwa, N. M., & Bello, M. Z. (2010). An Analysis of the Effect of Government Expenditure On Gross Domestic Private Investment in Nigeria. *European Scientific Journal*, 8(17), 48-53.

Huang, Y., Panizza, U., & Varghese, R. (2018). Does Public Debt Crowd Out Corporate Investment ? International Evidence. *The Graduate Institute of International Studies, Working Paper no 08-2018,* Economic Section.

Islam, M., Hossain, A., &Tareque, M. (2018). Impact of Public and Private Investmenton GDP Growth in Bangladesh: Crowding in or out?. *Global Journal of HUMAN-SOCIAL SCIENCE: Economics*, 18(5).

Keynes, J. M. (1936). *The General Theory of Employment, Interest and Money*. London: Macmillan Publishers.

Kollamparambil, U, & Nicolaou, M. (2011). Nature and Association of Public and Private Investment: Public Policy Implication for South Africa. *Journal of Economics and International Finance,* 3(2), 98-108.

Makuyana, G. & Odhiambo, N. (2019). Public and Private Investment and Economic Growth in Malawi: An ARDL-bounds Testing Approach, *Economic Research,* 32(1): 673–689.

Manda, S. (2019). Does Government Borrowing Crowd-out Private Sector Investment in Zimbabwe? *Asian Journal of Economics, Business and Accounting*, 12(1), 1-9.

Mankiw, G. N. (1998). *Principles of Economics*. Volume 1, Dryden Press, University of California.

Merga, T. (2022). Effect of Public Investment on Private Investment: Evidence from Ethiopia, *Applied Journal of Economics, Management, and Social Sciences*, 3(1), 17-24.

Nguyen, C. T., & Trinh, L. T. (2018). The Impacts of Public Investment on Private Investment and Economic Growth. *Journal of Asian Business and Economic Studies*, 25(1), 16 - 32.

Okisai, E. (2018). Impact of Economic Growth on Private Investment in Kenya. *International Journal of Economics, Commerce and Management,* 6(5), 361-372.

Omitogun, O. (2018). Investigating the Crowding Out Effect of Government Expenditure on Private Investment. *Journal of Competitiveness*, 10(4), 136–150.

Omojolaibi, J. A., Okenesi, T. P., & Mesagan, E. P. (2016). Fiscal Policy and Private Investment in Selected West African Countries. *CBN Journal of Applied Statistics*, 7(1), 277–309.

Ouedraogo, R., Sawadogo, H., and Sawadogo, R. (2019). Impact of Public Investment on Private Investment in Sub-Saharan Africa: Crowding in or Crowding out?, *African Development Review*, 31(1): 318–334.

Ponce, L. B. A., & Navarro, R. P. (2016). Effect of Public-Private Infrastructure Investment on Economic Growth. *Network Industries Quarterly,* 18(2), 10-12.

Sim, C. A. (1980). Macroeconomic and Reality. *Econometrica*, 48(1), 1-48.

Thilanka, H. R. A. C., & Ranjith, J. G. S. (2018). The Impact of Public Debt on Private Investment: Sri Lankan Experience. *International Journal of Business and Social Research,* 8(8), 1–10.