

MACROECONOMETRIC ANALYSIS OF ECONOMIC GROWTH IN TANZANIA: RAMSEY-CASS-KOOPMANS APPROACH

Wainyaragania Kennedy Arthur^{1*}

^{1*}Department of Economics, St. Augustine University of Tanzania, Tanzania

ABSTRACT: This study empirically analyzed economic growth, investment, and household consumption in Tanzania based on the Ramsey-Cass-Koopmans model. Specifically, this study aimed at determining the factors influencing consumption and investment, finding out the role that consumption and investment play in the economy, deriving the country's long-run economic growth model and identifying the factors influencing it, and lastly determining optimal resource allocation both in decentralized and centralized settings. Empirical regression models were specified to characterize the economy of Tanzania. The models estimated include economic growth, investment, and household consumption. These regression models were estimated using OLS. The study covered secondary annual data of 1970 – 2017 and analysis was carried out using Eviews9. Results showed that the major significant factors affecting long-run economic growth rate in Tanzania include investment, labor force and inflation. In a decentralized economy, results indicated that current investment in Tanzania is influenced by GDP growth rate which seem to have the most significant impact. Also, investment, per capita GDP and Growth rate of GDP influence current household consumption expenditure in Tanzania in decentralized economy. On the other hand, results from centralized economy revealed that none of the variables involved seem to have the most significant impact in influencing current investment in Tanzania implying that government activities in the economy are very minimal though significant. GDP growth rate and savings are the factors influencing current household consumption in a centralized economy. The study recommends that investors should be given more priority when formulating policies to deal with economic growth in Tanzania. Public investment should be encouraged in areas that benefit society and no private investment incentives. The government should create a conducive environment for private investment to operate in the country. Household consumption expenditure should also be encouraged and engaged in macroeconomic policies. In order to maintain high standards of household consumption, income fluctuations and stable spending should be considered when dealing with inflation expectations in the country.

Keywords: Economic growth, household consumption, investment, Tanzania.

1. INTRODUCTION

A problem of existence and characterization of solutions of optimal growth in a less developing economy is studied. The question here is on the behavior and dynamics of macroeconomic variables. How are these aggregates judged in the economy, and how should we think about them? Although these questions are not as simple as they are, it is clear that their answers are essential for policy issues regarding economic growth and development.

What are the principle variables driving the economy, what are their numbers, and what is their implication for structural changes in the economy? We brand it the 'demand shock' due to its properties. Commonly, the predictable and robust co-movement of real macroeconomic variables during the business cycle is explained by a single unobserved principal component. The co-movement of consumption and investment, reminiscent of the 'Ramsey-Cass-Koopmans (RCK) correlation,' realistically argues for a demand story, and not for the technology-driven fluctuations of an economy.

The goal of modern macroeconomic research (like this) is to provide a model that is consistent with trend facts in the dataset but can also replicate the cyclical properties of the economy. In particular, models that combine ingredients of household and firm behavior and include a well-specified definition of equilibrium are of most valuable.

This paper provides an empirical examination of the causes of economic fluctuations, their nature, number, and their implications for modeling policy formulation and analysis. The paper presents and estimates the Ramsey-Cass Koopmans (RCK) theory for the emerging Tanzanian economy.

1.1. The Ramsey-Cass-Koopmans Model

This model plays a crucial part as a tool for economists thinking about many macrodynamic situations in the economy, including investment, household consumption, and economic growth. The model should not be considered directly descriptive but rather as an examination of a benchmark case. The Ramsey-Cass-Koopmans model is the model that endogenizes the consumption-savings rate by explicitly introducing the consumer's infinite-horizon optimization to the model (Ryoji, 2009).

This model investigates the dynamics and behavior of economic aggregates based on the decision made at the microeconomic level. The Ramsey-Cass-Koopmans model is the version of the neoclassical model of economic growth based primarily on the work of Ramsey (1928), with significant extension by Cass (1965) and Koopmans (1965). It is considered to provide a natural benchmark case in the study of behavior and dynamics of economic aggregates, and it also gives economists a benchmark for many areas of modern macroeconomic analysis.

Collard (2011) shows that initially, Ramsey developed the model as a central planner's problem of maximizing the level of consumption over a successive generation. However, when Cass and Koopmans adopted the model, it turned to describe a dynamic economy, and later on, the model was extended to allow real business cycles.

According to (Ryoji, 2009), the Ramsey-Cass-Koopmans model, therefore, is based on the economic agent's intertemporal optimization. The competitive equilibrium path in this model corresponds to the social planner's optimal, which achieves the first-best allocation in which a different steady state where both physical capital and consumption exist. That is, the outcome of the model is Pareto optimal/efficient.

1.2. Research Background

Many less developing countries have been ranked by the International Monetary Fund (IMF) and the World Bank (WB) as the fast-growing economies of the world based on their high economic growth rates (IMF, 2017 and WB, 2016). Some of these countries, however, are found in the Sub-Saharan region. Surprisingly, it is this region that has extreme poverty. Although the economy is growing at high rates, many people are left impoverished and more impoverished with low investments and low consumption levels. High economic growth in these countries has failed to accommodate the poor. However, many countries in this region are resource-abundant countries. In their paper, Paul and Jan (1999) argue that improper allocation of resources and unfortunate (or lack of) policies have been the main reasons for no sound economic development that meet the needs of the people in most Sub-Saharan countries.

Recently, Tanzania ranked the 8th leading African economy. The World Economic Forum revealed the wealthiest economies in a list published in April 2018 through data provided by the IMF. Business Insider Sub-Saharan Africa worked with the data provided to create a ranking that focused on the ten economies with the most significant fortune through their GDP. The Business Insider named Nigeria (with GDP of \$408.61 billion) the first country followed by South Africa (\$370.89 billion), Algeria (\$197.63 billion), Morocco (\$121.0 billion), Angola (\$119.43 billion), Kenya (\$88.27 billion), Ethiopia (\$85.66 billion), Tanzania (\$56.66 billion), Ghana (\$51.62 billion), and Ivory Coast (\$48.14 billion).

1.3. An Overview of Tanzania's Economy

At independence 1961, Tanzania inherited a weak economy from the British colonial government. The industrial base was fragile, with only two factories (beer and cigarette). There was hardly any skilled personnel trained at higher levels; most children could not go to school. Hence, there were no essential human resources needed for development, and there were no funds from overseas to finance development plans, a few to mention.

After independence, the government announced the policy of socialism and self-reliance, and all means of production were under the state — emphasis was placed on agriculture and import-substitution industries. The economy's annual growth rate from 1967 – 1972 rose and stood at 4.8 percent on average, and per capita income rose in the 1970s and 1980s to \$309 (ILO, 1974).

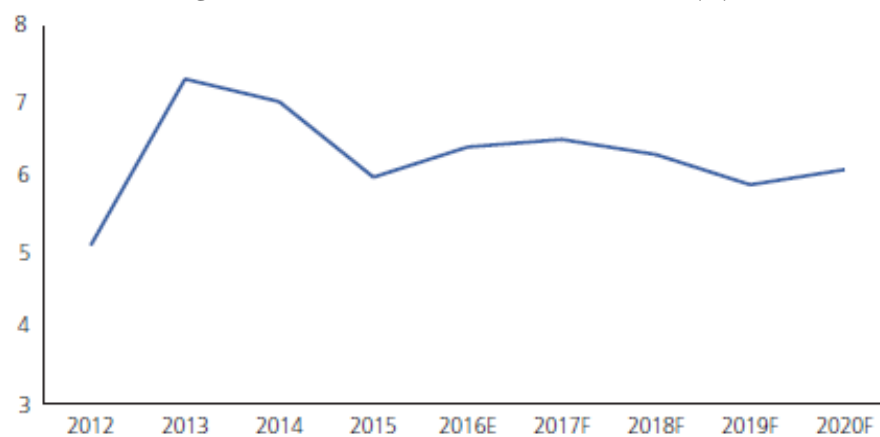
In the early 1980s, the Tanzanian economy was affected by both internal and external factors which contributed to the slowdown of the economy. The fall of commodity prices and the rise of oil prices in the

world market drained almost 60 percent of export earnings. Drought affected agriculture significantly at this time. Tanzania's economy was severely affected, and the country became highly indebted.

At the midst to the end of 1980s Tanzania started to restructure its economy with several reforms and programs such as the Structural Adjustment Programs (SAPs), encouraging both foreign and domestic private investment, reduce budget deficit and improve monetary control, depreciating the overvalued exchange rate, liberalize the trade regime, reducing price controls, easing restrictions on marketing, and restructuring of the financial sector. The economy was transitioning from a command economy to a market economy since 1985. The economy started to be driven by private investment and consumption and steady growth in the telecommunications, construction, port, and service sectors. These programs helped the country to have an excellent performance of growth, low and stable inflation, satisfactory foreign exchange reserves, and establishing external and net domestic debt sustainability. Overall, real economic growth averaged about 4 percent per year, but not enough to improve the lives of average Tanzanians.

The NBS (2016) recently revealed that Tanzania had maintained relatively high economic growth over the last decade, averaging 6-7 percent a year (see [figure 1](#). below).

Figure 1. Tanzania's Annual GDP Growth Rate (%)



Source: www.tradingeconomics.com

However, while the poverty rate in the country has slightly declined, the absolute number of poor has not because of the high population growth rate. Tanzania's real GDP growth rate slowed in 2017. According to government data, growth for the first three quarters of 2017 stood at 6.8 percent, down from 7.3 percent during the same period in 2016. The decline is mainly due to slower growth of services from the supply side and slower expansion of consumption and investment from the demand side.

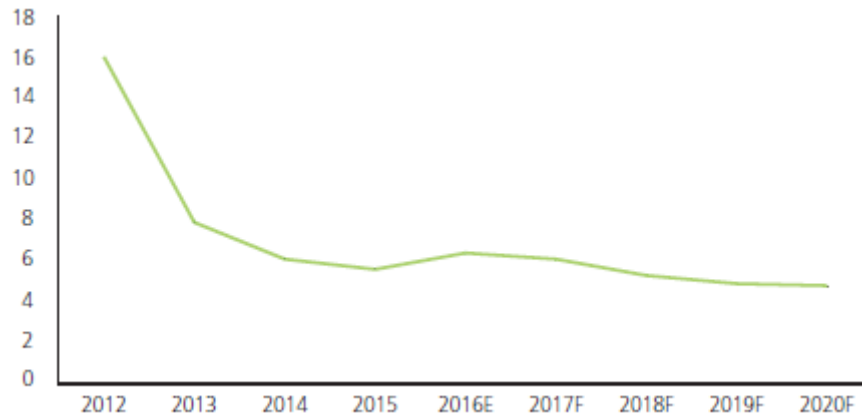
The economic outlook is favorable, with downside risks that are mainly under government control. The three most significant challenges facing the government to ensure growth momentum include; continuing to implement measures to ensure macroeconomic stability, especially consumption and investment, urgently implementing measures to enable and encourage the private sector to play a more significant role in Tanzania's economic development.

1.4. Current Macroeconomic Trend in Tanzania

The 2015/16 budget saw significant overrun in recurrent spending and significant shortfalls in development spending due to delays in securing funding. Fiscal deficit was about 3.5 percent of GDP.

The inflation rate remained low and near the target of 5 percent. However, the Tanzanian currency continued to depreciate. It was predicted that inflation would return to a 7-8 percent range in 2016-20 with tight fiscal policy. A relatively stable inflation environment (see [figure 2](#). below) promises future investment and consumption planning, which would spur the demand for credit.

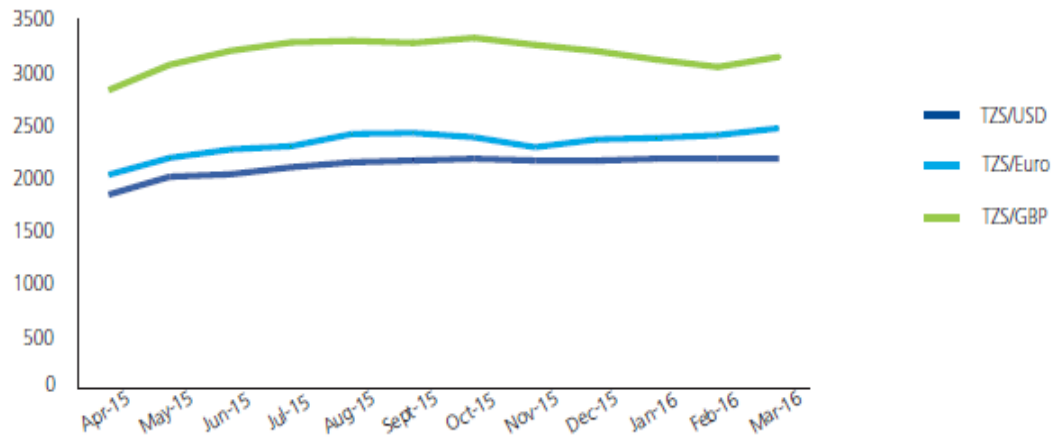
Figure 2. Tanzania's Inflation Rate (%)



Source: TEO (2016)

The Tanzanian shilling (TZS) experienced less depreciation in 2016 than in 2015 due to a positive balance of payments dynamics, improved local sentiments, tighter monetary policy (the statutory reserve ratio was now 10 percent from 8 percent in 2015). The value of the shilling remained stable following considerable volatility in 2015-2016 (figure 3).

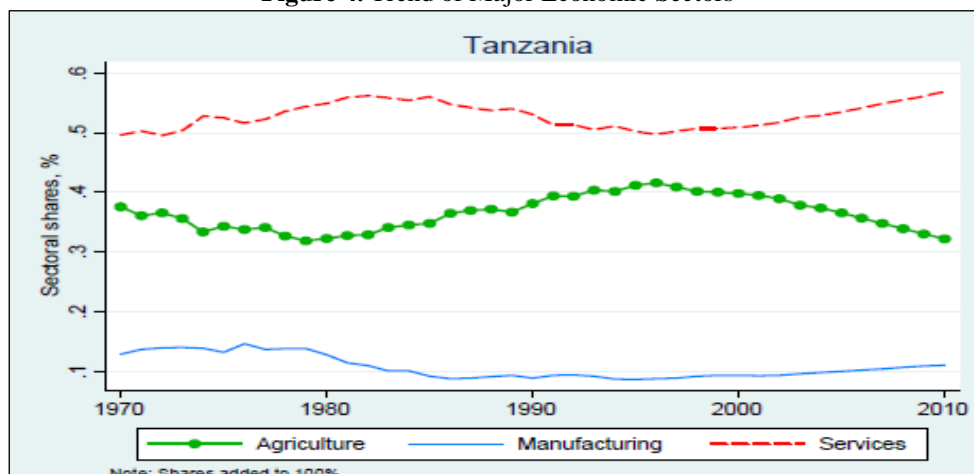
Figure 3. Exchange Rates



Source: Bank of Tanzania (2016)

In 2017, manufactured goods increased by 9 percent overtaking minerals, which led export growth to increase as well. The current account deficit narrowed significantly in 2016 as exports grew modestly, and imports fell significantly. Gross international reserves stood at 4.3 billion sufficient to finance approximately four months of imports.

Figure 4. Trend of Major Economic Sectors



Source: TEO (2016)

1.5. Statement of the Problem

In order to have significant economic development, developing countries have to maintain an average of 7 percent and above economic growth per annum. To achieve this requires a strong base of macroeconomic policies both in investment and consumption Epaphra (2014): (Nwachukwu and Odigie, 2011). However, a central challenge facing policymakers is how to assess the relative strength of those forces. It is not always clear which parameters should be changed and which should be kept constant across policy options.

Economists have a range of tools that can be used to make such an assessment. Inevitably, assessing the effects of a systematic policy change has to involve the use of a model. Ramsey-Cass-Koopmans model is the leading tool for making such an assessment (Lawrence *et al.*, 2018). This model does help to decide on parameters that should be changed. To be useful, this model must be data-based and observationally equivalent concerning macro data and microeconomic foundations.

What is the role of relative consumption and investment in the determination of aggregate output and in explaining the behavior and dynamics of the economy? This study explores these questions based on the RCK approach. Goodwin (1961) argued that in the course of planning in less developed/underdeveloped economies there arises at some point the question of what the rate of saving should be which creates the dilemma between the levels of consumption and investment needed for better economic growth and at the same time maintaining sound social welfare. It indicates a severe theoretical and policy gap apart from other shortcomings that need to be answered empirically. The rate is said to be very low, but how rapidly and how high should it be raised? Should the saving rate be raised, remain the same, or be reduced? Goodwin (1961) agreed that, as time passes, the policies become more comfortable to apply, but the prescriptions become debatable. Increasing capital goods capacity has received more significant attractions because machines to make machines involve growth but machines to make, say, for example, textiles do not. However, criticized in that we can always use promised future consumption as a reason for not consuming now, which does not provide a satisfactory basis for policy, the same question is, in what proportion should capital formation be divided between consumer goods industries and capital goods industries to have healthy economic growth and social welfare?

This study, in particular, intends to determine the best way to allocate investment in Tanzania in a way that balanced growth is possible afterward, and it produces a maximum total discounted amount of consumer goods. In this study, consumption is considered to be the sole aim of economic activity and that all consumption is equally desirable regardless of when it occurs, that is, any subjective time preference explicitly rejected. Planners only consider per capita consumption, thus ignoring any inequalities.

1.6. Research Objectives

The general objective of this study is to use the Ramsey-Cass-Koopmans approach to study the behavior and dynamics of Tanzania's economic aggregates (economic growth, consumption, and investment) basing on the decisions made at the microeconomic level. That is, what happens in Tanzania's economy as a whole when consumption and investment change? The specific objectives are;

- (i) To determine the factors that influence consumption and investment in the economy.
- (ii) To find out the role that consumption and investment play in the dynamics of economic growth.
- (iii) To derive the long-run economic growth model and identify factors influencing it.
- (iv) To determine the optimal allocation of resources between consumption and investment for sound economic growth and welfare of the people both in centralized and decentralized settings.

2. RESEARCH METHODS

This study used the Ramsey-Cass-Koopmans theoretical settings to specify the optimal empirical models. The purpose of Ramsey-Cass-Koopmans approach was to derive the structural restrictions that allow this study to identify different dynamics and parameters that affect the economy. Therefore, empirical regression models of this study are a version of the standard Ramsey-Cass-Koopmans setup in which it first describes the behavior of households and firms, respectively, both in centralized and decentralized aspects and later on the behavior of the government in the economy.

2.1. Empirical Regression Models Specification

In specifying the regression models the study followed general to specific techniques in modeling the equations by inclusion of maximum of four lags for each variable and start eliminating all insignificant

variables until the desired optimal econometric models were obtained. The following models, therefore, were finally estimated and used to make inference regarding the economy of Tanzania.

2.1.1. Model 1: Long-run Economic Growth Model

$$gdpgr_t = \beta_0 + \beta_1 invest_{t-3} + \beta_2 lf_{t-4} + \beta_3 gfce_{t-2} + \beta_4 inflr_{t-3} + e_t$$

2.1.2. Model 2: Investment Model in Decentralized Economy

$$invest_t = \alpha_0 + \alpha_1 gdpgr_{t-3} + \alpha_2 hce_{t-4} + \alpha_3 svng_{t-2} + \alpha_4 ir_{t-3} + \alpha_5 inflr_{t-1} + \alpha_6 gdppc_{t-2} + \varepsilon_t$$

2.1.3. Model 3: Household Consumption Model in Decentralized Economy

$$hce_t = \gamma_0 + \gamma_1 gdpgr_{t-1} + \gamma_2 invest_{t-1} + \gamma_3 inflr_{t-2} + \gamma_4 gdppc_t + \varepsilon_t$$

2.1.4. Model 4: Investment Model in Centralized Economy

$$invest_t = \pi_0 + \pi_1 gdpgr_{t-3} + \pi_2 hce_{t-4} + \pi_3 svng_{t-2} + \pi_4 ir_{t-3} + \pi_5 inflr_{t-1} + \pi_6 gdppc_{t-2} + \pi_7 gfce_{t-2} + \pi_8 txrev_t + \pi_9 ks_t + \mu_t$$

2.1.5. Model 5: Household Consumption Model in Centralized Economy

$$hce_t = \pi_0 + \pi_1 ir_t + \pi_2 gfce_{t-2} + \pi_3 gdppc_{t-4} + \pi_4 txrev_{t-2} + \pi_5 gdpgr_{t-4} + \pi_6 svng_t + \mu_t$$

Where; $gdpgr_t$ is the gross domestic product growth rate measured in annual percent growth rates. $invest_t$ is investment measured as a share of gross capital formation at current purchasing power parities (%). lf_t is the labor force representing the number of persons engaged measured in millions. $gfce_t$ is government final consumption expenditure representing the government size in the economy measured in current prices growth rate (%). $inflr_t$ is inflation rate measured by consumer price index reflects the annual percentage change in the cost of the average consumer of acquiring a basket of goods and services. hce_t is household consumption expenditure measured in current annual price growth rate (%) based on local currency in Tanzania. $svng_t$ is the country's savings representing the total value of demand, time and saving deposits at domestic deposit money banks measured as a share of gross domestic product. ir_t is interest rate representing lending interest rates adjusted for inflation measured in annual percent growth rate. $gdppc_t$ is gross domestic product per capita measured in real Tanzania Shillings. $txrev_t$ is tax revenue measured by millions of Tanzania Shillings and ks is capital stock measured in millions USD.

$\beta_s, \alpha_s, \gamma_s, \pi_s$ = Regression coefficients of the models (parameters)

e, ε, μ_s = error term of the models

$t = 1, 2, \dots, N$ = time dimension of a series in terms of years

2.2. Data Description and Sources

Macroeconomic variables applied here were selected based on Ramsey-Cass-Koopmans growth theory, literature and analysis techniques used. The annual secondary time series data of the period of 1970 – 2017 were picked. Four main factors influenced sample period choice. One is the requirement for econometrics analysis, which requires the number of observations to be at least 30. Second, it is the need to include the effect of the reforms on critical variables in the economy. Third, is the need to include the current data in this study and fourth, is the easy to access the relevant data during the sample period. Data were collected from the Bank of Tanzania, KNOEMA, and World Bank.

2.3. Data Analysis Techniques and Empirical Estimation

Data analysis was carried out by using EViews 9 computer software. The study used LS – Least Squares (NLS and ARMA) estimation method. Before estimating the empirical models, it was imperative to determine the statistical properties of the data as well as the time series characteristics of the data. This was done to ensure that data meet the properties of the empirical models to be estimated. In this case, graphical analysis, descriptive statistics, correlation matrix and Augmented Dickey and Fuller (1981) unit root test were performed. Also, diagnostic tests were performed to check robustness of the results and ensure that results are consistent and efficient, and are in line with theoretical assumption underscored the method employed.

3. RESULTS AND DISCUSSION

The pre-estimation test results revealed no abnormalities in the data series. The co-integration results indicated that all empirical models had a long-run equilibrium relationship. On the other hand, diagnostics tests confirmed that all regression models are robust, useful, and authoritative for making reasonable judgments since they obey the assumptions of the classical linear regression models and follows desired econometric properties.

3.1. Long-run Estimated Results of Economic Growth Model

Table 1 below presents results of estimated economic growth model (model 1).

Table 1. Regression Results of Economic Growth Model
Dependent Variable: GDPGR

Variable	Coefficient	t-Statistics	Prob.
C	3.236285	2.620949	0.0124
INVEST(-1)	-11.97313	-2.048966	0.0472
LF(-4)	0.413365	4.833232	0.0000
GFCE	0.030721	2.518776	0.0160
INFLR(-3)	-0.069832	-2.659029	0.0113

Source: Author's computation using data (2019)

Results suggest that long-run economic growth model has a good fit as presented by R-squared, which indicates that about 59 percent of GDP growth rates are determined by the explanatory variables. The joint significance given by F-statistic p-value (0.0000) shows that collectively the independent variables are significant determinants of the dependent variable.

Results in table 1 shows that, holding labor force, government final consumption expenditure, and inflation rate constant, a one percent increase in investment lagged one period leads to a decrease of current economic growth rate by 11.97 percent, and vice versa. The negative effect of investment on economic growth is also confirmed by [Anderson \(1990\)](#), who argue that if investment is used inefficiently it leads to a lower rate of economic growth. Recently, in Tanzania, there has been more public investment taking over the major private investment. The negative effect of investment may be because public investment tends to crowd-out private investment in the economy. 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 and Ichihashi, 2012](#)). Besides, the utilization of additional physical and financial resources, which would otherwise be available to the private sector, may also depress private investment [Blejer and Khan \(1984\)](#), leading to low economic growth.

Holding other factors constant, a one million increase in labor force lagged four periods leads to an increase in economic growth rate by 0.41 percent. The results also indicate that the current government final consumption expenditure has a significant positive effect on current economic growth at 1 percent significant level. A one percent increase (decrease) in government final consumption expenditure causes economic growth in Tanzania to increase (decrease) by 0.03 percent, ceteris paribus. The inflation rate lagged in three periods seems to have a significant adverse effect on current economic growth at 5 percent significant level. Other things being equal, a one percent increase (decrease) in inflation rate in Tanzania leads to a decrease (increase) in economic growth rate by 0.07 percent.

3.2. Results of Investment and Consumption Models in Decentralized Economy

This section provides results of the decentralized economy. The aim is to determine whether optimal allocation of resources occurs in either decentralized or centralized economy for better policy implementation. The results are presented in table 2 below.

Table 2. Regression Results of Investment and Household Consumption Models in Decentralized Economy

INVEST Variables	Model 2				HCE Variables	Model 3			
	Coef.	Std.Er	t-Statistic	Prob.		Coef.	Std.Er	t-Statistic	Prob.
C	0.1370	0.0371	3.6966	0.0007*	C	-82.1105	41.9282	-1.9583	0.0570**
GDPGR(-3)	0.0108	0.0033	3.3183	0.0020*	GDPGR(-1)	-1.6034	0.5067	-3.1644	0.0029*
HCE(-4)	-0.0016	0.0008	-2.0961	0.0430*	LNINVEST(-1)	-7.3217	4.2174	-1.7360	0.0901**

SVNG(-2)	-0.0062	0.0028	-2.2329	0.0s317 **	-				
IR(-3)	0.0023	0.0007	3.3620	0.0018*	-				
INFLR(-1)	0.0017	0.0007	2.3673	0.0233* *	INFLR(-2)	-0.2145	0.1065	-2.0135	0.0506**
GDPPC(-2)	2.10E-07	4.70E-08	4.476718	0.0001*	LNGDPPC	6.843867	2.99814 2	2.282703	0.0277**
R-squared=0.701412, F-statistic=14.48612, Prob(F-statistic)=0.000000, n=44 after adjustments					R ² = 0.273402, F-stat. =3.856843, Prob(F-stat.)=0.009471, n=46 after adjustments				

Source: Author's computation using data (2019)

* 1%level, ** 5% level, *** 10% level

The results above indicate a good fit, as shown by R-squares. Also, F-statistics p-values indicate that the coefficients are jointly statistically different from zero at 1 percent significant level.

Model 2 indicates that a 1 percent increase in GDPGR lagged three periods lead a 0.01 percent increase in INVEST and vice versa, other factors being equal. HCE lagged four periods seem to affect INVEST negatively indication that, holding other factors constant, INVEST decreases (increases) by 0.001 percent due to a 1 percent increase (decrease) in HCE. The increase in SVNG lagged two periods by 1 percent leads to a decrease of INVEST by 0.006 percent, ceteris paribus. On the other hand, other factors remaining equal, a 1 percent increase in IR lagged three periods, and INFLR lagged one-period causes INVEST to increase by 0.002 percent and 0.001 percent, respectively. Lastly, INVEST increases by 2.10E-07 percent as a result of an increase in GDPPC lagged two periods by 1 TZS, other factors being constant.

Empirical results from household consumption expenditure (model 3) show that the coefficients of the explanatory variables are all statistically significant, implying that these coefficients are significantly different from zero. A 1 percent increase in GDPGR lagged one period leads to a 1.60 percent decrease in HCE and vice versa, other factors being equal. On the other hand, the logarithm of INVEST lagged one period seem to affect HCE negatively indication that, holding other factors constant, HCE decreases (increases) by 7.32 percent due to a 1 percent increase (decrease) in LNINVEST. The increase in INFLR lagged two periods by 1 percent leads to a decrease of HCE by 0.21 percent, ceteris paribus. Lastly, HCE increases by 6.84 percent as a result of an increase in the logarithm of current GDPPC by 1 TZS, other factors being constant.

3.3. Results of Investment and Consumption Models in Centralized Economy

This section provides the empirical analysis and discussion of the results of centralized economy. Empirical results are reported in Table 3 below.

Table 3. Regression Results of Investment and Household Consumption Models in Centralized Economy

INVEST	Model 4				HCE	Model 5			
Variables	Coef.	Std.Er	t-Statistic	Prob.	Variables	Coef.	Std.Er	t-Statistic	Prob.
C	-0.009	0.0419	-0.2175	0.8291	C	4.0404	5.2155	0.7747	0.4434
GDPGR(-3)	0.0077	0.0027	2.8900	0.0067*	GDPGR(-4)	-1.2405	0.4336	-2.8609	0.0069*
HCE(-4)	-0.0019	0.0006	-2.9938	0.0051*	-	-	-	-	-
SVNG(-2)	-0.0072	0.0026	-2.7441	0.0096*	SVNG	1.1421	0.3536	3.2301	0.0026*
IR(-3)	0.0012	0.0006	1.9499	0.0595* **	IR	-0.2809	0.1111	-2.5269	0.0159**
INFLR(-1)	0.0022	0.0007	3.2862	0.0024*	-	-	-	-	-
GDPPC(-2)	1.95E-07	7.55E-08	2.5777	0.0145* *	GDPPC(-4)	-2.75E-05	1.39E-05	-1.9816	0.0550** *
GFCE (-2)	0.0005	0.0002	2.5777	0.0332* *	GFCE(-2)	-0.0996	0.0407	-2.4439	0.0194**
TXREV	-3.18E-08	7.41E-09	-4.2862	0.0001*	TXREV(-2)	2.05E-06	9.19E-07	2.2306	0.0319**
KS	1.01E-06	2.68E-07	3.7705	0.0006*	-	-	-	-	-
R-squared=0.828853, F-statistic=18.29548, Prob(F-statistic)=0.000000, N=44 after adjustments					R-squared=0.457594, F-statistic=5.202424, Prob(F-statistic)=0.000574, N=46 after adjustments				

Source: Author's computation using data (2019)

* 1%level, ** 5% level, *** 10% level

Results indicate that the equations estimated are of good fit and powerful. The estimated F-statistics are high and statistically significant at a 1 percent level rejecting the null hypothesis that all the explanatory variables have coefficients not different from zero.

Results from model 4 indicate that the coefficients of the explanatory variables are all significantly different from zero. A 1 percent increase in GDPGR lagged three periods cause a 0.0077 percent increase in INVEST and vice versa, other factors being equal. HCE lagged four periods seem to affect INVEST negatively indication that, holding other factors constant, INVEST decreases (increases) by 0.0019 percent due to a 1 percent increase (decrease) in HCE. An increase in SVNG lagged two periods by 1 percent leads to a decrease of INVEST by 0.0072 percent, *ceteris paribus*. On the other hand, other factors remaining equal, a 1 percent increase in IR lagged three periods, and INFLR lagged one period causes INVEST to increase by 0.0012 percent and 0.0022 percent, respectively. The results further reveal that INVEST increases by $1.95\text{e-}07$ percent as a result of an increase in GDPPC lagged two periods by 1 TZS, other factors being constant. GFCE causes a 0.0005 increase in INVEST as a result of a 1 percent increase in GFCE while TXREV causes a decrease in INVEST by $3.18\text{E-}08$ due to 1 million TZS increase, other factors being constant. Lastly, KS seems to affect INVEST positively where a 1 million USD increase in KS increases INVEST by $1.01\text{E-}06$ percent.

On the other hand, results from model 5 show that the coefficients of the explanatory variables are all statistically significant, implying that the coefficients are statistically different from zero. A 1 percent increase in GDPGR lagged four periods leads to a decrease in HCE by 1.2405 percent and vice versa, other factors being equal. On the other hand, current SVNG seems to affect HCE positively indication that, holding other factors constant, HCE increases by 1.1421 percent due to a 1 percent increase in current SVNG. The increase in current IR 1 percent leads to a decrease of HCE by 0.2809 percent, *ceteris paribus*. HCE decreases by $2.75\text{E-}05$ percent as a result of an increase in GDPPC lagged four periods by 1 TZS, other factors being constant. Also, holding other factors constant, HCE decreases by 0.0996 percent due to a 1 percent increase in GFCE lagged two periods, while it increases by $2.05\text{E-}06$ percent as a result of a 1 million TZS increase in TXREV lagged two periods.

3.4. Discussion of Major Findings

Lagged values of GDP growth seem to have a negative effect on current household consumption expenditure, implying that high GDP growth rates reduce consumption expenditure in Tanzania. This is a key finding regarding the economy of Tanzania. This explains why Tanzania is/has been experiencing high levels of economic growth but at the same time falls under the poorest countries of the world. The answer to this result is, however, probably clear, though not as simple as the situation itself. Most people are in agriculture sector, yet agriculture sector is not among the primary contributing sector to economic growth in recent years. Hence, increase in economic growth does not boost household consumption expenditure of the majority. These results are against those of [Akekere and Yousuo \(2010\)](#) who found a positive relationship in Nigeria's economy.

The findings of [Ofwona \(2013\)](#) in Kenya confirm that income is a crucial factor in determining household consumption, as shown in this study. However, with government intervention, income becomes less important factor though significant and sometimes with opposing effects. This finding is an alarm to policymakers in Tanzania. Government intervention in terms of taxes and expenditure reduces household consumption expenditure for two reasons. First, any increase in income is being taken by the government through higher and many taxes. Second, government spending done to those sectors that do not employ many citizens hence the multiplier effect is very minimal. Therefore, with government intervention the average propensity to consume among individuals is reduced as absolute income increases. Another key finding is that the study fails to support the existence of the relationship between household consumption expenditure and investment after government intervention. This finding supports the Ramsey-Cass-Koopmans model where the planner's allocation is the same as in competitive equilibrium.

On the other hand, investment has a positive effect on economic growth in Tanzania, both with and without government intervention. These results are supported by [Ipumbu and Kadhiwa \(1999\)](#). However, for the case of this study, with government intervention, the impact is more practical as compared to without government intervention. Therefore, the implication is that the government plays a vital role in boosting investment.

It is also important to note that consumption and investment in all cases have opposite effects to each other. However, investment has a more practical effect on household consumption when there is no government intervention as compared to rest case. Household consumption expenditure has meager power in influencing investment in Tanzania in both cases, though the impact is significant.

The incredibly lower level of correlation between investment and interest rate but affirmative is supported by [Gutierrez and Philippon \(2017\)](#), who confirmed that in most samples, this correlation seems to be very low. The investment function of this study in both scenarios seems not to fit well the aggregate

data due to very low explanatory power of the coefficients. This lack of the genuine underlying relationship among the variables may be due to biases associated with reverse causality. This finding is in line with that of [Caballero \(1999\)](#) using US data, the basic Q-equation fits poorly, and it leaves large unexplained residuals. So, still more empirical support is needed. However, this finding does not necessarily imply that the theories are wrong. [Himmelberg and Gilchrist \(1995\)](#); [Erickson and Whited \(2000\)](#); and [Cumins *et al.* \(2006\)](#) emphasize that measurement error has a substantial contribution to the empirical failure of the investment equations. However, the investment functions of this study capture most investment dynamics and behaviors in the study period because of the observed high levels of variations implying that the variables involved can explain the variation in investment.

The interest rate has a negative effect on household consumption expenditure. Which obeys the critical assumption of the Ramsey-Cass-Koopmans theory that the interest rate has a negative effect on the level of consumption?

4. CONCLUSIONS

This study examined the behavior and dynamics of Tanzania's economy by focusing on GDP growth rate on the one hand and the other hand, on household consumption and investment both in decentralized and centralized economy settings. The existence and characterization of the solution of optimal economic growth is studied through the Ramsey-Cass-Koopmans space of path in Tanzania. The motivation for carrying out this study rested on the fact that, despite macroeconomic stability policies, abundance of natural resources, the country's structural changes have been not satisfactory that lead to the country remaining among the poorest countries despite high economic growth experience. This unsatisfactory growth performance is said to be a result of low saving, investment, and consumption. Policies on the optimal allocation of resources among consumption and investment and the roles which these variables play in the Tanzania economy were therefore worth studying in this study. Specifically, the study focused on deriving the long-run economic growth model and identifying the factors influencing it, determining the factors influencing consumption and investment and the roles they play in the dynamics of the economy.

The empirical results from the economic growth model showed the derived optimal long-run economic growth model for Tanzania and its factors. This economic growth model showed the behavior and dynamics of the Tanzania economy during the period of study. Investment and inflation rate affect the Tanzania economy negatively, implying that as investment and inflation rate increases in the economy then GDP growth rate goes down and vice versa. Labor force and government final consumption expenditure had positive effect to Tanzania's economy, implying that, in the long run as labor force and government final consumption expenditure increases in the economy then GDP growth rate goes up and vice versa. Investment followed by labor force and inflation were the most significant factors which seem to have more practical/economic effect on economic growth rate in Tanzania. Therefore, as we have seen, investment plays a negative role in the Tanzania economy while government final consumption expenditure plays a decisive role. The economic/practical effect of investment is much more prominent as compared to that of government final consumption expenditure, as shown by the coefficients from the results. But since government final consumption expenditure has positive effect on the economy, for optimal allocation of resources, the government should allocate more resources on increasing the current government final consumption expenditure which will later stimulate investment in the economy in the long run rather than making direct investments which lead to crowding out effects and therefore decreasing GDP growth rate in the future.

The empirical results from the decentralized economy revealed the behavior and dynamics of investment and consumption. Household consumption expenditure and savings rate affected investment negatively, implying that in the long run as these variables increases causes investment rate to go down and vice versa. The rest of the variables have positive effect on investment implying that when these variables increase, investment also increases and vice versa. However, all factors seemed to have lesser practical effect on investment with GDP per capita having least effect while GDP growth rate has at least more practical effect as compared to the rest of the variables. Also, only GDP per capita has positive effect on household consumption expenditure, the rest of the factors have adverse effects. Variables in this model have a reasonable economic/practical effect.

Centralized economy results revealed that household consumption expenditure, savings, and tax revenue have negative effects on current investment in Tanzania while the rest have positive effects. Government final consumption expenditure and tax revenue, which represent government interference in the economy have very low economic/practical effect on investment, though the effect is significant. This

implies that the role of the government in influencing investment is very minimal. Therefore, the study concludes that optimal allocation of resources between consumption and investment is being done in a decentralized economy rather than in a centralized economy. Also, GDP growth rate, interest rate, GDP per capita, and government final consumption expenditure all have adverse effects in influencing current household consumption in the long run in a centralized Tanzania economy, while only savings and tax revenue seem to have positive effects. Government final consumption expenditure and tax revenue, which represent the social planner's problem in the economy have very low economic/practical effect on consumption, though the effect is significant. These empirical results reveal that the Tanzania government (through tax revenue and government final consumption expenditure) has no more significant influence on economic activities (investment and consumption), which, implies that the social planner's problem concept of Ramsey-Cass-Koopmans theory holds at a very minimal level for the case of Tanzania.

Therefore, for sound economic growth and development, macroeconomic policies in Tanzania should focus on the behavior (performance) and dynamics (the aspect of change) of investment, labor force, government expenditure, and the level of inflation rate. Investment should be taken seriously in policymaking. Private investment needs to be encouraged and considered as an engine for growth. Public investment should be made in such a way that no crowding-out of private investments occur in the economy. Also, household consumption expenditure should be taken into account in macroeconomic policies for fiscal planning. Policymakers, therefore, should try to predict how consumers will behave in the face of income fluctuations. In terms of consumers, consumption phenomena require a decision-making process. For that reason, the consumption function reveals a behavioral relationship in macroeconomics. Thus, policymakers, on the other hand, can maintain stable spending patterns among households by managing inflation expectations and encouraging stability in price levels.

This study provides a foundation and infrastructure for understanding the RCK model with macroeconomic variables. Even though devoted efforts have been put in this study to empirically analyze the RCK growth theory in Tanzania, still some gaps should be addressed, future studies should focus on microeconomic variables in the Ramsey-Cass-Koopmans settings. The study also recommends further researches on investment functions focusing on reverse causality.

REFERENCES

- Akekere, J. and Yousuo, P. O. J. (2010). An empirical analysis of change in income on private consumption expenditure in Nigeria from 1981 to 2010. *International Journal of Academic Research in Business and Social Sciences*, 2(12): 312-31.
- Anderson, D. (1990). Investment and economic growth. *World Development*, 18: 1057-79.
- Blejer, M. I. and Khan, M. S. (1984). Government policy and private investment in developing countries. *FMI, Staff Papers*, 31(2):
- Caballero, R. (1999). Aggregate investment. In John B. Taylor and Michael Woodford, editors, *Handbook of Macroeconomics, Volume 1B*, Amsterdam. Elsevier Science, North-Holland.
- Cass, D. (1965). Optimum growth in an aggregative model of capital accumulation. *The Review of Economic Studies*, 32(3): 233-40.
- Collard, D. A. (2011). Ramsey, Saving, and the Generations. *Generations of Economists*. London Routledge. 256-73.
- Cumins, J. G., Hassett, K. A. and Oliner, S. D. (2006). Investment behavior, observable expectations, and internal funds. *American Economic Review*, 96(3): 796-810.
- Dickey, D. A. and Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica*, 49(4): 1057-72.
- Epaphra, M. (2014). Empirical investigation of the determinants of Tanzania's national savings. *Journal of Economics and Development Studies*, 2(4): 223-41.
- Erickson, T. and Whited, T. M. (2000). Measurement error and the relationship between investment and q. *Journal of Political Economy*, 108(5): 1027-57.
- Goodwin, R. M. (1961). The optimal growth path for an underdeveloped economy. *The Economic Journal*, 71(284): 756-74.
- Gutierrez, G. and Philippon, T. (2017). Declining Competition and Investment in the U.S. Mimeo NYU.
- Himmelberg, C. P. and Gilchrist, S. (1995). Evidence on the role of cash flow for investment. *Journal of Monetary Economics*, 36(3): 541-72.
- Ipumbu, W. S. and Kadhiwa, G. (1999). Savings and Investment in Namibia. Windhoek, Namibia: Bank of Namibia, Research Dept. Series Bon Occasional, Paper No. 2.

- Koopmans, T. C. (1965). On the Concept of Optimal Economic Growth. The Econometric Approach to Development Planning. 28, 225-300, Amsterdam, North-Holland.
- Lawrence, J. C., Martin, S. E. and Mathias, T. (2018). On DSGE Models. *Journal of Economic Perspectives*, 32(3): 113-40.
- Nwachukwu, T. E. and Odigie, P. (2011). What Drives a Private Saving in Nigeria. Paper Presented at Workshop Organised by African Economic Research Consortium (AERC), Nairobi Kenya.
- Ofwona, A. C. (2013). An estimation of the consumption function for Kenya using Keynes' absolute income hypothesis for the period 1992-2011. *Journal of Emerging Trends in Economics and Management Sciences*, 4(1): 103-05.
- Paul, C. and Jan, W. G. (1999). Why has Africa grown slowly? *The Journal of Economic Perspectives*, 13(3): 3-22.
- Phetsavong, K. and Ichihashi, M. (2012). *The Impact of Public and Private Investment on Economic Growth: Evidence from Developing Asian Countries*. DEC Discussion Paper, Hiroshima University.
- Ramsey, F. P. (1928). A mathematical theory of saving. *The Economic Journal*, 38(152): 543-59.
- Ryoji, O. (2009). *Ramsey-Cass-Koopmans Model: Setup of the Model and Competitive Equilibrium Path*. Department of Industrial Engineering and Economics, Tokyo Tech.