Turkish Economic Review
www.kspjournals.org
Volume 3 December 2016 Issue 4

Investment and Economic Growth: An Empirical Analysis for Tanzania

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Abstract. This paper analyzes the causal effect between domestic private investment, public investment, foreign direct investment and economic growth in Tanzania during the 1970-2014 period. The modified neo-classical growth model is used to estimate the effect of investment on economic growth. Also, the economic growth models based on Phetsavong & Ichihashi (2012), and Le & Suruga (2005) are used to estimate the crowding out effect of public investment on domestic private investment on one hand and foreign direct investment on the other hand. In the same way, the crowding out effect of foreign direct investment on domestic private investment is estimated. A correlation test is applied to check the correlation among independent variables, and the results show that there is very low correlation suggesting that multicollinearity is not a serious problem. Moreover, the diagnostic tests including RESET regression errors specification test, Breusch-Godfrey serial correlation LM test, Jacque-Bera-normality test and white heteroskedasticity test reveal that the model has no signs of misspecification and that, the residuals are serially uncorrelated, normally distributed and homoskedastic. Broadly, the empirical results show that the domestic private investment and foreign direct investment play an important role in economic growth in Tanzania. Besides, a revealed negative, albeit weak, association between public and private investment suggests that the positive effect of domestic private investment on economic growth becomes smaller when public investment-to-GDP ratio exceeds 8-10 percent. Similarly, foreign direct investment tends to marginally reduce the impact of domestic private investment on growth. These results suggest that public investment and foreign direct investment need to be considered carefully in order to avoid a reduced positive impact of domestic private investment on growth. Domestic saving may be promoted to encourage domestic investment for economic growth.
Keywords. Public investment, Domestic private investment, FDI, Crowding out effect, Economic growth.
JEL. F21, F43, O40, O47.

1. Introduction

Tanzania is among the least developed countries with a 2012 per capita GDP of $483.48 measured at constant US$ 2005, or $1379.63 measured in purchasing power parity (PPP). Agriculture contributed about 25 percent of GDP while employed more than 70 percent of total labour force during the 2008-2012 period. This unsatisfactory growth performance in Tanzania and other developing countries has been attributed to poor saving and investment (Epaphra,

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2014; Nwachukwu, 2011; Loayza, *et al*., 2000; Khan & Villanueva, 1991). Studies indicate that if Africa is to make significant progress in reducing poverty it will have to sustain average growth rates of about 7 percent or above in the medium to long term, and this will require investment rate of 25 percent of Gross Domestic Product (GDP) or above (UNCTAD, 2014, Clarke, 2013, and ECA 1999). Understandably, between 2000 and 2014, Tanzania had one of the strongest growth rates of the non-oil-producing countries in Sub-Saharan Africa. During that period, annual real GDP growth rate was, on average, 6.6 percent, with 7.2 percent in 2014 (World Bank, 2015). However, per-capita GDP remains low. Agriculture, which accounts for the largest share of total labour force records low levels of investment expenditure. For example, the annual foreign direct investment (FDI) inflows to agriculture are lower than that of mining and quarrying and manufacturing which account for 3.4 percent and 8.2 percent share in GDP respectively (Tanzania Investment Centre, 2015).

Investment plays an important role in economic growth. Countries such as Asian Tiger, which are able to accumulate high levels of investment, achieve faster rates of economic growth and development. Public investment in basic infrastructure can be an essential precondition for capital accumulation in the private sector. Also, public investment in education, health facilities and other public goods which benefit society but for which private incentives are lacking may improve human capital formation and environment in which private sector can thrive, which in turn may lead to economic growth. For example, study by Diamond (1989) finds that capital spending on education, health, and housing has a positive effect on economic growth. However, public investment could also lead to a crowding-out of private investment which would have negative implications for growth (Swaby, 2007). Crowding-out may occur when additional public investment requires raising future tax and domestic interest rate, or if the public sector produces investment goods that directly compete with private goods (Phetsavong & Ichihashi, 2012).

In addition, the utilization of additional physical and financial resources, which would otherwise be available to the private sector, may also depress private investment (Blejer & Khan, 1984, Aschauer, 1989). The crowding-out effect could also occur when a distortion of public sector is too large. In order to finance a rising capital spending, the government needs more financing which in turn generates higher interest rates; therefore, minimizing the private sector's ability to access to monetary markets (Phetsavong & Ichihashi, 2012). Nonetheless, the impact of public investment on private investment is a matter of empirical investigation.

Apart from public investment, private investment may bring technology and create employment and help to adopt new methods of production while enhancing productivity by bringing competition in the economy. Thus, with rising macroeconomic uncertainties such as inflation, investment such as FDI needs to grow at a faster pace in poor countries, because it plays a crucial role in providing much needed macroeconomic stability in these countries. Nevertheless, African's economy remains weak and some of the African countries, for example South Sudan and Central African Republic, face the severe domestic problems such as political instability, macroeconomic policy issues, and social conflicts which hold growth back.

The effects of investment on economic growth are of two folds. First, demand for investment goods forms part of aggregate demand in the economy. Thus, a rise in investment demand will, to the extent that this demand is not satisfied by imports, stimulate production of investment goods which in turn leads to high economic growth and development. Secondly, capital formation improves the

productive capacity of the economy in a way that, the economy is able to produce more output. Further, investment in new plants and machinery raises productivity growth by introducing new technology, which will also lead to faster economic growth (Ipumbu & Kadhikwa, 1999).

Theoretically, the contribution of investment to economic growth has been invariably assumed to be positive. However, the relationship between them is a matter of empirical investigation. For example, Barro (1991), and Levine & Renelt (1992), using cross-country data to test the relationship between public investment and economic growth, fail to produce robust statistical results linking public investment and growth. Similarly, Warner (2014) points out that on average the evidence shows a weak positive association between public investment in both short-run and long-run. Moreover, although international organizations recommend developing countries to rely primarily on FDI because they stimulate economic growth more than other types of capital inflows, Nunnenkamp & Spatz (2004), Saqib *et al.* (2013) finds that FDI adversely affects economic growth while domestic investment has a positive effect on economic growth in Pakistan. Indeed, the link between FDI inflows and growth is far from being firmly established once endogeneity problems and the heterogeneity of host economies are taken into account (Nunnenkamp & Spatz, 2004). Therefore, the effect of FDI on economic growth remains ambiguous.

The main objective of this paper is to examine the impact of investment on economic growth in Tanzania. Specifically, the paper aims at examining the effect of domestic private investment, public or government investment, and FDI on real GDP growth. Evidence for crowding out, or crowding in, is addressed separately through the economic growth models based on Phetsavong & Ichihashi (2012), and Le & Suruga (2005). The study is important because there has been relatively little empirical research that takes into account all the three types of investment. In addition, studies of the extent to which real GDP responds to investment reach somewhat different conclusions. This may be due to differences in countries and time samples, methodologies, and nature and sources of investment and GDP data. The study fills this gap in information by piecing together empirical evidence on some aspects of the Tanzanian economy. The paper uses unit root and co-integration tests, which allow for heterogeneity in parameters and dynamics, to examine the long-run impact of three categories of investment and control variables on economic growth in Tanzania during the 1970-2014 period.

2. An Overview of Investment and Real GDP Growth

Generally, African economy is not homogeneous. Sub-Saharan Africa GDP growth during the 2000-2014 period was 4.7 percent (Figure 1). Central Africa Republic's and Zimbabwe's growth during the last 15 years were, on average, -0.4 percent and -1.0 percent respectively. This is unsurprising because Central African Republic is still affected by political and security crisis while Zimbabwe was affected by high inflation particularly in the second half of 2000s. Furthermore, Northern African growth remains uneven where Libya is highly unstable due to insecurity problems and political and economic governance collapse. As a result the country grew, on average, at the rate of less than 4 percent during the 2000-2014 period. In contrast, Some of East African countries, for example Tanzania and Uganda grew at the rate of 6.6 percent during the last 15 years. The growth rate of 6.6 percent was well above sub-Saharan Africa and World growth rates of 4.7 percent and 2.7 percent, respectively, during the same period. In fact, these countries like Equatorial Guinea of West Africa were recorded with the high increase in FDI during the 2000-2014 period (Figure 2). However, the fluctuation

in East Africa average growth is believed to be caused by the volatile GDP growth in South Sudan, which was recorded at -3.9 percent during the 2000-2014 period (Figure 1). South Sudan also experienced FDI net inflows to GDP ratio of -2.9 percent during the same period. According to World Bank (1989), GDP growth is higher for those countries which have relatively higher investment to GDP ratio.

In Tanzania, the economy recorded a growth rate of 7.3 percent in 2013, up from 6.9 percent in 2012, driven by information and communications, construction, manufacturing and other services (AEC, 2015). Indeed, high rate of economic growth in Tanzania is being supported by public investments in infrastructure, particularly in the transport and energy sectors (AEC, 2015).

In order to compare the proportion of GDP to the key variables adopted in this study, the trends of growth, domestic private investment, public investment and FDI, are illustrated. Figures 3-5 illustrate the trends of economic growth, domestic private investment or simply private investment-to-GDP ratio, public investment-to-GDP ratio and FDI-to-GDP ratio. The overall economic performance of Tanzania during the 1970s and first half of the 1980s was very disappointing. The fall of the economy in the early 1980s mainly was contributed to unsettled security and political conflict with Uganda and marked its lowest growth of -2.4 percent in 1983, but the downfall of the economy in the early 1990 mainly was attributed to financial reforms and macroeconomic uncertainty such as high inflation rate. The real GDP growth rate during the 1970-1985 period, was 2.9 percent, while during the 1986-1995 and the 1996-2014 periods, were 3.1 percent and 6.1 percent respectively (World Bank, WDI, 2016). Over the past few years, inflation has stabilized at single digits, declining from an annual rate of 34percent in 1994 to 6.1 percent in 2014 due to prudent monetary policy, a favourable food situation and declining fuel prices (BoT, 2015). Also, export performance remained strong, driven by gold and tourism receipts (BoT, 2015).

During the 1970-1986 period and early 1990s, overall investment declined significantly mainly due to immense difficulties with high inflation especially during the 1990s. This means that, it has been costly to hold wealth in terms of money because of negative real interest rates. This might be caused by national policies that discourage liberalization of economy where the government controlled the economy. During the entire period of 1970-1986, the gross investment was on average 23.2 percent of GDP and domestic private investment averaged on 6.3 percent. The roles of private sector and financial intermediaries to enhance investment were at low level mainly due to the fact that the discounting rate was negative for most of this period. During the same period public investment and FDI were on average 8.7 percent and 8.2 percent. Domestic private investment was beyond 10 percent during the 1986-2003.

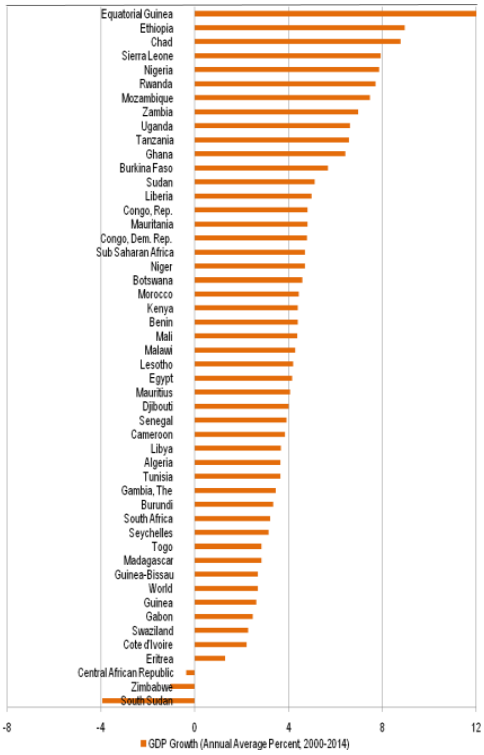

Figure 1.

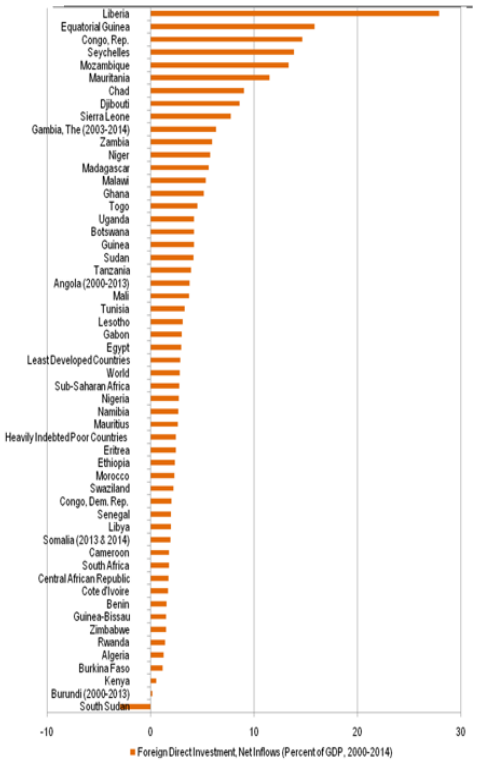

Figure 2.

Figure 1. *Real GDP Growth (Average Percent, 2000-2014)*
Figure 2. *Foreign Direct Investment, Net Inflows (Percent of GDP, 2000-2014*).
Source: Authors Compuation Using Data from World Bank, WDI, 2016

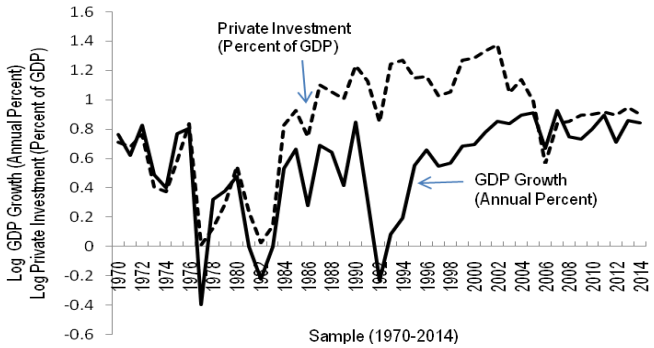

Figure 3. *Real GDP Growth and Private Investment, 1970-2014*

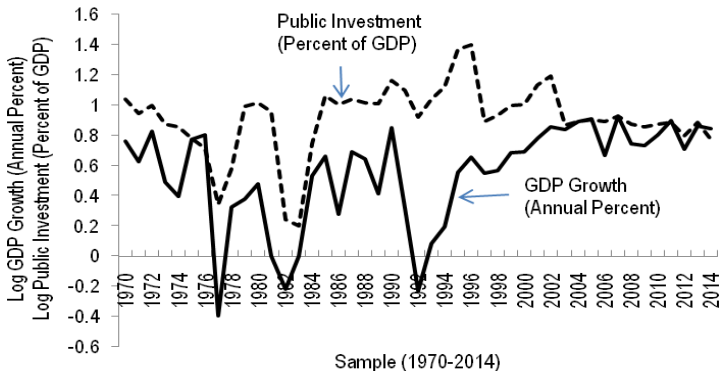

Figure 4. *Real GDP Growth and Public Investment, 1970-2014*

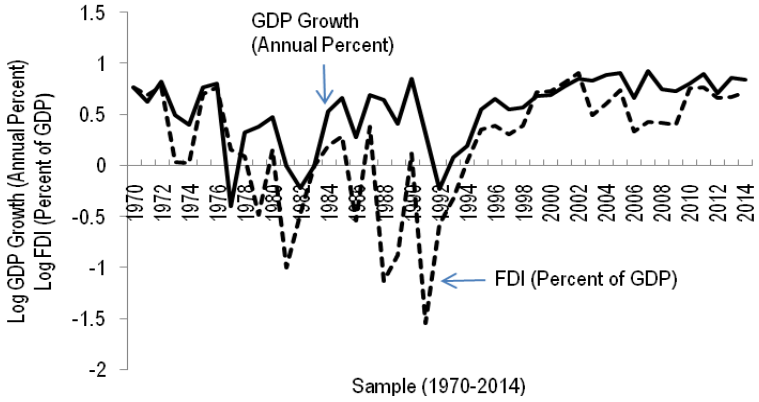

Figure 5. *Real GDP and FDI 1970-2014*
Source: Authors Compuation Using Data from World Bank, WDI (2016)

Although an open economy such as Tanzania can attract FDI to help in the financing of growth, risk, policy uncertainty and other considerations such as global financial crisis may limit the amount of FDI in the host country. For example, the value of FDI was USD 650 million in 2009 compared to USD 744 million in 2008, equivalent to a decrease of 14.5 percent. The decrease was a result of the impact of the global financial and economic crises. Nonetheless, Tanzania undertakes economic reforms to improve the country's corporate environment and allow the private sector to play a greater role in the production and distribution of goods and services, with the government assuming the role of facilitator and regulator (URT, 2015). The country ranked 131st out of 189 economies in the World Bank report *Doing Business 2015* report, representing a drop of one position from the rank of 130th out of 193 countries in the previous year (URT, 2015).

FDI net inflows as percent of GDP was on average 3 during the 2004-2014 period (Figure 6). Its highest value over the past 20 years was 5.2 in 1999, while its lowest value was 0.2 in 1998. Moreover, during the 2008-2014, South Africa, the United Kingdom and Canada accounted for an average of 70 percent of the total FDI inflows to Tanzania implying that the sources of FDI inflows is inadequately diversified, thus exposing the country to risks emanating from external shocks (TIC, 2015). The total value of the investment in the economy increased from USD 8.73 billion in 2012 to USD 11.37 billion in 2013 (URT, 2014) while the inflow of FDI in 2013 was USD 1.88 billion compared to USD 1.80 in 2012 reflecting investment in tourism infrastructure/hotels and mining exploration (URT, 2014). Indeed, on average, services such as trade and repairs, hotels and restaurants, transportations, communications, financial intermediations, real estates, public administration, and health accounted for 42.5 percent share in total FDI and contributed 50 percent in total GDP during the 2008-2014 period (Figure 6). Net inflow of FDI to mining and quarrying was 30.5 percent of total FDI net inflow to Tanzania during the 2008-2014 period while its GDP contribution was lower than 3.5 percent during the same period.

Despite its importance, FDI flows to agriculture in Tanzania was, on average 1.3 percent of total FDI flows during the 2008-2014 period. During the last 10 years, FDI inflows to the agriculture sector was one of the lowest levels of FDI flows to the economy. However, agriculture remain the mainstay of the economy because of the sizeable share of the labour force engaged in the sector and its important role in the economy, contributing, on average, about 25 percent of total GDP over the past 10 years. As a result, the high levels of economic growth in

recent years have not translated into rapid poverty reduction partly because of low productivity in the agriculture sector, which is estimated to employ more than 70 percent of the labour force. About 28.2 percent of Tanzanians are poor, and poverty incidence is about 33 percent in rural areas compared to 21.7 percent in urban areas (HBS, 2011/12). Over the past five years, the agriculture sector grew at an annual average of about 3.2 percent, compared to the economy's overall 6.4 percent annual average growth over the same period, while population growth was estimated at 2.7 percent (World Bank, WDI, 2014). This implies that the key to achieving broad-based growth lies in the significant improvements in agricultural productivity by raising the levels of investment to agriculture sector which is plagued by infrastructure gaps.

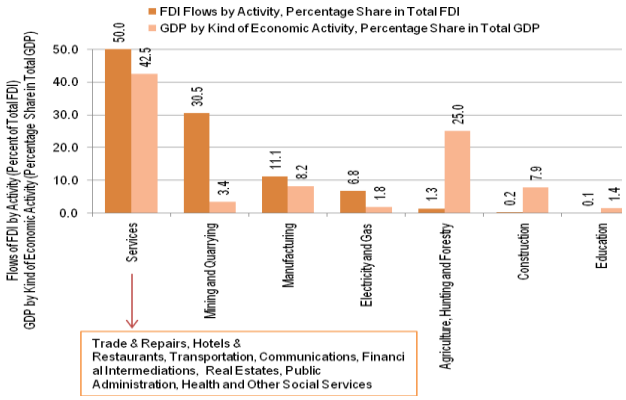

Figure 6. *FDI and GDP by Kind of Economic Activity, 2008-2014*
Source: Authors Computation Using Data from Bank of Tanzania and TIC (2015)

Generally, while there is optimism for the role of FDI in economic growth, there is some pessimism as well, particularly, in the economies of the least developed countries. Foreign firms may invest capital only on what they think is productive. For example, on mining and manufacturing sectors rather on agriculture sector. Also, FDI may drive away domestic firms, lowering the welfare of the nation (Hanson *et al*, 2001). In addition, Aitekn & Harrison (1999) did not find any evidence of beneficial spillover effects from foreign firms to domestic ones in Venezuela over the 1979-1989 period. This suggests that the role of FDI on the recipient economy is a subject of empirical research.

Tanzania's current national strategies for economic reform strongly emphasize the importance of encouraging private participation in the economy. The Second National Strategy for Growth and Reduction in Poverty (NSGRP) that was adopted in late 2010 provides an operational framework for achieving Tanzania's Development vision 2025 which aims to transform Tanzania into a middle-income country. In the same line, the regulatory framework to encourage private participation across infrastructure sectors has recently been enhanced with the Public Private Partnership (PPP) Act 2010, the PPP Regulations 2011, and the Public Procurement Act 2011. Such legal instruments could have a very positive impact across infrastructure sectors. Indeed, the number of domestic projects registered by TIC has risen between 1997 and 2012, overtaking the number of foreign and joint-venture projects registered with the Centre over that time (URT, 2013). This study examines degree of responsiveness of the economic growth to the changes domestic private investment, public investment, FDI, and control variables such as labour force, macroeconomic uncertainty, trade liberalization, life expectancy on real GDP growth

3. Literature Review

3.1. Economic Growth Theory

Economic growth models are two folds: The neoclassical growth model developed primarily by Solow (1956) and the new growth models pioneered by Romer (1986), Lucas (1988), and Barro (1990). In the neoclassical growth model also known as exogenous growth model, the long-run growth rate is determined by the rate of population growthand technical progress which are assumed to be exogenous. The Solow model of production is expressed as

$$y_t = Af(K_t, L_t) \tag{1}$$

where

$y = Real\ GDP$

$K = Capital\ stock$

$L = Labour\ employment$

$A = Exogenously\ determined\ factor\ of\ technology$

and capital-to-GDP ratio can take on any nonnegative value, that is

$$k_t = \frac{K_t}{Y_t} \geq 0 \tag{2}$$

Technically the neoclassical production function is homogeneous of degree one and implies that factors must be available or else output will be zero, that is, economy does not exist. In the short-run, the model allows unlimited substitutability between capital and labour to produce any given amount of output, that is, any amount of capital can be used with the appropriate amount of labour basing on the law of diminishing return. While in the long-run, when economies of scale are being realized, both factors will be increasing proportionally, and eventually results in increasing returns to investment. The theory also assumes that the possibility of achieving high growth rates will be low when there is an increase in the average per capitaincome (Crafts & Toniolo, 1996). The justification is, the countries with low per capita income have a weak capital formation, and therefore, investment willachieve growing returns contrary to the countries with high per capita incomes (Tawiri, 2010). This leads to the conclusion that developing countries are able to converge in income with developed countries if they succeed in increasing domestic and foreign investment (Tawiri, 2010). However, this hypothesis has been successful in practice in developed countries, but has not achieved the same result in developing countries (Obstfeld, 2009) leading to the emergence of modern neoclassical economic theory which relies on the hypothesis of conditional convergence. The modern neo-classical theory isolates some variables that affect growth rate and per capita income, which lead to the proof of the opposite relationship between growth and per capita income. The theory adds other variables such as population growth, education and trade.

The development of the new growth model also known as endogenous model followed the neoclassic growth model whose most important weakness was and still is not to take into account internal factors in long-term economic growth such as policies and institutions and focused on the external factors such as the technology and human capital (Cihan, 2006). According to endogenous growth model, growth depends on savings and investment in human capital on one hand (Lucas, 1988, Mankiw, *et al.*, 1992), and investment in research and development

on the other (Mattana, 2004). Furthermore, the model assumes that the free market leads to less than optimal level of capital accumulation in human capital and research and development. Therefore, the government may improve the efficiency of resource allocation through investment in human capital, and encouraging private investment in high-tech industries. In endogenous growth model, investment is considered as a significant factor that affects the growth. For example improvement of education and training and better health tends to increase the productivity of labour and technical improvement funded by the capital investment increases productivity.

Apart from neoclassical and new growth models, Prebisch in the 1950s developed a dependency theory. Dependency theory explains that the cause of the low levels of development in underdeveloped countries is their reliance and dependence on more economically developed countries. The theory also implies that a certain structure of the world economy favours some countries to the detriment of others and limits the development possibilities of the subordinate economics (Santos, 1971). Prebisch (1950) suggests that economic activities in the richer countries often lead to serious economic problems in the poorer countries. Poor countries export primary commodities to the rich countries who then manufacture products out of those commodities and sell them back to the poorer countries. The value added by manufacturing a usable product always cost more than the primary products used to create those products. Therefore, poorer countries never earn enough from their export earnings to pay for their imports.

3.2. Accelerator and Neo Classical Theory of Investment

The Accelerator theory of investment comes after Keynesian concept of multiplier which states that as the investment increases, income increases by a multiple amount. The acceleration principle was initially suggested by Clark (1917) and applied by Samuelson (1939) to a business cycle while describing the effect quite opposite to that of multiplier. The principle states that when income increases, investment will increase by the multiple amounts. This implies that when individual's income increases will lead to the increase in consumption, and in turn the greater amount of the commodities would have to be produced. At the full employment level of the economy, more capital will be required to produce additional commodities. This is sometimes called induced investment as the investment is induced by the income or consumption changes. Therefore Accelerator is the correlation between increases in investment resulting from an increase in income. If national income increases, induced investment will be positive but it may fall to zero if national income or output remains constant. In another theory, neoclassical theory of investment, income is function of employment given the capital stock, and its growth is determined in the capital market by the interest rate which equates the demand for investment and supply of the savings. According to this model market imperfections may prevent the interest rate from moving rapidly enough to keep investment at the full employment level in the short run, but the model realizes that goal in the long run (Gordon, 1992).

3.3. Empirical Literature Review

There are a number of studies that have shown a relationship between investment and economic growth. However, they get different results depending on a sample, and method used. Le & Suruga (2005) examine the impact of public investment and FDI on economic growth using a panel data of 105 of developed and developing countries during the 1970-2009 period. The findings of that paper show that both public investment and FDI have a positive impact on the economic growth, however, the effect of FDI on economic growth becomes weaker when the public investment exceeds 8-9 percent implying that excessive public investment

can hinder the economic benefits from FDI. This also implies that public investment leads to crowding FDI or private investment (Blejer & Khan, 1984). Nonetheless, it is empirically evidenced that public investment in infrastructure such as transportation and communications bears a positive results to the economic growth while public investment in the state owned enterprises has a negative impact to the economic growth (Khaliq & Noy, 2007). Similarly, Easterly & Rebelo (1993), using more disaggregated expenditure functions for a mixed sample of both developed and developing countries, find that only public investment in transport and communication generates positive effect on economic growth.

The study by Saqib (2013) on the Pakistan's economic performance, reports that economic growth is negatively affected by foreign investment while domestic investment has a positive impact on economic growth. These findings support the dependency theory, that FDI has a negative impact on the host country's economic growth. In contrast to Saqib (2013)'s findings, Moudatsou (2003) study on European Union economy over the 1980-1996 suggests that FDI inflows have positive effects on growth in European Union countries through trade reinforcement. However, other studies on FDI and growth suggest that the effects of FDI on economic growth depend on a number of factors such as the level of technological advancement of the host economy, the economic stability, countries investment policy and the degree of openness (Bengoa *et al*. 2003). For example, FDI being the source of capital formulations and financing can increase productivity of the host country and its comparative advantage that may results to the impact of both GDP and exports.

Barro (1995) empirically examines the determinants of economic growth for a panel of 116 countries over the 1965-1985 period. Using the OLS methods of estimation, Barro (1995), finds that large government size, government-induced distortion of the market and political instability have a negative effect on economic growth. The results for over 100 countries suggest that for a given initial level of real per capita GDP, growth rate is accelerated by factors such as lower government consumption, higher levels of human capital related to increased levels of schooling, lower inflation, better law enforcement, and improvements in trade.

In a different study, Haque (2012) develops a simple analytical model embodying the distinction between public and private investment and implements it using aggregate public and private gross capital formation data for Bangladesh over the 1972-73 to 2010-11 period. Haque (2012) uses a co-integration approach. The key findings of the paper suggest that public and private investments have positive effects on economic growth in short-run and long-run. In addition, the paper shows that, in the long-run, private investment is more effective than public investment. Similarly, Aurangzeb & Ul-Hak (2012) find that public investment, domestic private investment and foreign direct investment have significant and positive impact on the economic growth in Pakistan. In addition, the Granger causality test indicates the bidirectional relationship of GDP growth with FDI and public investment and unidirectional relationship of GDP growth with private investment. Also, in a similar study, Maaida, Waqar & Amara (2012) investigate the impact of investment, political and macroeconomics uncertainty as measured by inflation on the economic growth in Pakistan using the vector autoregressive approach (VAR). The results of their paper suggest a positive impact of private and public investment on economic growth in long run, but in the short run only the private investment has a significant relation with growth. In addition, the study indicates that Government consumption expenditure and macroeconomic

uncertainty hamper the economic growth. According to Deverajan *et al.* (1996)[1], public capital expenditure has a negative effect on economic growth in developing countries, and the effect gets dramatically reverse for developed countries. Deverajan *et al.* (1996) confirm that expenditures normally considered productive could become unproductive if there is an excessive amount of them. These results also are supported by Ghosh & Gregoriou (2007) in an optimal fiscal policy framework of developing countries.

Apart from Le & Suruga (2005), there are a number of times series and panel studies that investigate the correlation between public investment and private investment. For example, Everhart & Sumlinski (2001), using panel data of 63 developing countries over the 1970-2000 period, examines the partial correlation between public and private investment. Everhart & Sumlinski (2001), find evidence of a negative correlation between public and private investment. However, the correlation appears to be positive for the countries with better institutions. In a similar study, Ashauer (1989) examines whether high public capital spending crowds out private investment in the United Sates using annual time series data over the 1925-1985 period. The results suggest that for a given rate of return, an increase in public capital spending may reduce private investment. However, at the same time it may also increase the marginal productivity of private capital which, in turn, crowds in private capital implying both crowding in and crowding out effect. Furthermore, Eduardo & Christian (2011), investigate the relationship between public investment and private investment using a sample size of 116 countries during the 1980-2006 period. The results suggest that on average public investment has a negative impact on private investment. In addition, Eduardo & Christian (2011), find that the crowding-out effect of public investment through weak public institutions on average outweighs the crowding in effect coming through the channel of increasing in the marginal productivity of private investment. Generally, Erden & Holcombe (2005), challenge the negative effects of public investment on private investments. In fact, Erden & Holcombe (2005), observe evidence of a positive relationship between public investment and private investment some developing countries during the 1980-1997 period.

3.4. Research Gap

Despite the fact that the study of the role of investment in economic performance has attracted in the literature, it has remained one of the controversies in the world economy. In fact, the literature shows that the impact of domestic private investment, public investment and FDI on economic growth differs from one country to another and from one time period to another. This also reflects different in sectors of investment emphasized, methodologies and source and nature of data. For example, most economists and policymakers believe that FDI benefits a host country through added employment, new technology and transfer of knowledge. Some worry, however, that it has a crowding out effect on domestic investment and eliminates competition in the local markets. Nonetheless, either type of investment is an important determinant of economic growth; hence, it is expected to be an influential factor on economic growth.

It is acknowledged that previous studies have made useful contribution to understand the importance of investment in the economy; however, many of these studies apply a cross country regression analysis methodology. Cross country studies in this context have heterogeneous results which lack generality. Indeed, they fail to explain the reasons for a number of exceptional cases. These can be

[1]The study on the relationship between public expenditure and economic growth for a sample of 43 developed and developing countries over the 1970-1990 period.

well explained using a country specific study. Moreover, since investment and growth are very dynamic processes, studies that are based on cases many years ago might not be as relevant now. The technological changes in the last few decades have revolutionized the way countries improve their economy. This paper intends to close methodological gap evident in previous studies by applying latest econometric techniques for time series data and examining the causality between investment and economic growth for Tanzania. Thus, this paper has policy implications.

4. Research Methodology

4.1. Specification of the Growth Model

Most growth models specified for developing countries trace their roots back to the neoclassical framework of Solow (1956).This framework takes as its starting point an aggregate production function relating output to factor inputs and a variable usually referred to as total factor productivity (Khan & Reinhart, 1989):

$$y_t = Af\left(K_t, L_t, Z_t\right) \tag{3}$$

where $y =$ the level of output
$K =$ the stock of physical capital
$L =$ the labor force
$Z =$ a vector including other factors affecting growth
$A = a$ measures factor productivity

Equation (3) can be written in growth terms as follows

$$\frac{dy_t}{y_t} = \left(A \bullet \frac{\partial y_t}{\partial K_t}\right)\frac{dK_t}{y_t} + \left(A \bullet \frac{\partial y_t}{\partial L_t} \bullet \frac{L_t}{y_t}\right)\frac{dL_t}{L} + \left(A \bullet \frac{\partial y_t}{\partial Z_t} \bullet \frac{z_t}{y_t}\right)\frac{dZ_t}{Z_t} + \frac{dA}{A} \tag{4}$$

and for estimation purposes equation (4) can be expressed as

$$\frac{\Delta y_t}{y_{t-1}} = \gamma_0 + \gamma_1 \frac{I_t}{y_{t-1}} + \gamma_2 \frac{\Delta L_t}{L_{t-1}} + \gamma_3 \frac{\Delta Z_t}{Z_{t-1}} \tag{5}$$

Where

$$\gamma_0 = \frac{dA}{A}$$

$$\gamma_1 = A \bullet \frac{\partial y_t}{\partial K_t}$$

$$\gamma_2 = A \bullet \frac{\partial y_t}{\partial L_t} \bullet \frac{L_t}{y_t}$$

$$\gamma_3 = A \bullet \frac{\partial y_t}{\partial Z_t} \bullet \frac{Z_t}{y_t}$$

and $I_t = dK_t$

The constant term (γ_o) is assumed to capture *the* growth in productivity, γ_1 is the marginal productivity of capital, γ_2 is the elasticity of output with respect to labour and γ_3 is the elasticity of output with respect to other factors[2].

[2] See Khan, & Reinhart (1989)

Differentiating from the previous work, investment in this paper is divided into three factors: domestic private investment (or simply private investment), public investment, and FDI. This allows us to compare the effect of all three variables on real GDP growth. The signs of partial derivatives of y with respect to total investment, private domestic investment, public investment as well as FDI are assumed to be positive. Indeed, Neo-Keynesian and Neo-classic investment theory suggestinvestment is positively related to the growth of real GDP. Also, a series of theoretical models (Thirlwall 1994, Becker, Glaeser & Murphy, 1999) and applied studies (Denton & Spencer, 1998; Denton & Spencer, 1997; Duval, Eris & Furceri, 2010; Ejaz, 2007; Khan & Reinhart, 1989) examine the effect of labour force on economic growth. In this paper, population level is used as a proxy for the labor force.[3]Population growth enlarges labour force and, therefore, increases economic growth. A large population also provides a large domestic market for the economy. Moreover, population growth encourages competition, which induces technological advancements and innovations (Tsen & Furuoka, 2005). However, other studies show that a large population may reduce productivity because of diminishing returns to more intensive use of land and other natural resources. According to Malthus (1798), population increase is detrimental to a nation's economy due to a variety of problems caused by the growth. For example, overpopulation and population growth place a tremendous amount of pressure on resources, which result in a chain reaction of problems as the nation grows. In particular, rapid population growth is associated with malnutrition and hunger (Malthus, 1798). It also tends to depress savings per capita and retards growth of physical capital per worker (Tsen & Furuoka, 2005). Therefore, it is important to examine the impact of population on economic growth in a poor country such as Tanzania.

In addition to capital, labour, and productivity growth, other determinants of growth include trade, life expectancy and macroeconomic uncertainty proxied by inflation. It is widely accepted that among the driving factors of long-run growth, trade plays an important role in shaping economic performance (Krugman, 1990). In poor countries, people have low per capita incomes and markets in such countries are usually small. Also, production patterns in these countries are skewed towards labour intensive service, agriculture and manufacturing. Thus, a liberalized trade regime allows low-cost producers to expand their output well beyond that demanded in the domestic market (Krugman, 1990). Indeed, neoclassical approach to the positive impact of trade liberalization on economic growth explains the gains from trade liberalization by comparative advantages in the form of resource endowment[4] and differences in technology[5]. Aside from the benefits of exploiting comparative advantages, theories have suggested additional gains from trade arising through economies of scale, exposure to competition and the diffusion of knowledge. Empirical evidence on the positive effects of trade liberalization on economic growth include Dollar (1992), Frankel & Romer (1999), Dollar & Kaaray (2001), Bhagwati & Srinivasan (2001), Wacziarg & Welch (2003). However, there are some critics who dispute these findings on methodological ground (Rodrik, 1996; Rodriguez & Rodrik, 2001). For example, countries such a Bangladesh, India and Sri Lanka, experience large increases in trade and significant reduction in tariff and non-tariff barriers and do extremely well in terms of income growth (Dollar & Kaaray, 2001).

[3] Also, see Khan & Reinhart (1989)
[4] The Hecksher-Ohlin model
[5] The Ricardian model

There is also a growing consensus that improving life expectancy can accelerate economic growth. Studies on the effect of increasing life expectancy on economic growth is abundant, for example, Bloom & Sachs (1998), Gallup, Sachs & Mellinger (1999), Bloom, Canning & Sevilla (2002), Lorentzen, McMillan & Wacziarg (2008), find large effects of increasing life expectancy on economic growth. Similarly, Bloom & Sachs (1998), argue that wiping out malaria in sub-Saharan Africa could increase growth rate by as much as 2 percent a year. In the same line, World Health Organization (2001) points out that poor health has pernicious effects on economic development in sub-Saharan Africa and South Asia. However, the standard neoclassical model highlights the limits of improvement in life expectancy. Increased life expectancy increases population which reduces capital-labor ratios and depresses per capita income. These controversies imply that understanding whether life expectancy have a large effect on economic growth is important for poor countries that suffer from low life expectancy and high mortality rate.

Moreover, macroeconomic instability may adversely affect economic growth. For example, uncertainty related to higher volatility in inflation could discourage firms from investing in projects that have high returns, but also a higher inherent degree of risk. The usual arguments for lower and more stable inflation rates include reduced uncertainty in the economy and enhanced efficiency of the price mechanism. A reduction in the level of inflation could have an overall effect on the level of capital accumulation in cases of tax distortions or when investment decisions are made with a long-run perspective. However, evidence on the relationship between inflation and growth is somewhat mixed (Bassanini & Scarpetta, 2001). Although it is widely accepted that that investment and growth suffer in cases of high inflation, the relation is less clear in cases of moderate or low inflation (Edey, 1994; Bruno & Easterly, 1998). In addition, to the extent uncertainty is the link to investment and growth; it would suggest a focus on variation in inflation. However, given the correlation between level and variability of inflation, the two effects could be difficult to distinguish (Bassanini & Scarpetta, 2001).

Given that $\gamma_0 = \frac{dA}{A}$ reflects the residual part of the basic equation (5), the regression equation can be expressed to capture the specific regressors as follows:

Model 1:

$$\log(y_t) = \zeta_0 + \zeta_1 \log(pK_t) + \zeta_2 \log(gK_t) + \zeta_3 \log(FDI_t) + \zeta_4 \log(L_t) + \zeta_5 \log(TL_t) + \zeta_6 \log(\Gamma_t) + \zeta_7(\pi_t) + \varepsilon_t \quad (6)$$

where

$\zeta_0, \zeta_1, \ldots, \zeta_7$	=	Parameters to be estimated
$t = 1, \ldots, T$	=	The period of time, years
ε	=	Random error term

In *model 1* private investment is divided into FDI and domestic private investment[6]. The model examines the overall effect of all given factors on economic growth. This allows us to compare the effect of all regressors, especially public investment, FDI, and domestic private investment on economic growth.

[6] See also Phetsavong & Ichihashi (2012), and Le & Suruga (2005).

4.2. Complementary Effect of Public Investment on Domestic Private Investment , FDI and Economic Growth

Model 1 presents a reduced-form of the estimation equation in which the impact of public investment captures not only the direct productivity impact of public capital but also the improvement to productivity through stimulation of domestic private investment and FDI. However, there is evidence that part of the explanation for the impact of public investment increase is that there appears to be crowding-out of domestic private investment and FDI, as high public investment is associated with lower domestic private investment-to-GDP ratio and FDI-to-GDP ratio. Following the approach by Phetsavong & Ichihashi (2012), and Le & Suruga (2005), the dummy variables as the interactive form are introduce to check for the level of public investment which reduces the positive effect of either domestic private investment or FDI on economic growth. Also, due to increased competitive pressure, FDI may crowd-out domestic private investment and deter positive impact of domestic private investment on growth. The dummy variables are computed as follow:

Complementary effect of public investment on domestic private investment	=	$pK_t \times gDm_t$
Complementary Effect of public investment on FDI	=	$FDI_t \times gDm_t$
Complementary Effect of FDI on domestic private investment	=	$pK_t \times fdiDm_t$

gDm is defined as 1 whenever the proportion of public investment in GDP equals or exceeds 8.0 percent to 10 percent, respectively. Whenever, public investment is less than these levels, gDm is defined as 0. Similarly, $fdiDm$ is defined as 1 whenever the ratio of FDI to GDP equals or exceeds 6.0 percent to 8.0 percent, respectively. Also, $fdiDm = 0$ whenever FDI is less than these levels. Hence, the complementary effect of public investment on domestic private investment, FDI and economic growth on one hand, and the complementary effect of FDI on domestic private investment and growth on the other, are expressed, respectively as follows:

Model 2:

$$\log(y_t) = \zeta_0 + \zeta_1 \log(pK_t) + \zeta_2 \log(gK_t) + \zeta_3 \log(FDI_t) + \zeta_4 \log(L_t) + \zeta_5 \log(TL_t) + \zeta_6 \log(\Gamma_t) + \zeta_7(\pi_t) + pK_t \times gDm_t + \varepsilon_t \quad (7)$$

Model 3:

$$\log(y_t) = \zeta_0 + \zeta_1 \log(pK_t) + \zeta_2 \log(gK_t) + \zeta_3 \log(FDI_t) + \zeta_4 \log(L_t) + \zeta_5 \log(TL_t) + \zeta_6 \log(\Gamma_t) + \zeta_7(\pi_t) + FDI_t \times gDm_t + \varepsilon_t \quad (8)$$

Model 4:

$$\log(y_t) = \zeta_0 + \zeta_1 \log(pK_t) + \zeta_2 \log(gK_t) + \zeta_3 \log(FDI_t) + \zeta_4 \log(L_t) + \zeta_5 \log(TL_t) + \zeta_6 \log(\Gamma_t) + \zeta_7(\pi_t) + pK_t \times fdiDm_t + \varepsilon_t \quad (9)$$

Table 1 reports the unit measurements of the variable presented in equation (6). It also summarizes the expected signs of the coefficients on these variables.

Table 1. *Summary of Variables*

Variable	Abbreviation	Unit Measurement	Expected Sign
Economic growth	y	log(Real GDP growth, annual percent)	
Total Investment	K	$\left(\frac{K}{GDP}\right)x100$	+
Private investment	pK	$\left(\frac{pK}{GDP}\right)x100$	+
Public investment	gK	$\left(\frac{gK}{GDP}\right)x100$	+
FDI	FDI	$\left(\frac{FDI}{GDP}\right)x100$	+
Labour force	L	log(Population level, in millions)	+ or −
Trade liberalization	TL	$\left(\frac{TL}{GDP}\right)x100$	+
Life expectancy	Γ	Life expectancy at birth, years	+ or −
Inflation (macroeconomic stability/uncertainty)	π	Inflation rate, measured as the growth rate of consumer price index.	−

Source: Authors construction with the help of literature review

4.3. Granger Causality Test

Causality is traditionally tested by the standard two-step Engle Granger causality procedure. Granger Causality test is used to determine the direction of causality between variables in the short-run using the F-statistic and in the long-run using the t-statistic. The test indicates the presence or absence of long run links between the variables. The VAR model is estimated basing on the following pair of regression equations (10) and (11) with stationary variables.

$$\Delta y_t = \sum_{j=1}^{m} \alpha_j \Delta y_{t-j} + \sum_{j=1}^{m} \delta_j \Delta K_{t-j} + \Delta \varepsilon_{1t} \tag{10}$$

$$\Delta K_t = \sum_{j=1}^{m} \beta_j \Delta y_{t-j} + \sum_{j=1}^{m} \gamma_j \Delta K_{t-j} + \Delta \varepsilon_{2t} \tag{11}$$

where y_t and K_t are the two co-integrated variables. K_t is divided into pK_t, gK_t and FDI_t. ε_{1t} and ε_{2t} are error terms. Assuming that ε_{1t} and ε_{2t} are serially uncorrelated, then, to test for the causality, the joint hypotheses $\delta_j = 0 \; for \; j = 1,\ldots,m$ and $\beta_j = 0 \; for \; j = 1,\ldots,m$ is simply tested. The test statistics follow a Chi-squared distribution with $(k-m)$ degrees of freedom. The variable K is said not to Granger-cause the variable y if all the coefficients of lagged K in equation (10) are not significantly different from zero, because it implies that the history of K does not improve the prediction of y. If none of the null hypotheses is rejected, it means we accept the claims that K does not Granger cause investment and investment also does not Granger cause y. This indicates that the two variables are independent of each other. If all hypotheses are rejected, there is bi-directional causality between K and y. The optimal lag length for the VAR model is determined by using the Akaike Information Criterion (AIC) and the Schwartz Bayesian Information Criterion (SBIC).

4.4. Time Series Characteristics of the Data

4.4.1. Unit Root Test

The use of time series variables in estimating econometric models requires that a stochastic process generating the data series be stationary. The distinction between whether the levels or differences of a series is stationary leads to substantially different conclusions and hence, in principle, it is important to test the order of integration of each variable in a model, to establish whether it is non-stationary and how many times the variable needs to be differenced to derive stationary series (Benerjee *et al*., 1993). Engle & Granger, (1987) define a non-stationary time series to be integrated of order d if it achieves stationarity after being differentiated d times. This notion is usually denoted by $x_t \sim I(d)$. The null hypothesis of the unit root implies non-stationarity, such that if the null hypothesis is rejected then the series is stationary. Therefore no differencing in the series is necessary to induce stationarity.

There are several ways of testing for the presence of unit root. For the case of this study, all the series are tested for the probable order of difference stationarity by using the augmented Dickey-Fuller (ADF). The idea behind the ADF test is that, it makes a parametric correlation for higher-order correlation by assuming that the series follows autoregressive process and adjusting the test methodology. In addition, the ADF test controls for higher-order correlation by adding lagged difference terms of the dependent variable to the right-hand side of the regression. ADF regression is specified as

$$\Delta x_t = \alpha + \beta x_{t-1} + \sum_{j=1}^{p_i} \rho_j \Delta x_{t-j} + \varepsilon_t \tag{12}$$

where x_t for $t = 1, \ldots, T$, is the series over period *t*, ρ is the number of lags in the ADF regression, and ε_t is the error term which is assumed to be independently and normally distributed random variables for all t with zero means and constant variances σ^2. Hence, the null hypothesis to be tested is $H_0 : \beta = 0$ i.e. a variable contains unit root and hence is non-stationary, against the alternative hypothesis: $H_1 : \beta < 0$ i.e a variable does not contain unit root and hence is stationary. The decision rule is that: If the calculated ADF Test statistic is greater than the MacKinnon critical values, reject the null hypothesis of non-stationarity and accept the alternative of stationarity, otherwise accept the null hypothesis of non-stationarity. ADF method is conducted to check for a unit root for all variables in both levels and first differences

4.4.2 Testing Cointegration

Co-integration test provides the basis for tracing the long-term relationship between the variables. Two or more variables are said to be co-integrated if their linear combination is integrated to any order less than 'd'. There are two procedures that are popularly used to identify and estimate the cointegrating vectors and the short run adjustment parameters. This paper uses Granger and Engle two-step estimation procedure and the Johansen procedure to test whether the variables in consideration have a long run relationship. The former procedure involves normalizing the cointerating vector on one of the variables, which makes the assumption that the corresponding element of the cointegrating vector is non-zero. The Johansen procedure is a multivariate approach, the estimation of which would consume a lot of degree of freedom. This theory of co-integration which was

put forward by Johansen & Juselius (1990) indicates that the maximum likelihood method is more appropriate in a multivariate system.

The ordinary least squares method (OLS) is used for estimation. OLS is simple and widely used in empirical work. If the model's error term is normally, independently and identically distributed (n.i.i.d.), OLS yields the most efficient unbiased estimators for the model's coefficients, i.e. no other technique can produce unbiased slope parameter estimators with lower standard errors (Ramírez *et al.*, 2002).

4.4.3. Data and Sources of Data

The data used in this study is time series spanning from 1970 to 2014. The data is obtained from three main sources: World Development Indicator (WDI) and Bank of Tanzania. The regressand (economic growth) is in a real GDP growth obtained from WDI. Private domestic investment, FDI, public investment and other regressors such as trade, inflation, and labourforce are also obtained from WDI. GDP by kind of economic activity and FDI flows by activity are obtained from Bank of Tanzania and Tanzania Investment Centre. As discussed ealier, all the regressors excluding labourforce, life expectancy and inflation are measured as a percent of GDP.

5. EmpiricalResults

5.1. Descriptive Statistics

Exploratory data analysis is employed to ascertain the statistical properties of the variables used in the empirical analysis (Mukherjee, White & Wuyts, 1998). Table 2 reports descriptive statistics of the variables of the estimation model. The descriptive statistics indicate that real GDP growth, domestic private investment-to-GDP ratio, labour force, trade-to-GDP ratio or trade liberalization, and the rate of inflationare approximately normally distributed because their respective skewness values are less than 0.5 in absolute terms[7]. According to Bulmer (1965), if skewness is between -0.5 and +0.5, the distribution is approximately symmetric[8]. However, skewness values of public investment-to-GDP ratio, FDI-to-GDP ratio and life expectancy reject the null hypothesis of normal distribution. The public investment-to-GDP ratio, FDI-to-GDP ratio and life expectancy have approximate skewness values of 0.5, 1.3 and 1.4 respectively. The failure of the normality test is addressed by transforming all variables, except the inflation rate, by using a logarithm operator (Stock & Watson, 2003; Murkhejee, White & Wuyts, 2003).

Table 2.*Descriptive Data Analysis*

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
y	45	4.30	2.53	-2.4	8.46	-0.43	2.65
K	45	22.94	7.54	11.25	36.98	0.34	1.97
pK	45	8.80	4.11	2.54	18.47	0.49	2.60
gK	45	8.59	2.40	5.07	14.58	0.54	2.47
FDI	45	5.55	4.66	0.18	17.83	1.31	3.71
L	45	28.80*	11.1*	13.6*	51.80*	0.43	2.05
TL	45	36.02	11.21	17.22	56.80	-0.11	1.82
Γ	45	52.31	4.98	46.68	64.94	1.35	3.54
π	45	16.86	10.82	3.49	36.15	0.37	1.59

Note: *Million. Sample: 1970-2014.
Source: Computed Using Data from World Bank, WDI (2015)

[7] The normal distribution is symmetric and has value of zero for skewness
[8] Principles of Statistics

Table 3 reports the correlation matrix of the variables of the estimation model. The results of the correlation matrix suggest that private investment, FDI and trade liberation are highly positively correlated with economic growth. Other variables such as public investment, labour force and life expectancy seem to have a less strong positive correlation with economic growth. Unsurprisingly, the correlation between inflation and economic growth is negative. In addition, the correlation matrix shows that the pair-wise correlations between explanatory variables are not quite high (i.e. less than 0.8), suggesting that multicollinearity is not a serious problem.

Table 3. *Correlation Matrix of the Variables*

	y	pK	gK	FDI	L	TL	Γ	π
y	1							
pK	0.55	1						
gK	0.43	-0.52	1					
FDI	0.64	-0.25	0.03	1				
L	-0.42	0.55	0.18	0.29	1			
TL	0.70	0.37	0.27	0.48	0.60	1		
Γ	0.41	0.11	-0.16	0.31	0.79	0.59	1	
π	-0.44	-0.03	0.09	-0.61	-0.28	-0.31	-0.32	1

Source: Computed Using Data from World Bank, WDI (2015)

5.2. Time Series Properties of the Data

5.2.1. Stationarity Tests

Table 4 presents the ADF unit root test results. As reported in the ADF test, none of the variables are stationary in their level, suggesting that the hypothesis of a unit root cannot be rejected in all variables in level $[I(0)]$. These results conclude that all variables are non-stationary. The variables in consideration however, as reported in Table 5 are stationary in the first differences. This means that the variables are integrated of order 1 $[I(1)]$. This also suggests that the variables are potentially cointegrated.

Table 4. *ADF Unit-Root Test,* $I(0)$

Variable	Test Statistic	5%Critical Value	MacKinnon Approximate for $Z(t)$
Economic growth, y	-2.810	-3.536	0.1934
Total Investment, K	-2.409	-3.536	0.3745
Private investment, pK	-1.361	-2.952	0.6008
Public investment, gK	-1.361	-2.952	0.6008
FDI, FDI	-2.171	-2.950	0.2168
Labour force, L	-1.616	-2.952	0.4748
Trade liberalization, TL	-2.638	-2.950	0.0854
Life expectancy, Γ	-3.034	-3.536	0.1228
Inflation, π	-2.035	-2.947	0.2715

Notes: (1) I(d) = Order of Integration.
Source: Computed Using Data from World Bank, WDI (2016)

Table 5. *Empirical Results: ADF Unit-Root Test,* $I(1)$

Variable	Test Statistic	5%Critical Value	MacKinnon Approximate for $Z(t)$
Economic growth, y	-8.431	-2.950	0.000
Total Investment, K	-.8.344	-2.950	0.000
Private investment, pK	-7.519	-2.950	0.000
Public investment, gK	-5.795	-2950	0.000
FDI, FDI	-10.962	-2.950	0.000
Labour force, L	-7.094	-2.950	0.000
Trade liberalization, TL	-8.483	-2.950	0.000
Life expectancy, Γ	-8.817	-2.950	0.000
Inflation, π	-7.477	-2.950	0.000

Notes: (1) I(d) = Order of Integration.
Source: Computed Using Data from World Bank, WDI (2015)

5.2.2. Results of Cointegration Test

Both Johansen test for cointegration and Engle-Granger two step methods are used to determine the presence of cointegration between variables. The use of a single equation procedure was deemed appropriate, at least with respect to preserving the degree of freedom. Results of Johansen test for cointegration and Engle-Granger two step methods are presented in Tables 6 and 7 respectively. On the basis of the Maximum Eigen value test, as reported in Table 6, the null hypothesis of no cointegration $(r=0)$ is rejected at the 5 percent level of significance in favour of the specific alternative, namely that there is at most 6 cointegrating vector $(r=6)$[9]. Similarly, cointegration test results based on Engle-Granger two step method suggests existence of equilibrium in the estimating model. The ADF test applied to the error term of the cointegrating equation is also integrated of order zero $[I(0)]$. Figure 7 also confirms the existence of cointegration between variables. According to Thomas (1993), if an equilibrium relationship exists, then the disequilibrium error should fluctuate about zero (Figure 7).

The implication is that a linear combination of all the seven series is found to be stationary and that there is a stable long-run relationship between the series. The cointegration results also that estimation of the growth equation by ordinary least square (OLS) method would not yield spurious regression results.

Table 6. *Johansen Tests for Cointegration*

Maximum Rank	Eigenvalue	Trace statistics	5% critical value
0		358.3192	156.00
1	0.95831	221.6901	124.24
2	0.84973	140.1920	94.15
3	0.62011	98.5735	68.52
4	0.59503	59.7045	47.21
5	0.43019	35.5192	29.66
6	0.39986	13.5635*	15.41
7	0.27046	0.0038	3.76
8	0.00009		

Sample: 1972-2014. Number of obs = 43

[9] 10 This is because the first significant value, where trace statistic is less than critical value at 5% level, is found at maximum rank of 6.

Table 7. *Static Model: Tests for Cointegration between Economic Growth and Explanatory Variables*

	Test Statistic	1% Critical Value	5% Critical Value
Z(t)	-5.507***	-3.621	-2.947

MacKinnon approximate p-value for Z(t) = 0.0000.
Notes (1) *** denote rejection of the null hypothesis at 1% critical value

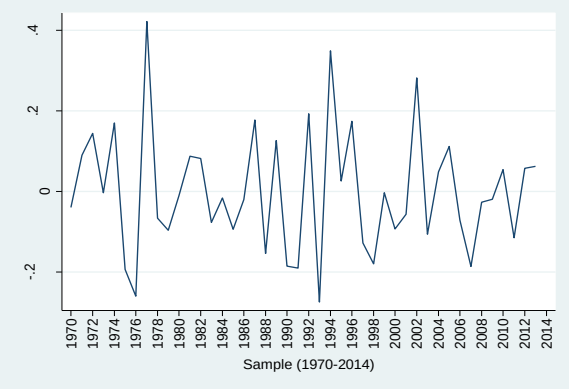

Figure 7. *Long Run Cointegrating Vector*
Source: Author's Computation Based on Data from World Bank, WDI (2015)

5.2.3. Regression Results

Regression results are reported in Table 8.*A priori*, the results suggest that the equation estimated is of good fit and very powerful. The estimated coefficient of determination, $\overline{R}^2$ suggests that 77 percent of the variation in real GDP growth is jointly explained by the factors included in the estimation model. Besides, the estimated F-statistic is high and statistically significant at 1 percent level rejecting the null hypothesis that all the explanatory variables have coefficients not different from zero. This suggests that the model estimated has good overall explanatory power. Moreover, the estimated p-value for RESET Regression Errors Specification Test fails to reject the null hypothesis of no model misspecification error, suggesting that the model is not misspecified. Figures 8 and 9 suggest that residuals are normally distributed, they are not correlated and that their mean is zero.

Specifically, probability values of Portmanteau test for white noise and Barlett's periodogram-based white noise test fail to reject the hypotheses that residuals are random or independent, there is no serial correlation among residuals and that residuals are stationary. Likewise, variance inflation factor (VIF) is used for multicollinearity diagnostics. A rule of thumb is that if $VIF(\hat{\gamma}_i) > 10$ then multicollinearity is high. In this study the VIF values for all the regresssors, as reported in Table 8, are lower than 10, with the mean value of 3.99. These results suggest that multicollinearity is not a problem in the estimated model.

Table 8. *Empirical Results*

y	Coef.	Std. Err.	t	$P>\|t\|$	[95% Conf. Interval]		VIF
pK	0.578***	0.148	3.90	0.000	0.278	0.879	5.10
gK	0.214	0.174	1.23	0.227	-0.139	0.566	2.87
FDI	0.125**	0.061	2.04	0.049	0.001	0.250	2.27
L	-1.603***	0.385	-4.16	0.000	-2.384	-0.822	7.65
TL	0.592**	0.194	3.05	0.004	0.199	0.986	2.36
Γ	5.850***	1.477	3.96	0.000	2.857	8.842	5.86
π	-0.006**	0.003	-2.07	0.046	-0.012	0.000	1.79
_cons	0.860	1.575	0.55	0.588	-2.337	4.052	

F(7,37) = 22.30 Prob > F = 0.00

$\bar{R}^2$ = 0.7721

RESET Regression Errors Specification Test	Portmanteau test for white noise
Ho: Model has no omitted variable	Ho: Residual is whitenoise i.e. there is no serial correlation (heteroskedasity) and the mean is zero
F(3,33) = 1.29 Prob>F = 0.296	Q-Statistic = 29.16 Prob> χ^2 =0.085

Notes: (i) ***Indicates significance at 1% level, and ** at 5% level, (ii) Dependent Variable: Real GDP growth, annual percent.

Source: Computed using data from World Bank, WDI (2016) and Bank of Tanzania (Annual Reports)

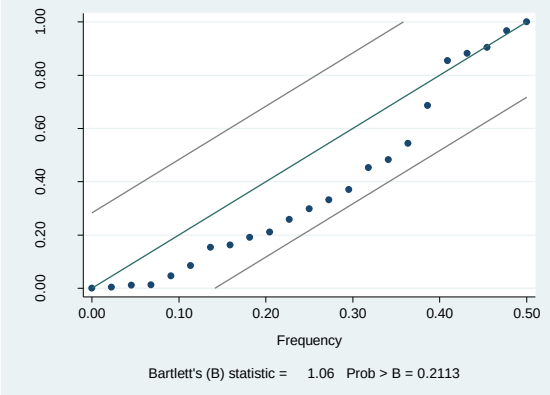

Figure 8. *White noise Test of the Residuals*

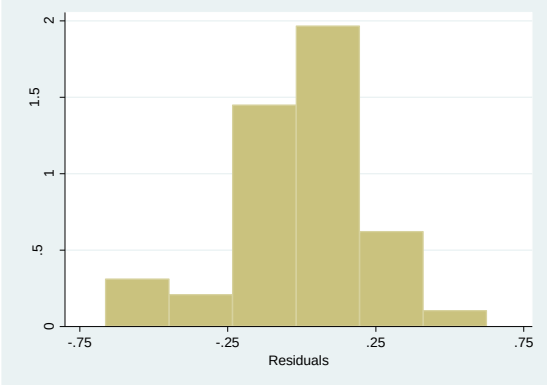

Figure 9. *Normality Test of the Residuals*

The results obtained from the growth model show that the coefficient of the domestic private investment has the correct sign and is significantly different from zero at the 1 percent level, as is the coefficient for the FDI which is statistically significant at the 5 percent level. A 1 percent increase in domestic private investment and FDI may lead a 0.58 percent and 0.13 percent increase in real GDP

growth respectively, other factors being equal. The increase in the public investment apparently does not exert a significant effect on the real GDP growth in Tanzania during the sample period. These results are similar to Swaby (2007)'s, study for Jamaica. Indeed, Swaby (2007), finds that in the long-run domestic private sector investment and FDI have a positive statistically significant direct impact on the level of GDP whereas public investment is not found to have any significant impact on GDP. In fact it is found to have the effect of crowding-out net private investment (Swaby, 2007). Unsurprisingly, a number of papers have identified an inverse association between government spending and output growth (e.g. Grossman, 1988, Marlow, 1986, Peden & Bradley, 1989, and Grier & Tullock, 1989).

The growth in the labour force seems to have a negative effect on the growth of the economy. Indeed, the coefficient for the labour force is significant different from zero at the 1 percent level implying that a 1 percent increase in labour force may reduce real GDP growth by 1.6 percent *ceteris paribus*. However, this may have something to do with the fact that the study proxies the labour force with the population level (see Khan & Reinhart, 1989). This is due to the fact that growth of labour force and population growth undoubtedly correlated. The negative effect of labour force as proxied by population is broadly consistent with previous studies such Malthus (1798) and Tsen & Furuoka (2005). In contrast, the coefficient on life expectancy is statistically significant at the 1 percent level, suggesting that greater life expectancy is associated with higher economic growth. This result is consistent with that of (Warner, 2014).

The results also suggest a significant impact of macro policy settings. Specifically, the coefficient on trade liberalization or degree of openness is statistically significant at the 1 percent level whereas inflation is significant different from zero at the 5 percent level. Both coefficients have signs as they are expected. Indeed, trade seems to exert bigger impact on real GDP growth than both domestic private investment and FDI. Results indicate that a 1 percent increase in the degree of openness may lead a 0.59 percent increase in real GDP growth. Unsurprisingly, inflation has a negative effect on economic growth. These results are consistent with the view that uncertainty about price developments mainly influences growth via distortions in the allocation of resources and via discouraging the overall accumulation of physical capital, while high levels of inflation may discourage saving and investment leading to low real GDP growth.

5.2.4. Crowding in or Crowding out

Complementary Effect of Public Investment on Private Domestic Investment and Economic Growth

In order to examine the interactive relationship between public investment and private domestic investment, a dummy variable ($pK \times gDm$) is employed into the model to capture the interrelationship between public investment, private domestic investment, and economic growth. $pK \times gDm$ is classified into 5 levels: 8.0 percent, 8.5 percent, 9.0 percent, 9.5 percent, and 10 percent. Dm is defined as 1 whenever it equals or exceeds these percent points, and it is defined as 0 whenever it is less than the given levels.

The regression results of the complementary effect of public investment on domestic private investment and economic growth are reported in Table 9. The key variable in the Table is $pK \times gDm$. The results indicate that $pK \times gDm$ is statistically significant and negative. The negative coefficient of the variable $pK \times gDm$ suggests that the positive effect of domestic private investment on economic growth reduces when public investment-to-GDP ratio exceeds 8-10 percent. For example, Table 9 indicates that the coefficient for the domestic private

investment, (pK) is 0.665 while for $pK \times gDm$ is -0.102. This suggests that when $gK \geq 8.0$ percent, the slope coefficient for the pK reduces from 0.665 to 0.563. The results also suggests that the coefficient for the pK reduces to 0.513 from 0.745 when $gK \geq 8.5$ percent. These results imply that the positive effect of private domestic investment on economic growth become weaker when public investment increases at some extent levels.

A view of the public and private investment as proportions of GDP and their interrelationship in Tanzania is provided in Figure 9. Fairly divergent movements in public and private investment can be seen in Tanzania, suggesting apparent tendency for one sector to crowd out another or for the public sector to play a countercyclical role by compensating for variations in private investment.

In the 1970s, major private companies were nationalized, prices and trade strictly controlled, and exports increasingly restricted. In parallel, social services were highly subsidized and attracted heavy government investment (Ngowi, 2009). As a result, public investment-to-GDP ratio was higher than domestic private investment-to-GDP ratio. Indeed, during the subsequent recovery of public investment in the early 1970s, private investment stagnated. During the second half of 1980s Tanzania liberalized trade and engaged in investment deregulation, opening the country to international banks as a result domestic private-to-GDP ratio increased from 10.1 percent in 1989 to 16.2 percent while public investment-to-GDP ratio declined from 10.1 percent to 8.9 percent during the same period.

Table 9. *Regression Results: Complementary Effect of Public Investment on Private Domestic Investment and Economic Growth*

Variable	(1) *If* $gK \geq 8.0$	(2) *If* $gK \geq 8.5$	(3) *If* $gK \geq 9.0$	(4) *If* $gK \geq 9.5$	(5) *If* $gK \geq 10$
pK	0.665***	0.745***	0.792***	0.740***	0.759***
	(4.48)	(5.05)	(4.36)	(4.35)	(4.38)
gK	0.322	0.334**	0.196	0.226	0.216
	(1.84)	(2.03)	(1.17)	(1.34)	(1.28)
FDI	0.089	0.070	0.062	0.072	0.073
	(1.47)	(1.18)	(0.92)	(1.09)	(1.12)
L	-1.847***	-2.047***	-2.105***	-1.958***	-1.976***
	(-4.76)	(-5.31)	(-4.62)	(4.62)	(-4.66)
TL	0.616***	0.645***	0.532**	0.529**	0.520**
	(3.30)	(3.61)	(2.80)	(2.76)	(2.71)
Γ	6.100***	6.357***	7.199***	6.874***	6.940***
	(4.29)	(4.66)	(4.52)	(4.45)	(4.49)
π	-0.004	-0.003	-0.005	-0.005	-0.004
	(-1.39)	(-1.14)	(-1.71)	(-1.55)	(-1.45)
$pK \times gD$ı	-0.162**	-0.232**	0.171*	-0.156*	-0.164*
	(-2.06)	(-2.86)	(-1.91)	(-1.78)	(-1.86)
_cons	2.079	3.003	2.259	1.729	1.753
	(1.28)	(1.85)	(1.34)	(1.08)	(1.10)
F-Stat.	21.74	24.33	21.36	21.06	21.23
Frob>F	0.000	0.000	0.000	0.000	0.000
$\overline{R}^2$	0.790	0.809	0.787	0.785	0.786
DW	1.41	1.55	1.41	1.40	1.39

Notes:(i) ***Indicates significance at 1% level, and ** at 5% level, (ii) Dependent Variable: Real GDP growth, annual percent.

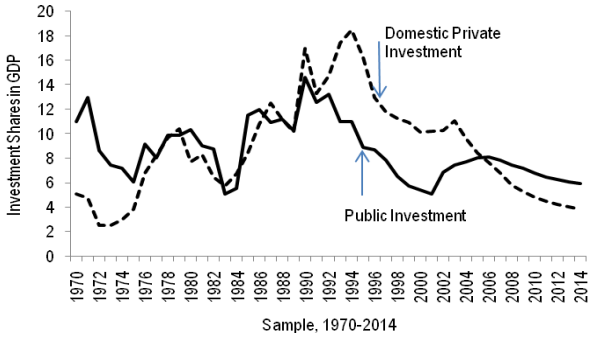

Figure 9. *Public Investm. and Domestic Private Investment (Percent of GDP), 1970-2014*
Source: Authors computation Using Data from World Bank, WDI (2015)

The increase in public investment in the first half of the 2000s that is from 5.7 percent in 1999 to 8.1 percent in 2006 was accompanied by a decrease in private investment, from 10.9 percent in 1999 to 7.7 percent in 2006. A generally negative, albeit weak, association between public and private investment can be seen during the early 1970s, 1990s, and 2000s, giving way to a negative association during most of the study period.

Complementary Effect of Public Investment on FDI and Economic Growth

Regarding the third model, the coefficient for the interactive variable $FDI \times gDm$ appears to be statistically insignificant when public investment-to-GDP ratio exceeds 8-10 percent, suggesting that the positive effect of FDI on economic growth is not affected by an increasing public investment. Overall, public investment in Tanzania has no a substitutable effect on FDI. Figure 10 presents the trend of FDI and public investment shares in GDP during the 1970-2014 period. Taking the 1970-1990, there has been no clear correlation between public investment and FDI; the partial correlation coefficient between the two variables is also very weak.

Table 10. *Regression: Results Complementary Effect of Public Investment on FDI and Economic Growth*

Variable	(1) *If* $gK \geq 8.0$	(2) *If* $gK \geq 8.5$	(3) *If* $gK \geq 9.0$	(4) *If* $gK \geq 9.5$	(5) *If* $gK \geq 10$
pK	0.531***	0.555***	0.568***	0.520***	0.522***
	(3.46)	3.67)	(3.78)	(3.06)	(3.01)
gK	0.254	0.208**	0.200	0.254	0.257
	(1.44)	(1.19)	(1.13)	(1.38)	(1.37)
FDI	0.252*	0.216*	0.198	0.193*	0.183
	(1.98)	(1.81)	(1.66)	(1.69)	(1.67)
L	-1.674***	-1.640***	-1.656***	-1.576***	-1.580***
	(-4.30)	(-4.22)	(-4.19)	(-4.04)	(-4.05)
TL	0.616***	0.601***	0.593***	0.568***	0.572***
	(3.17)	(3.08)	(3.04)	(2.86)	(2.89)
Γ	6.546***	5.646***	5.770***	5.708***	5.729***
	(3.71)	(3.77)	(3.87)	(3.80)	(3.82)
π	-0.005	-0.005	-0.005*	-0.005	-0.004
	(-1.68)	(-1.60)	(-1.72)	(-1.62)	(-1.74)
$pK \times gD_i$	-0.151	-0.114	-0.091*	-0.091	-0.081
	(-1.13)	(-0.89)	(-1.71)	(-0.71)	(-0.64)
_cons	1.821	1.458	1.381	0.923	0.908
	(1.02)	(0.85)	(0.79)	(0.58)	(0.57)
F-Stat.	19.82	19.49	19.31	21.06	21.25
Frob>F	0.000	0.000	0.000	0.000	0.000
$\overline{R}^2$	0.774	0.771	0.769	0.769	0.784
DW	1.38	1.55	1.41	1.40	1.39

Notes(i) ***Indicates significance at 1% level, and ** at 5% level, (ii) Dependent Variable: Real GDP growth, annual percent.

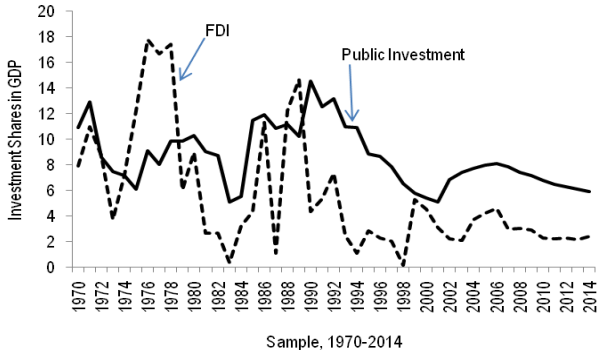

Figure 10. *Public Investment and FDI (Percent of GDP), 1970-2014*
Source: Authors computation Using Data from World Bank, WDI, 2015

Complementary Effect of FDI on Private Domestic Investment and Economic Growth

A dummy variable, $pK \times fdiDm$, is employed into model 4 to capture the interrelationship between FDI, domestic private investment, and economic growth. $pK \times fdiDm$ is classified into 5 levels: 5.0 percent, 6.0 percent, 7.0 percent, 7.5 percent, and 8.0 percent. As presented above, $fdiDm$ is defined as 1 whenever it equals or exceeds these percent points, and it is defined as 0 whenever it is less than the given levels. The empirical results of the complementary effect of FDI on domestic private investment and economic growth are reported in Table 11.

When FDI-to-GDP ratio exceeds 5-8 percent, the coefficient for the interactive variable $FDI \times fdiDm$ appears to be statistically insignificant. However, the coefficients of domestic private investment marginally decline as FDI-to-GDP ratio increases. Results show that the coefficients of domestic private investment are 0.618, 0.585, 0.493, 0.493, and 0.492

if $fdiDm \geq 5.0$, $fdiDm \geq 6.0$, $fdiDm \geq 7.0$, $fdiDm \geq 7.5$ and $fdiDm \geq 8.0$ respectively. This mixed relationship between FDI and domestic private investment is reported in Figure 11. During the 1970s FDI-to-GDP ratio was above domestic private investment-to-GDP ratio. During 1980s there was not clear correlation, while during the 1990s, 2000s, and 2010s domestic private investment-to-GDP ratio was above FDI-to-GDP ratio but both were declining mainly due high proportionate increase in GDP.

Table 11. *Regression: Results Complementary Effect of FDI on Domestic Private Investment and Economic Growth*

Variable	(1) *If* $FDI \geq 5.0$	(2) *If* $FDI \geq 6.0$	(3) *If* $FDI \geq 7.0$	(4) *If* $FDI \geq 7.5$	(5) *If* $FDI \geq 8$
pK	0.618***	0.585***	0.493***	0.493***	0.492***
	(3.50)	(3.56)	(3.13)	(2.92)	(2.99)
gK	0.196	0.213	0.263	0.235	0.247
	(1.08)	(1.21)	(1.51)	(1.35)	(1.40)
FDI	0.106*	0.223*	0.171**	0.148**	0.149**
	(1.71)	(1.83)	(2.51)	(2.27)	(2.28)
L	-1.714***	-1.629***	-1.40***	-1.253***	-1.312***
	(-3.66)	(-3.38)	(-3.45)	(-2.444)	(-2.793)
TL	0.615***	0.593***	0.540***	0.559***	0.561***
	(3.03)	(3.01)	(2.77)	(2.84)	(2.86)
Γ	6.004***	5.907***	5.375***	5.104***	5.199***
	(3.91)	(3.66)	(3.61)	(3.11)	(3.26)
π	-0.007	-0.006*	-0.005*	-0.005*	-0.005
	(-2.03)	(-1.98)	(-1.86)	(-1.74)	(-1.89)
$pK \times fdiD$	-0.038	-0.009	-0.023	-0.111	-0.107
	(-0.43)	(-0.09)	(-1.46)	(-0.31)	(-1.08)
_cons	1.394	0.958	0.218	0.392	0.125
	(0.69)	(0.50)	(0.13)	(0.20)	(0.07)
F-Stat.	19.10	18.99	20.37	19.679	19.741
Frob>F	0.000	0.000	0.000	0.000	0.000
$\overline{R}^2$	0.767	0.766	0.778	0.772	0.773
DW	1.39	1.28	1.46	1.41	1.42

Notes(i) ***Indicates significance at 1% level, and ** at 5% level, (ii) Dependent Variable: Real GDP growth, annual percent.

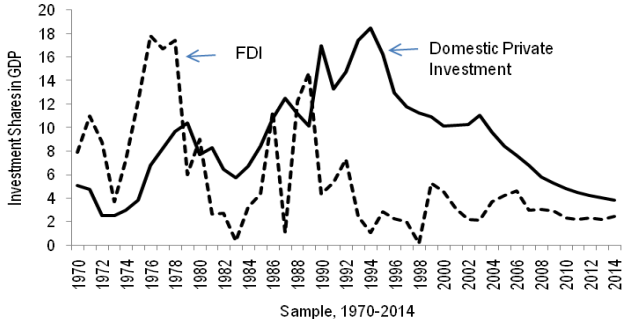

Figure 11. *FDI and Domestic Private Investment (Percent of GDP), 1970-2014*
Source: Authors computation Using Data from World Bank, WDI (2015)

5.2.5. Granger Causality

It is important to determine the direction of causality between domestic private investment and economic growth on one hand, and FDI and economic growth on the other hand for policy purposes. This is due to the fact that literature review has a contradicting result on the relationship between investment and growth. Granger causality test is used to determine the causation between the key variables of this paper namely domestic private investment, FDI and real GDP growth for which they are $I(1)$ and found cointegrated. The existence of causality between the variables is tested through the null hypotheses that $\delta_j = 0$ in equation (9) and $\beta_j = 0$ in equation (10) for all js. If the null hypothesis accepted, there is no causality. If the null hypothesis is rejected, causality is inferred. The $VAR(2)$ model is used to determine the direction of causality and the results are presented in Table 11. From Table 11, the null hypothesis that economic growth (y) does not Granger cause domestic private investment (pK) is not rejected at 5 percent level

of significance but we fail to reject the null hypothesis that pK does not Granger cause y at 5 percent level. These results suggest unidirectional causation in the long-run that runs from domestic private investment to economic growth in the case of Tanzania.

Table 11. *Results of Granger Causality Wald Test*

Lag Level / Null hypothesis (H_0)	1		2		Results
	F-Stat.	Prob.	F-Stat.	Prob.	
$\dot{y}$ does not Granger cause pK	0.013	0.909	1.879	0.167	Do not reject H_0
pK does not Granger cause $\dot{y}$	3.923	0.054	3.135	0.054	Reject H_0
$\dot{y}$ does not Granger cause *FDI*	4.210	0.005	4.784	0.004	Reject H_0
FDI does not Granger cause $\dot{y}$	5.289	0.001	6.631	0.004	Reject H_0

Source: Computed using data from World Bank, WDI (2015)

The results also suggest that causality between real GDP growth and FDI runs in both directions. This bi-directional causal effect is statistically significant at 1 percent level in both directions.

6. Conclusions

The main objective of this paper is to examine the causal effect between investment and economic growth and point to policy measures aimed at further strengthening economic growth in Tanzania. In this regard, the paper analyzes the effect of domestic private investment, public investment and FDI on economic growth in Tanzania. The paper also analyzes the crowding out effect of public investment on domestic private investment and FDI. The modified neo-classical growth model to include control variables such as trade, life expectancy and macroeconomic stability proxied by inflation is used to estimate the impact of investment on economic growth. Also, the economic growth models based on Phetsavong & Ichihashi (2012), and Le & Suruga (2005) are used to estimate the crowding out effect of public investment on private domestic investment on one hand and FDI on the other hand. Likewise, the crowding out effect of FDI on domestic private investment is estimated. Macroeconomic time series data spanning from 1970 to 2014 is used for descriptive analysis and empirical estimations. The unit root test conducted confirms that the variables are stationary in first difference and the co-integration tests also confirm the existence of long run relationship between the variables included in the regression models. The diagnostic tests such Breusch-Godfrey serial correlation LM test, Jacque-Bera-normality test and white heteroskedasticitytest reveal that the model has the desired econometric properties.

The empirical results suggest that both domestic private investment and FDI have an impact on economic growth in Tanzania. The causality tests also confirm the existence of a long run unidirectional causal relationship that runs from domestic private investment to economic growth and bi-directional causation between FDI and economic growth. In addition, the paper confirms that domestic private investment is more effective than FDI. The significant effect of public investment on economic growth could not be established. Furthermore, the empirical results show that public investment crowds out domestic private investment. This implies that any increase in public investment more than its proper level would only reduce the positive effect of domestic private investment on economic growth. Moreover, empirical results suggest that FDI tends to

marginally reduce the positive effect of domestic private investment on growth. Thus, the results may suggest that public investment and FDI need to be considered carefully in order to avoid their impact on private domestic investment, which in turn would reduce the growth rate of real GDP. Domestic saving should be promoted to encourage domestic private investment for growth. Other factors such trade liberalization and life expectancy on one hand, and population growth and inflation on the other hand seem to affect economic growth positively and negatively respectively.

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