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Determinants of Private Investment in Tanzania: 1970-2015

Ali A.L. Kilindo*

Abstract

This study provides an empirical analysis of the macroeconomic factors that affect private investment decisions in Tanzania. Theory and empirical literature is reviewed in an effort to identify a private investment function for the period 1970 to 2015. The results suggest that private investment is determined by aggregate demand as measured by output. In addition, there is evidence that the crowding in effect of public investment and credit flow to the private sector has positive impact on capital accumulation, while external debt and inflation have had negative effects. Since time series data can bring spurious regression results, we avoid this by testing for stationarity and co-integration prior to estimation of the model. The results of the ECM model suggest that private investment is co-integrated with the suggested variables. In terms of policy, the results suggest the importance of inflation control, development of credit markets and public investment as economic policy instruments for private investment growth in Tanzania.

***Keywords**: investment, crowding-out, co-integration, Tanzania, unit-root*

1. Introduction

The role of private investment on economic growth has been recognized in many countries in the world. This explains the wide range of research that has been undertaken to investigate the factors that determine private investment. Unfortunately, many developing countries experienced a decline in investment rates that began in the 1980s. During the same period there were institutional and structural characteristics of capital formation such as financial repression in the credit market, a strong government presence, dependency on foreign resources and various forms of economic instability. Studies have mostly investigated how these factors have impinged private sector investment. Other studies on private-sector investment have also extended empirical analysis to variables representing uncertainties in the investment decision-making process and external constraints. Among the studies following that line of analysis include Greene and Villanueva, (1995), Serven and Salinamo (1993) and Agosin (1994). Most recently, studies along those analytical approaches include Kohpaiboom (2008), Gnansoumou (2010), Hassan and Salim (2011), Bayai and Nyangara (2013) and Ayeni (2014). The external debt crisis and the deterioration in the terms of trade that affected developing economies in the 1980s has been explained as the cause of revised analysis that brings out the importance of external constraints

* Department of Economics, College of Social Sciences, University of Dar es Salaam, Tanzania.

For the case of Tanzania, empirical studies have mainly sought to analyse the relationships between private and public sector investment and the determinants of private investment. Along this line of research, Moshi and Kilindo (1998) analysed how macroeconomic policies influence private investment growth, but modern econometric techniques were not applied. Thus, the estimated models' results of that study could be culprits of spurious regression. To circumvent spurious regression using Tanzanian data Kilindo (2016) employs stationarity and co-integration approach to establish estimates that are prior tested for stationarity of the time series. The estimated results of the model, which tried to link public and private investment, showed that public and private-sector investment was complementary in the long-term. More variables are related to private capital formation for a longer period of four and a half decades in Tanzania, covering the period1970-2015. We believe that an empirical analysis of private investment will only be wholly satisfactory when modern econometric procedure is improved by the use of modern econometric techniques.

Therefore, the objective of this paper is to analyse the main determinants of private investment in Tanzania during the period 1970–2015. To avoid spurious regression, we use modern econometric techniques to test the variables for unit root and performing stationarity and co-integration (Engle & Granger, 1987; Hendry & Mizon, 1963; Harris & Solis, 2003).

The econometric model used is based on recent studies in developing countries and takes into account not only the more common variables, but also the influence of external constraints on private investment. The main goals are to obtain, following other studies, a private investment model that is well specified and consistent with theory. It is well documented in literature that stationarity and co-integration analysis allow short-term and long-term effects of explanatory variables to be distinguished from one another.

The results of this study indicate that during the period of the study, private investment was positively influenced by aggregate demand (output level), public investment and credit; and negatively influenced by the exchange rate, conditions of uncertainty and credit rating as measured by the rate of inflation and external debt, respectively. The importance of public investment and financial credit as policy instruments for encouraging private investment is revealed by the model estimation results.

The paper is organized in five sections. This introduction is followed by section two that looks at the evolution of variables used in the analyses and sources of statistical data. The third section briefly reviews the theory of private investment. The fourth section describes the methodology used and analyses the empirical results. The fifth and last section concludes the study and discusses the policy implications.

2. Evolution of Major Macroeconomic Variables

The in this study analysis employs annual data obtained from the National Accounts for the period 1970–2010. We use real GDP (y) to measure real output. This is obtained by adjusting nominal GDP by the consumer price index (CPI). Gross fixed capital formation by public and government is used to measure public and private investment ratio.

Table 1 provides average value of these variables over the sample period. It is seen that Tanzania's economic performance, as reflected by the growth of GDP, is considered impressive in the last decade. During the period 1970–79 the average GDP growth was 4.3 percent, and then increased to an unimpressive 3.8 percent in the 1990s. The 1980s were considered as tough years for the Tanzanian economy. This was due to the global recession of the early 1980s and the adverse shocks in commodity prices. Growth performance of the economy plunged and as result the average GDP growth was only about 2.3 percent. Recovery was realized during the 2000 to 2010 decade as the GDP growth recorded 7 percent. For the five years from 2010 to 2015 the average growth was 7.2 percent.

Table 1: Trend in selected indicators: 1970–2010

Variables	1970–79	1980–89	1990–99	2000–10	2011–15
Y	4.31	2.25	3.75	7.0	7.2
Credit	0.6	3.4	5.4	12.4	24.5
Exchange rate (TZS Per US$)	7.6	64	425	1125	1770
Private investment/GDP	4.8	7.23	14.40	16.37	24.66
Public investment/GDP	12.8	9.44	10.10	6.60	31.32
Total investment/GDP	**17.76**	**16.67**	**24.40**	**22.97**	**51.98**

Notes: y is growth in GDP; credit is credit to the private sector.

Table 1 also evidences that Tanzania witnessed increases in private investment and public investment ratios. During the 1990s the government initiated privatization programs to give the private sector an increased role in the nation's development process. Public investment to GDP ratio was then seen to gradually decline, with the average ratio of about 10 percent during 1990–99, but declined to 6.6 percent during the period 2000–2010. The shift to private-sector-led growth is reflected in the upward trend in the private investment ratio from 4.8 percent in the 1970s to more than 16 percent during the 2000–2010 period, and 31 percent during the 2011–2015 period.

3. The Theory of the Determinants of Private Investment

Theoretical and empirical considerations suggest that the most important variables that determine private investment levels in developing countries are domestic output, the real interest rate, public investment, availability of credit to the private sector, the size of the external debt, the exchange rate and macroeconomic stability (Serven & Solimano, 1997).

Jogernson (1963), the origin of the neoclassical theory of investment, says that the value of capital stock desired by a competitive enterprise is a positive function of its output level, which may be treated as a proxy for the level of demand. As an extension of this result to the aggregate level, we can consider a country's output as a measure of demand in the private sector as a whole. Another variable considered relevant in the neoclassical theory in investment decision-making is real interest rate. In this case it represents the usage cost of capital or the cost of credit. Increases in the interest rate payable are a disincentive to investment and thus it is expected that a negative relationship between the two variables exists.

Due to the lack of the involvement of the private sector in large investment projects, developing country governments generally play a large part in economic activity. Public sector capital can either 'crowd-out' or 'crowd-in' private sector investment. Crowding-out occurs through competing for appropriating resources (physical and financial), and producing marketable goods (Naqvi, 2002; Cruz et al., 1999). Crowding-in occurs when public sector capital increases productivity by generating a positive eternality. The best example of this is in the case of investment in infrastructure and the provision of public goods, which may act countercyclical by increasing the demand for private-sector inputs and services.

The size of external debt is one of the variables that accounts for the influence of external credit constraints or the financing of production activities in developing countries. The decline in external resources being transferred to heavily indebted countries was one of the causes of the low investment rates in the 1980s (Serven & Solimano 1992). High debt levels also meant that resources previously used to finance local companies were transferred abroad as service payments and charges. Along this line of argument, in a study of Zimbabwe Bayai and Nyangara (2013) included the external debt in analyzing determinants of private investment. Their findings affirm a negative relationship between external debt and private investment. Acosta and Loza (2005) arrive at similar conclusions when they use the ratio of external debt to GDP in an analysis of short- and long-term determinants of private investment in Argentina.

The real cost of imports is determined by the exchange rate. A currency devaluation increases the real cost of purchasing imported capital goods, thereby reducing the profitability of the private sector possibly causing investment to decline. Production capacity and activity can also be reduced to low levels due to a real devaluation that causes a fall in the real income of the economy as a whole. Currency devaluation has a positive impact on investment in sectors producing internationally traded goods. Studies that have included exchange rate in the factors determining private investment include those of Acosta and Loza (2005), Bayai and Nyangara (2013) and Ayeni (2014).

To bring on board the problem of investment irreversibility following Pindyck (1988) and Cabello (1993), the inflation rate is included as a measure of economic stability. According to theory of investment irreversibility, spending on fixed

capital cannot be recovered in full if a company concerned should decide to sell this capital at a later date. Many capital goods are company-specific and have a lower resale value than purchase price. This means that investment is an irrecoverable cost. Installed capital cannot be used for other purpose without a company incurring costs. The existence of uncertainties may have a large influence on investment decisions since the future is unpredictable, especially in developing countries. A number of studies hold that it is mainly in developing countries that investment is irreversible (Caballero, 1993; Chibber & Wijnbergen, 1988; Khan & Kumar, 1978).

It would therefore appear that economic stability and the credibility of public policies play an important role in stimulating investment. Similar to the treatment of inflation in most analyses of the determinants of private investment, this study uses investment changes in the inflation rate as a proxy of uncertainty in the economy.

Many companies in developing countries encounter restrictions in the credit market as a result of information asymmetries between lenders and borrowers. Given the underdeveloped nature of emerging capital markets -- such as long-term financing and the futures markets -- bank loans and external borrowing may be the only sources of credit for private-sector investment financing. This study uses data on the credit to the private sector as published by the Bank of Tanzania to represent credit availability.

Most of the data used for the explanatory variables are only available annually. A sample with the largest possible explanations is the period 1970–2015. This is an adequate span for analysis with the number of explanatory variables and the lags for each variable.

4 Methodology

4.1 Data

We use GDP figures from the *National Accounts* published by the National Bureau of Statistics (NBS). Private investment data used were taken as private-sector gross fixed capital formation figures. The public investments data used were obtained from the public-sector gross fixed capital formation statistics also published in the system of *National Accounts* by the NBS.

The values of private investment, output, public investment, exchange rate and credit series were expressed in millions of TZS. For the investment figures we used fixed capital formation. The change in the general price index was used as a measure of inflation, while external debt divided by GDP was used as a measure of foreign indebtedness. The study also used the external debt-GDP ratio published by the Bank of Tanzania (BoT). The data used are those for the nominal exchange rate against the US dollar as reported by the BoT, the central bank of Tanzania.

4.2 Statistical Behaviour of Variables

Before the model estimation we investigated into the variability of the data set by computing standard statistics. These are variance, standard deviation, skewness and kurtosis. As Table 2 shows, the values for skewness and kurtosis are not far from suggesting normality in the series. Plots of the series with trend lines are appended in Annex 1.

Table 2: Descriptive statistics

Statistic	**Variables**						
	log GDP	***log Pub. Inv***	***Log Priv. Inv***	***Log Debt***	***Log Credit***	***Log Ex. Rate***	***Inflation***
Mean	13.82	11.53	11.66	5.46	11.64	4.93	16.84
Std Dev.	2.99	3.09	3.46	2.61	2.85	2.23	10.99
Variance	8.99	9.55	12.02	6.79	8.15	4.97	120.85
Skewness	-0.14	0.11	-0.15	-0.39	0.03	-0.32	0.37
Kurtosis	1.58	1.89	1.67	2.48	1.79	1.32	1.59

The trend equations in Table 3 were estimated to come up with the trend graphs that appear in the Annex 1**.**

Table 3: Estimated Trend Equations

Variable	**Constant**	**Coef.**	**Std error**	**t**	**Prob.**	**95 percent conf.**
GDP	-8.6167	0.2216	0.0041	54.04	0.0000	.2299
Public Inv.	-6.2115	0.2267	0.0061	37.10	0.0000	.2390
Priv. Inv	-5.6401	0.2562	0.0049	51.94	0.0000	.2602
Debt	-1.2095	0.1810	0.0106	17.14	0.0000	.2023
Credit	-6.6812	0.2109	0.0040	52.67	0.0000	.2190
Exch. rate	-1.2292	0.1578	0.0078	20.20	0.0000	.1736
Inflation	-23.2898	-0.2742	0.1163	-2.36	0.0003	-.3973

4.3 Econometric Analysis

We use the Engle and Granger's (1987) method to verify the co-integration hypothesis in series that prove to be integrated of order one and then estimate the differences model with the error correction mechanism.

The Dohansen's (1988) method is often used to analyze the co-integration vectors by means of a vector autoregressive (VAR) model to determine more accurately the number of co-integration ratios and the coefficient vector estimates for the ratios. Before the 1980s many economists used linear on (de-trended) non-stationary time series data, which was latter shown to be a dangerous approach that could produce spurious correlation since standard de-trending techniques can result in data that are still non-stationary. For integrated I (1) processes, it was shown that de-trending does not work to eliminate the problem of spurious correlation, and that the superior alternative is to check for co-integration. Two series with I(1) trends can be co-integrated only if there is a genuine relationship between the two. Thus the standard current methodology for time series

regressions is to check all-time series involved for integration. If there are I(1) series on both sides of a regression relationship, then it's possible for regressions to give misleading results.

The possible presence of co-integration must be taken into account when choosing a technique to test hypotheses concerning the relationship between two variables having unit roots (i.e., integrated of at least order one). The usual procedure for testing hypotheses concerning the relationship between non-stationary variables was to run ordinary least squares (OLS) regressions on data that had been differenced. This method is biased if the non-stationary variables are co-integrated. Granger and Engle (1987) formalized the co-integrating vector approach, and coined the term cointegration

As noted above, time series data can bring spurious regression results. Like in most other studies, this was avoided by testing for stationarity. This is augmented with the test by Dickey-Fuller (1981) (ADF) and Harris and Solis (2003), in addition to visual inspection of the correlograms of the variables. In view of the possible existence of structural breaks, the Perron (1989) test is applied to circumvent wrong indication of non-stationarity in what is actually a stationary series.

4.3.1 Unit Root Test Results

Table 4 displays the results of the Dickey-Fuler (ADF) test for the level and first difference series. Column two of the table shows the deterministic parameters (constant and linear trend). These present a significant value of *t* at the 10 percent, and are thus included in the regression of each of the variables.

Table 4: ADF Unit Root Test

Variable	At level		At first difference	
	Test statistic	***Order of integration***	***Test statistic***	***Order of integration***
LogPriv inv.	-0.338 (0.9200)	I (1)	-4.884* (0.0000)	I (0)
LogPubl. inv	-0.377 (0.9138)	I (1)	-5.670* (0.0000)	I (0)
LogExch	-0.376 (0.9140)	I (1)	-4.323* (0.0004)	I (0)
LogGDP	-0.557 (0.8803)	I (1)	-3.567** (0.0064)	I (0)
LogInterest	-1.280 (0.6381)	I (1)	-5.524* (0.0000)	I (0)
LogExt. debt	-2.446 (0.1291)	I (1)	-7.923* (0.0000)	I (0)
LogCrdt priv	-0.477 (0.9841)	I (1)	-3.329** (0.0136)	I (0)

Note: The critical values are; 1 percent (-3.655), 5 percent (-2.961) and 10 percent (-2.613).The asterisks (*), (**) and (***) represent the critical values 1 percent , 5 percent and 10 percent respectively. In brackets are the probability values.

We can see from the results that the interest rate and inflation rate series are integrated of order zero or stationary, while the first differences of the private investment, public investment, external debt, exchange rate and credit series are integrated of order one.

4.3.2 The Philip-Perron Test

All series of variables that the ADF test showed to be non-stationary were subjected to the tests of Perron (1988) and Perron (1989), Toda and Perron (1994), and Ng and Peron (2001). This was to show whether they were really non-stationary or were affected by a structural break, causing a permanent change in their averages.

Table 5 presents the results of the Perron test for the level and differences of the series. Columns two and four show the statistic values. Charemza and Deadman (1997) supply the upper critical values of *t* as -3.48 and -4.15 at the 5 percent and 10 percent significance levels, respectively. The GDP series seem to be stationary when first differentiated. This suggests that the ADF test results were skewed by the presence of a structural break. Other variables of the Perron's tests confirm earlier results from the ADF test.

Table 5: Phillip-Perron Unit Root Test

Variable	At level		At first difference	
	Test statistic	***Order of integration***	***Test statistic***	***Order of integration***
LogPriv inv.	-0.370 (0.9150)	I (1)	-4.948* (0.0000)	I (0)
LogExch	-0.403 (0.9095)	I (1)	-5.714* (0.0000)	I (0)
LogExch	-0.488 (0.8943)	I (1)	-4.343* (0.0004)	I (0)
LogGDP	-0.491 (0.8938)	I (1)	-3.567** (0.0064)	I (0)
LogInterest	-1.367 (0.5978)	I (1)	-5.631* (0.0000)	I (0)
LogExt. debt	-2.691 (0.0755)	I (1)	-7.841* (0.0000)	I (0)
LogCrdt priv	-0.172 (0.9706)	I (1)	-3.286** (0.0155)	I (0)

Note: The critical values are; 1 percent (-3.655), 5 percent (-2.961) and 10 percent (-2.613).The asterisks (*), (**) and (***) represent the critical values 1 percent , 5 percent and 10 percent respectively. In brackets are the probability values.

What emerges from the unit root tests is that private investment, output, public investment, external debt, exchange-rate and credit series are integrated of order one (I(1)); being non-stationary in level while stationary in first differences. The interest rate and inflation rate variation series are stationary before differencing or in levels or I(0).

4.3.3 Co-integration Tests

The study made use only of the integrated variables of order one that proved statistically significant in determining private investments output, exchange rate and credit. Tables 6 and 7 present the results of applying Johansen's (1988, 1994) procedure.

The Johansen's methods are more general in character compared to the Engle-Granger method, which does not specify the endogenous and exogenous variables *a priori*. A three lag VAR was estimated for the private investment, output, exchange rate and credit variables; and another VAR model with one lag was estimated for the private investment and public investment variables.

Table 6: Co-integration Results

Unrestricted Co-integration Rank Test (Trace)					
Hypothesis Ho H_A	***Hypothesized No. of CE (s)***	***Eigen value***	***Trace Statistic***	***0.05 Critical Value***	***Prob.*****
r=0 r>0	None *	0.940356	159.6629	47.85613	0.0000
r≥1 r>1	At most 1 *	0.627281	52.52694	29.79707	0.0000
r≥2 r>2	At most 2	0.285854	15.02362	15.49471	0.0588
r≥3 r>3	At most 3	0.057001	2.230220	3.841466	0.1353

Notes: Trace test indicates 2 cointegrating eqn (s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 7: Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesis Ho HA	Hypothesized No. of CE (s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
r=0 r>0	None *	0.940356	107.1360	27.58434	0.0000
r≥1 r>1	At most 1 *	0.627281	37.50332	21.13162	0.0001
r≤2 r>2	At most 2	0.285854	12.79339	14.26460	0.0843
r≥3 r>3	At most 3	0.057001	2.230220	3.841466	0.1353

Note: Max-eigenvalue test indicates 2 cointegrating eqn (s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The null hypothesis of no co-integration is rejected in both models and the existence of one co-integration vector is not refuted.

4.4 Estimation and Results for Private Investment

The second stage is to identify with the respective lags significant variables in the private investment equation. The process will involve working from the general to the preferred model, the general model being the autoregressive distributed lags (ADL) model (Charenza & Deadman, 1997; Shafik, 1992). By eliminating variables and lags that prove to be statistically insignificant, the model was gradually reduced. The general form of the model appears as equation 1.

$$\Delta y = \beta_0 + A(L)\Delta yt - 1 + \beta(L)\Delta q + \eta \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where *yt* represents private investment, *qt* the vector of independent variables, and *nt* (the error term). To test the determinants of private investment the expression in equation 2 was used with two lags.

$$\Delta \log p \quad in = \alpha_0 + \sum \alpha_1 \Delta \log p \quad in - 1 + \sum \alpha_2 \Delta \log o + \sum \alpha_3 \Delta \log e. \; ha \quad r + \sum \alpha_4 \Delta \log d + \sum \alpha_5 \Delta \log c + \sum \alpha_6 \Delta \log in + E(\quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Positive coefficients are obtained for output and credit, while the exchange rate coefficient is negative. The positive coefficients on output and credit show that private investment was stimulated both by the level of activity in the economy

and by the availability of long-term financing, which is in conformity with empirical findings in literature. The negative coefficient for the exchange rate shows that currency devaluation led to a fall in investment over the long term.

In the second equation, the predominance of the crowding in effect is seen, with investment in public goods having a positive impact on private-sector investment. After establishing the long-term dynamics of private investment, we then attempt to determine the short-term relationships among the variables. The relationships are represented in the models with the first differences of the I(I) variables, including the error correction mechanism (ECM) and the inflation rate, the variables that were stationary in level. Table 8 presents the results.

Table 8: Estimated Model Results, 1970-2015
(Dependent Variable: Δlog Private Investment)

Variable	Coefficient	Standard Error	*t*	*t* prob
Δlog private inv. -1	-0.0675	0.1818	-0.37	0.0071
Δlog output	0.8932	0.3649	2.45	0.0026
Δlog public inv.	0.2619	0.1113	2.35	0.0005
Δ log Debt	-0.2425	0.1925	2.49	0.0429
Δlog credit	0.4515	0.1902	2.35	0.0026
Δ log exchange rate-1	-0.1785	0.1488	-1.20	0.1261
Inflation-1	-0.0101	-0075	-1.35	-.0053
ECM-1	-03380	0.1597	-2.12	0.0114
Adj R^2 0.616				
F(14,29) = 5.93				

The importance of output growth and credit availability in allowing higher levels of private investment is supported by the positive coefficients. Output impacts with an elasticity of 0.8 percent show evidence that agrees with the accelerator process. This is also the evidence that supports the theory of 'crowding-in' effect of public investment. The negative coefficient for the exchange rate indicates that a fall in investment, resulting from currency devaluation/depreciation, occurred during the period of analysis. The increase in the external debt has adverse effects on private investment as it was signaling a bad credit rating, and thus decreasing private investment. It also indicates that the debt position with the rest of the world is a variable that impacts the expectations of investors since this usually determines the sustainability of investments through time of the economic policies that a government undertakes. The operation of the financial credit system seems to have been an important factor in private investment growth as indicated by the positive coefficient on the estimation results.

The lagged inflation rate also proved to be significant as a determinant of investment, indicating that uncertainty in the economy was instrumental in reducing the investment level. The interest rate coefficient did not prove to be

statistically significant, an indication that short-term variations in this rate did not affect investment and thus was dropped in our final equation.

The positive impact of public investment in the estimated equation confirms the crowding-in effect. An increase in public investment by 1 percent brings about increase in private investment by 0.26 percent, suggesting that public investment had a positive effect on the productivity of private capital. This result is similar to that obtained by Moshi and Kilindo (1998) and by Kilindo (2016) using Tanzania time series data.

4. Conclusion

The aim of this paper was to identify the variables that have influenced private investment growth in Tanzania for the period 1970 to 2015. Descriptive statistics were computed prior to model estimation to test variability in the data set. Further to circumvent possible spurious regression among the variables, stationarity, co-integration procedures are applied to the variables in an effort to obtain a well specified model that would inform policy in implementing action to encourage private investment. The results from the model suggest that private investment growth can be achieved by increasing economic activity, public investment and credit availability to the private sector. Further macroeconomic fundamentals such as inflation control, maintaining a competitive exchange rate and good credit rating are central to encouraging private investment as they reduce uncertainties.

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Annex 1: Variable trends