

**THRESHOLD EFFECTS IN THE INFLATION, ECONOMIC GROWTH AND  
INVESTMENT RELATIONSHIP: THE CASE OF MALAWI**

**MASTER OF ARTS (ECONOMICS) THESIS**

**MUSSA BONOMALI**

**UNIVERSITY OF MALAWI  
CHANCELLOR COLLEGE**

**OCTOBER, 2016**

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**MASTER OF ARTS (ECONOMICS) THESIS**

**By**

**MUSSA BONOMALI**  
**BSoc Sc. Economics (Zanzibar University)**

Submitted to the Department of Economics, Faculty of Social Science, in partial  
fulfillment of the requirements for the degree of Master of Arts in Economics

**UNIVERSITY OF MALAWI**  
**CHANCELLOR COLLEGE**

**OCTOBER, 2016**

## **DECLARATION**

I, MUSSA BONOMALI, hereby declare that this thesis is my original work and that it has never been submitted, for similar purposes, to any University or any institution of higher learning. Acknowledgements have been duly made where other people's work has been used. I, therefore, remain solely responsible for all errors herein.

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**Name**

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**Signature**

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**Date**

## **CERTIFICATE OF APPROVAL**

We, the undersigned, certify that this work results from the student's own effort. It has, therefore, been submitted with our approval.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Martin Phangaphanga. PhD (Lecturer in Economics)

**FIRST SUPERVISOR**

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Spy Munthali, PhD (Senior Lecturer in Economics)

**SECOND SUPERVISOR**

## **DEDICATION**

I dedicate this work to my Mum and Dad, and my family for the encouragement and the support they gave me. May the Good Lord always be with you!

## **ACKNOWLEDGEMENTS**

First of all I would like to give all the thanks and praise to the Lord Almighty for making all this possible for me!

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## **ABSTRACT**

The study analyses the relationship among inflation, economic growth and investment. This was done by examining whether there are two thresholds in the non-linear relationships between inflation and growth. In Malawi, the test for the second threshold would add value to the study done by Nkume and Ngalawa (2014) who tested for only one threshold. The study also goes beyond the Nkume-Ngalawa study and it attempts to explain possible transmission channels of inflation to growth, of which the investment channel was chosen. The study goes further to investigate a two-tier threshold between inflation and investment. This study follows the methodology developed by Khan and Senhadji (2001) to examine the existence of threshold effects in the inflation-growth relationship. This methodology was later extended by Iqbal and Nawaz (2010) to examine the possibility of the existence of a second threshold in the inflation-growth relationship. Before testing for the second threshold, the first threshold was also retested so as to aid in the determination of the second threshold. Using Malawian data for the period 1980 to 2014 and following the work of Iqbal and Nawaz (2010), the results suggest the existence of inflation threshold level of 11 percent, and they do not support the existence of a second threshold in the inflation-growth relationship. In the inflation-investment relationship, the results do not support investment as the transmission channel of inflation to growth in Malawi and also do not support the existence of threshold effects in inflation-investment relationship. This finding suggests that bringing inflation down to single digits should be the goal of macroeconomic management in Malawi.

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## **LIST OF ACRONYMS AND ABBREVIATIONS**

|        |   |                                                    |
|--------|---|----------------------------------------------------|
| 2SLS   | : | Two-Stage Least Squares                            |
| ADF    | : | Augmented Dickey-Fuller                            |
| ADMARC | : | Agricultural Development and Marketing Corporation |
| CPI    | : | Consumer Price Index                               |
| GDP    | : | Gross Domestic Product                             |
| HDI    | : | Human Development Index                            |
| HSSP   | : | Health Sector Strategic Plan                       |
| HIS    | : | Integrated Health Survey                           |
| IMF    | : | International Monetary Fund                        |
| MDGs   | : | Millennium Development Goals                       |
| MGDS   | : | Malawi Growth and Development Strategy             |
| NSO    | : | National Statistical Office                        |
| OLS    | : | Ordinary List Squares                              |
| PP     | : | Phillips-Perron                                    |
| RSS    | : | Residual Sum of Squares                            |
| SAP    | : | Structural Adjustment Policies                     |

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## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 Background to the Study**

It is widely believed among economists that the main objective of macroeconomic policies is to achieve economic growth while maintaining inflation at lower rate and that high inflation is detrimental to medium as well as long-term growth Khan and Senhadji (2001). Hence rapid output growth and low inflation are most common objectives of macroeconomic policy. Over the years, the existence and the link between these two variables has become a subject of considerable interest and debate. Economic theories reach a variety of conclusions about the responsiveness of output growth to inflation.

Firstly, one would argue that some inflation can be conducive to growth via the Mundell-Tobin effect and it predicted shift from money holdings to financial assets that usually drive interest rates down and consequently might lead to an increase in economic activity. In other words, with higher inflation people tend to convert their money balances into financial assets which reduce interest rates and that can increase capital accumulation. Secondly, others would argue that inflation can be detrimental to growth because it might increase macroeconomic uncertainty and that usually leads to lower investment and consequently lower economic activity as well.

Empirical literature is divided into two main strands. One strand of literature has found negative and significant relationship between inflation and economic growth Fischer (1993); Barro (1995); Bullard and Keating (1995); Malla (1997); Bruno and Easterly (1998) and Faria and Carneiro (2001) while other has confirmed positive and significant association between inflation and economic growth Lucas (1973); Malik and Chowdhury (2001) and Gillman and Nakov (2004). These strands of literature highlight the possibility of non-linear relationship between inflation and economic growth.

However studies like Pollin and Zhu (2005) and Fischer (1993) have uncovered that the relationship between inflation and economic growth may be non-linear; it has been shown that there was a positive relation between low inflation and high output growth, while higher inflation was associated with lower economic growth. According to these studies, the hypothesis of non-linearity suggested that the adverse effect of inflation on economic growth is not universal because it appears only when inflation exceeds some turning point or threshold level below which inflation has a positive or non-significant effect on economic growth. That is if the inflation-growth relationship is non-linear, it becomes necessary to estimate the turning point, or threshold at which the sign of the relationship switches.

It is also important to find out how inflation affects growth more particularly, thus, finding out the channel through which inflation can affect growth in non-linear settings or in other words to find out what gives rise to the so called threshold effect in the relationship between inflation and economic growth.

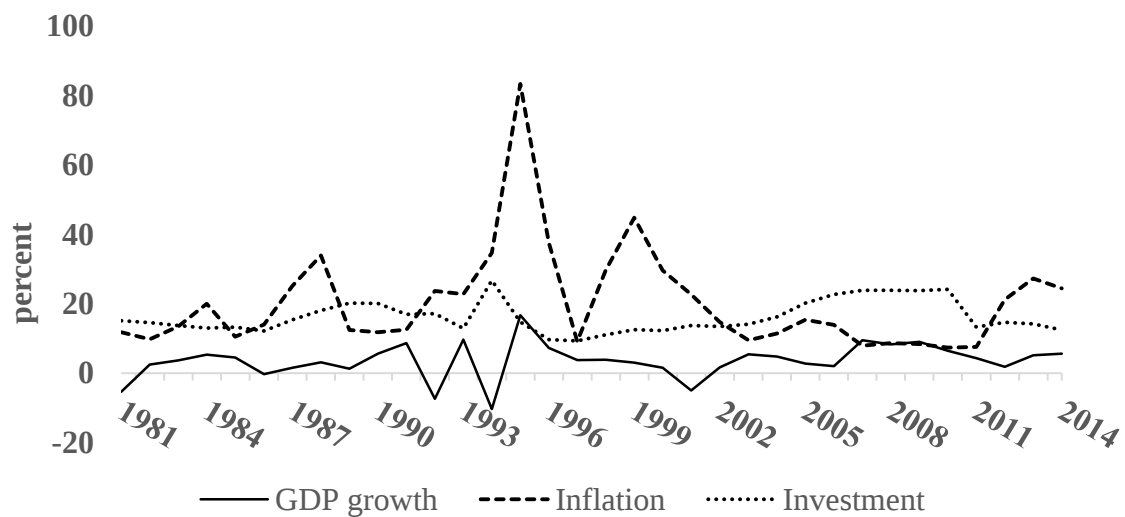
Recent literature considers investment as an important channel through which the impact of inflation is transmitted nonlinearly in economic growth (Iqbal and Nawaz, 2010). Investment, inflation and economic growth nonlinear nexus can be explained by using financial market development. A growing theoretical literature describes mechanisms whereby even predictable increases in the rate of inflation interfere with the ability of financial sector to allocate resources effectively.

Recent evidence indicates that there is a significant, and economically important negative relationship between inflation and both banking sector development and equity market activity. Further, the relationship is nonlinear Boyd, *et al.*, (2001). A predictable increase in the rate of inflation can slow down financial market development. Inflation tax on real balance reduces real returns to savings which in turn causes an informational friction afflicting the financial system. These financial market frictions results in credit rationing and thus limit availability of investment and finally this reduction in investment adversely impacts economic growth. Inflation creates uncertainty in the financial market and increases the risk associated with the investment which translated in reduction in economic activities (Hellerstein, 1997).

Inflation can discourage investors by reducing their confidence in investments that take a long time to mature in stock market. Barro (1995) explored the investment-inflation relationship and its impact on growth and found that a reduction in economic growth occurred due to reduction in the propensity to invest, which was an outcome of inflation. Li (2006) estimated the relationship between inflation and investment for 27 developed

and 90 developing countries over the period 1961-2004 and found that the relationship for both developed and developing countries is nonlinear.

Inflation in Malawi like many of the less developed countries has been relatively unstable. To set in the perspectives of the analysis of this study, it is imperative to observe the trends of the relationship among inflation, economic growth and investment in Malawi over the period of analysis of this study. Figure 1 below illustrates the trend of inflation, economic growth and investment. From the figure below, one would not easily figure out with a naked eye what impact inflation has on economic growth. However, it could be observed that each year when inflation went up, the following year economic growth declined.



**Figure 1: GDP growth, Inflation rate and investment behaviour in Malawi (1981-2014)**

## **1.2 Problem Statement and Justification**

As put by Khan and Senhadji (2001), high and sustained output growth in conjunction with low inflation is the central objective of macroeconomic policy. It is generally accepted that inflation has negative effect on medium and long term growth. Inflation hinders efficient resource allocation by obscuring the signaling role of relative price changes, the most important guide to efficient economic decision making (Fischer, 1993). Particularly, a predictable increase in the rate of inflation can slow down financial market development. Inflation, a tax on real balance, reduces real returns to savings; hence limit the availability of investment and finally reduction in investment adversely impacts economic growth.

As put by Khan and Senhadji (2001), if inflation is harmful to growth, it readily follows that policy makers should aim at low rate of inflation. But how low should inflation be? Should the target inflation be 10 percent, 5 percent, or for that matter, zero percent? More generally, at what level of inflation does the relationship between inflation and growth become negative?

For example, Malawi's economy has lost significant momentum in the last few years. Slowed economic growth coupled with high inflation and low investment is a major problem of the Malawi economy. The growth rate of real GDP dropped to 5.2 percent in 2013 from 8.7 percent in 2008. Investment, a key determinant of economic growth, declined from 23.9 percent of GDP in 2010 to 19.7 percent of GDP in 2013. Inflation rate rose from 7.6 percent in 2011 to 24.4 percent in 2013.

The statistics show that it is important to investigate the nexus among inflation, investment and economic growth. To the best of my knowledge there is only one study in Malawi that investigated the nonlinear relationship between inflation and economic growth. Using a data set spanning from 1980-2013, Nkume and Ngalawa (2014) estimated inflation threshold level of 17 percent for Malawi beyond which inflation is harmful to economic growth while below this level is favourable to economic growth.

This study is different from the study by Nkume and Ngalawa (2014) in two respects. The Study by Nkume and Ngalawa (2014) focused on the existence of only one threshold level between the two variables and not considering the possibility of the existence of second threshold in the relationship between inflation and growth. Secondly, the Nkume-Ngalawa study did not examine the role of investment as a channel through which inflation affects economic growth.

The idea behind the two threshold levels is that inflation can be divided into three parts. As inflation rises from zero to a certain level which is regarded as the first or low threshold level, we expect its impact on growth to be negligible or even positive. As inflation crosses the low threshold level we expect an adverse impact on the GDP growth up to a certain level which is the second threshold level. When inflation crosses the second threshold level, the marginal adverse impact of growth diminishes. Thus, the inflation growth relationship flattens when the economy has high inflation. Intuitively, we can say that once inflation exceeds the second threshold level, all the damage to the financial system has already been done, and then perfect foresight dynamics comes into

being. When these occur, further increases in inflation have no additional detrimental effects on economic growth (Iqbal & Nawaz, 2010).

In the context of developing countries the logic behind the existence of a second threshold could be explained in the sense that; long history of inflation in many developing countries led to the adoption of indexation system to negate, at least, partially the adverse effects of inflation (Khan & Senhadji, 2001). In indexation system is where the value of something is varied in relation to the other value, for example government payment that changes by the same amount as the general level of prices. Once in place these indexation mechanisms makes it possible for governments to run higher rates of inflation without experiencing adverse growth effects because relative prices do not change that much. Malawi has had a number of indexation cases in the past, where workers had demanded a pay increment that matches the rate of inflation so as to negate the rising cost of living.

### **1.3 Study Objectives and Hypothesis**

The main objective of this study is to analyses the relationship among inflation, economic growth and investment.

Specific Objectives include:

1. To investigate the nature of inflation-growth relationship in Malawi with the possibility of two threshold levels.
2. To investigate the nature of Inflation-Investment relationship in Malawi.

Testable Hypotheses:

1. There is no possibility of two thresholds in the relationship between inflation and economic growth
2. There is no relationship between inflation and investment in Malawi.

#### **1.4 Significance of the Study**

Given that the key macroeconomic aggregates of inflation, investment and economic growth whose performances have been quite volatile in Malawi, it is imperative be carried out on the topic.

In addressing the objectives, the study will contribute to the body of knowledge on the relationships among inflation, economic growth and investment, thus, will bring some insights on knowledge generation on Malawi in relation to previous studies.

#### **1.5 Organization of the Paper**

This chapter has given the background to the study, problem statement, justification and objectives of the study and related hypotheses as well as the significance of the study. Chapter two presents an overview of the Malawi economy and macroeconomic performance. Chapter three is the Literature Review. This has two sections; the theoretical and the empirical reviews of the literature. Chapter four presents the methodology used in the study. Specifically the chapter talks about the specification and estimation of the model, measurements of the variables and expected signs of the parameter estimates, the data and their sources. The chapter also talks about times series

properties, how they are dealt with in the study. Chapter five gives the empirical results that will be obtained from estimation of the model in chapter four. Chapter six, the final chapter of the study, gives the conclusion of the study. It specifically gives the summary of the results, policy recommendations and suggested areas for further research.

## **CHAPTER TWO**

### **OVERVIEW OF MALAWI'S ECONOMY**

#### **2.0 Country Background**

Malawi is a poor country whose economy is predominantly based on agriculture, with tobacco, sugar and tea as main export commodities. The agricultural sector accounts for more than a third of gross domestic product and generates more than 90 percent of the foreign exchange earnings. The World Bank (2003) notes that approximately 84% of agriculture value-added originates from 1.8 to 2 million smallholder farmers who on average own only 1 hectare of land and crop production accounts for 74% of all rural incomes. The economy is unable to guarantee food security, much less provide sustainable economic growth for the nation. As a result, the bulk of the population that significantly contributes to the total wealth of the nation remains poor.

Malawi enjoys political stability with gradually maturing democracy. Since the introduction of multi-party system of government in 1994, the country has conducted five presidential and parliamentary elections. In May 2014, the country held its first ever tripartite elections.

Malawi's population, put at 14.4 million, 85% rural and 15% urban. While Malawi is amongst the least urbanised countries in Africa, the pace of rural-urban migration is rapid. The process is driven by lack of alternative employment opportunities in rural areas and rapid population growth. Due to rapid population growth, population density increased from 105 persons per square kilometer in 1998 to 139 in 2008 (Gebrehiwot & Mwanakwate, 2015). This poses challenges of sustaining livelihoods.

Malawi has made strides in improving the health outcomes of its people. Among the achievements has been the reduction in infant and child mortality rates from 76 per 1000 in 2004 to 66 per 1000 in 2012 and from 133 per 1000 to 112 per 1000 respectively. The government is implementing the health sector strategic plan 2001-2016 (HSSP), which was endorsed by development partners and other stakeholders. However, the key challenge in the HSSP implementation is the limit in budgetary resources. Despite the gains, Malawi is off track on some of the health MDGs targets. The maternal mortality rate of 574 per 100 000 live births (2014), is far above the MDGs target of 155 per 100 000 live births.

As put by Gebrehiwot and Mwanakwate (2015) Malawi has registered positive economic growth for much of the past decade, progress in poverty reduction has been limited. According to the NSO (2012) Integrated Household Survey (IHS) report, Malawi's poverty level was reduced only marginally from 52.4% in 2005 to an estimated 50.7% in 2011. The proportion of ultra-poor increased from 22.2% in 2005 to 25.7%. The incidence of rural poverty in fact increased slightly from 55.9% in 2005 to 56.6% in 2012

while urban poverty fell sharply from 25% in 2004 to 17% in 2011. The pattern of income distribution has become more skewed with Gini coefficient increasing from 0.390 in 2005 to 0.452 in 2012. The slow progress in poverty reduction and worsening income distribution suggests that growth has not been inclusive. Poverty is exacerbated by high degree of vulnerability of households to shocks; Malawi's Human Development Index is amongst the lowest in the world. In 2014, Malawi was ranked 174<sup>th</sup> out of 189 countries with an HDI of 0.414.

## **2.1 Macroeconomic Performance**

Since independence in 1964, Malawi pursued an agricultural sector-led development strategy which paid dividends in the early years of independence. This is manifested by the self-sufficiency in food production enjoyed particularly in the 1970s. The economy grew at an average rate of 6 percent per annum. However, the policies that favoured the estate sector which concentrated more on tobacco made the economy vulnerable to external shocks. Further to that, the system of pan-territorial and pan-seasonal prices undermined the profitability of smallholder farming and acted as an implicit taxation extracted by ADMARC (Jayne & Jones, 1997). Hence reduced incentives for growth and created distortions in the economy. It was demonstrated by Kydd and Christiansen (1982) that adverse pricing policies and other government interventions effectively favoured the large scale agricultural interests, at the expense of the smallholder farmers.

Malawi experienced a crisis that manifested itself in poor and negative growth of the economy, deteriorating terms of trade, transport bottlenecks due to trade route

redirection, rising cost of fuel, adverse weather conditions and weakening internal demand between 1979 and 1981. The rate of growth on average declined from 2.9% in the period 1960-1979 to -1.0% per annum during the 1980s (Frausum & Sahn, 1996). The crisis exposed fundamental weaknesses of the estate-led export strategy that led to the marginalization of the smallholder sector with consequent welfare implications.

The economic crisis described above pushed Malawi towards the adoption of World Bank sponsored Structural Adjustment Policies and IMF Stabilization measures in 1981. The emphasis was on policies that would stimulate the growth and development of the agricultural sector due to its importance in the livelihood systems of a majority Malawians. The reforms in the agricultural sector were aimed at removing biases against the smallholder sector and increasing the participation of smallholder farmers in the production of high value export crops such as tobacco, cotton and groundnut. Reform in the agricultural sector included the removal of subsidies on fertilizer, decline in taxation of smallholder farmers, privatization and liberalization of marketing arrangements and activities of agricultural parastatals (Frausum & Sahn, 1996).

However, the economy has continued to show signs of staggering growth. The growth in real GDP between 1990 and 1999 averaged 4.3%. Malawi's real GDP growth has been highly variable during 2001-04 and much below the targeted rate of 6% per year. Drought, combined with poor government policy and the suspension of donor assistance, retarded real GDP growth to 1.9% in 2002. The recovery in maize production pushed real GDP growth to 4.4% in 2003. However, low rainfall levels in the 2004/05 growing

season reduced the harvest, and slowed real GDP growth to an estimated 4.2% in 2004 (African Development Bank, 2005). Overall, fluctuation in GDP is a result of the high dependence on rain-fed agriculture. The economy fails to diversify as the industrial sector remains basic and constrained by an unfavourable investment environment, weak entrepreneur class, undeveloped human capital, and high transport and power costs (Africa Development Bank, 2005).

Real GDP growth in 2015 was projected to decelerate to 5.5% from 5.7% in 2014 largely because of late arrival of rains and the floods that hit Malawi in January 2015, disrupting agricultural activities and transport services. Growth may also be constrained by reduced government spending, as a result of fiscal tightening. Despite the recent challenges, the growth outlook is viewed as largely favourable. Growth is forecast to pick up to 6% in 2016, underpinned by stable macro-economic environment and business climate reforms and surge in public investment.

Inflation rose from an average of 8.9 percent from the early 1960s to mid-1970s to about 22 percent between the mid-1980s to the early 1990s (Ndaferankhande & Ndhlovu, 2006). The major cause of this rise in inflation was the global oil prices shock in the 1970s and the Mozambican civil war where Malawi's closest sea port is based; these two events increased the cost of transport and goods and Malawi suffered a period of cost-push inflation (Nkume & Ngalawa, 2014). In 1994 Malawi switched to a flexible exchange rate regime in accordance with the IMF Structural Adjustment Programmes (SAPs), inflation went up to 34 percent from just above 22 percent in 1993. In 1995

Malawi recorded its highest inflation rate at 83 percent due to several events, including political transition (multiparty democracy from one party regime) and financial sector liberalization that occurred during that period (Ndaferankhande & Ndhlovu, 2006). Inflation then fell to 9.14 percent in 1997 with improving economic situation after the 1995 crisis (Nkume & Ngalawa, 2014). Following further devaluation of the Malawian kwacha combined with monetary and fiscal policy indiscipline; inflation rose to 44 percent in 1999 (Simwaka, *et al.*, 2012).

During 2004-2009 periods, average inflation remained below 12 percent compared to about 35 percent inflation over the preceding decade. This was attributed to the accumulation of substantial foreign reserves, which helped minimize volatility in the country's currency (Agbor, 2012).

By December 2012, inflation rate reached 29 percent; this was due to the devaluation of kwacha by almost 100 percent as demanded by the IMF (Ott, 2013). Since the 2012 devaluation, inflation on average has been about 22 percent.

## **2.2 Policy Highlights**

Malawi's monetary policy has been historically unclear, with an unclear inflation policy (Sato, 2001). For so many years, monetary authorities in the country have been generalising that single digit inflation is a desirable target. This is also documented in the Malawi Growth and Development Strategy (MGDS) which its main objective is to achieve poverty reduction through sustainable growth and infrastructure development. A

key element for achieving sustainable economic growth is the pursuit of sound macroeconomic policies with a view to maintain inflation at single digit levels; while prudent fiscal and monetary policies are expected to deliver low inflation (GoM, 2012)

### **2.3 Conclusion**

All in all, Malawi has faced a lot of challenges on her way to achieving sustainable economic growth while maintaining inflation at lower levels. Recently the pull out of donors, devaluation of the currency and poor harvest has led to further increase in level of inflation and reduced growth. However, the government has been pursuing a number of policies to put these macroeconomic aggregates on track, such as tight monetary policy and prudent fiscal policy.

## CHAPTER THREE

### LITERATURE REVIEW

#### 3.1 Theoretical Review

Economic theories reach a variety of conclusions about the relationship between inflation and economic growth. In this section will discuss classical, Keynesian, Neo-Keynesian, Neo-classical, Monetarism and Endogenous growth theories and their contribution to the relationship between inflation and growth. Classical economics recalls supply-side theories which emphasizes on the need for incentives to save and invest if a nation's economy is to grow, linking it to land, labour and capital. Keynesian and Neo-Keynesian provided a more comprehensive model for linking inflation to growth under the AS-AD framework. Monetarism updated the quantity theory, emphasizing the role of monetary growth in determining inflation, while Neo-Classical and Endogenous growth theories sought to account for the effects of inflation on growth through its impact on investment and capital accumulation.

Classical theorists laid the foundation for a number of growth theories. The foundation for the classical growth model was laid by Adam Smith who posited a supply side driven model of growth and his production function was as follows:  $Y = f(L, K, T)$ . Where  $y$  is output,  $L$  is labour,  $K$  is capital, and  $T$  is land, so output was related to labour, capital

and land inputs. Consequently, output growth ( $gY$ ) was driven by population growth ( $gL$ ), and investment ( $gK$ ) and land growth ( $gT$ ) and increases in overall productivity ( $gF$ ). Therefore:  $gY = (gF, gK, gL, gT)$ . Smith argued that growth was self-reinforcing as it exhibited increasing returns to scale. Moreover, he viewed savings as a creator of investment and hence growth, therefore, he saw income distribution as being one of the most important determinants of how fast/slow a nation would grow. He also posited that profits decline not because of decreasing marginal productivity, but rather because the competition of capitalists for workers will bid wages up (Samuelson, 1959). Although the link between the change in price level and its effects on profit level and output were not explicitly articulated in the classical growth theories; the relations between the two variables is implicitly suggested to be negative as indicated by the reduction in firm's profit levels through higher wage costs.

Endogenous growth theories describe economic growth which is generated by factors within the production process, for example economies of scale, increasing returns or induced technological change; as opposed to outside (exogenous) factors such as the increase in population. In endogenous growth theory, the growth rates depend on one variable which is the rate of return on capital. Variables, like inflation, that decreases that rate, which in turn reduces capital accumulation and decreases the growth rate. The main difference between the endogenous growth models and the neo-classical economies is that in the neo-classical economies, the rate of return on capital declines as more capital is accumulated. In the basic versions of the endogenous growth models, per capita output continues to increase because the return on capital does not fall below a positive lower

bound. The basic intuition is that only if the return on capital is sufficiently high, will people be induced to continue accumulating it.

Endogenous models that explain growth further with human capital develop growth theory by implying that the growth rate also depends on the rate of return to human capital, as well as physical capital. A tax on either form of capital induces a lower return. When such endogenous growth models are within a monetary exchange framework of Lucas (1973) and Lucas and Stokey (1987), the inflation rate (tax) lowers both the return on all capital and the growth rate. A tax on capital income directly reduces the growth rate, while a tax on human capital would cause labour to leisure substitution that lowers the rate of return on human capital and can also lower the growth rate.

The Keynesian model provides a more comprehensive model for linking inflation to growth under the AD-AS framework. In the AD-AS framework, the AS curve is upward sloping rather than vertical, which is its critical feature. If the AS curve is vertical changes on the demand side of the economy affect only prices. However, the AS curve is upward sloping in the short run so that the change in the demand side of the economy affects both price and output (Dornbusch *et al.*, 1996). It was also believed that the positive relationship can be due to agreements by some firms to supply goods at a later date at an agreed price. Therefore, even if the prices of goods in the economy have increased, output would not decline, since the producer has to fulfill the demand of the consumer with whom the agreement was made.

Mundell (1963) was one of the first to articulate a mechanism relating inflation and output growth separate from excess demand for commodities. In this model an increase in inflation or inflation expectations immediately reduces people's wealth. This works on the idea that the rate of return on individual's real money balances falls. Hence, people save more by switching to assets so as to accumulate the desired wealth by increasing their price, thus driving down the real interest rates. Greater savings means greater capital accumulation and thus output growth.

Tobin (1965) another neoclassical economist, developed Mundell's model further by following Solow (1956) and Swan (1956) in making money as a store of value in the economy. The Tobin effect suggests that inflation causes individuals to substitute out of money into interest earning assets, which leads to greater capital intensity and promotes economic growth. In effect, inflation exhibits a positive relationship to economic growth.

Monetarism has several essential features, with its focus on the long-run supply-side properties of the economy as opposed to short-run dynamics. Milton Friedman, who coined the term "Monetarism", emphasized several key long-run properties of the economy, including the Quantity Theory of Money and the Neutrality of Money. The Quantity Theory of Money linked inflation and economic growth by simply equating the total amount of spending in the economy to the total amount of money in existence. Friedman proposed that inflation was the product of an increase in the supply or velocity of money at a rate greater than the rate of growth in the economy. Friedman also challenged the Phillips curve (inflation-unemployment trade-off) that it holds only in the

short run. His argument was based on the premise of an economy where the cost of everything doubles. Individuals have to pay twice as much for goods and services, but they don't mind because their wages are also twice as large. Individuals anticipate the rate of future inflation and incorporate its effects into their behavior. Hence, employment and output is not affected. This concept is called the "neutrality of money". Neutrality of money holds if the equilibrium values of real variables including the level of GDP are independent of the level of money supply in the long run. Super neutrality holds when real variables including the rate of growth of GDP are independent of the rate of growth in the money supply in the long run. If inflation worked this way, then it would have no harm. However, in reality inflation does have real consequences for other macroeconomic variables. Through its impact on capital accumulation, investment and exports, inflation can negatively impact a nation's growth rate. In summary, monetarism suggests that in the long run, prices are mainly affected by the growth rate in money, while having no real effect on growth. If growth in the money supply is higher than the economic growth rate, inflation will result.

One of the earliest neo-classical models was postulated by Solow (1956) and Swan (1956). The model exhibited diminishing returns to labour and capital separately and constant returns to both factors jointly. Technological change replaced investment (growth of capital) as the primary factor explaining long-term growth, and its level was assumed by Solow and other theorists to be determined exogenously, that is, independently of all other factors, including inflation (Todaro, 2000).

In conclusion of the above theoretical review on the relationship between inflation and

economic growth, we can see three major predictions on the relationship between inflation and economic growth. First, are those that perceive inflation as having negative effects on economic growth. Secondly, are those that see money a substitute for capital, therefore they see inflation having positive effects on growth. Third, some theories find that there are no effects of inflation on economic growth and in this category are those who see money as being super neutral.

### **3.2 Empirical Literature**

While there seems to be consensus on the fact that very high inflation is bad for growth, there have been mixed results from empirical studies concerning their precise relationship. As pointed out by Sarel (1996); this negative effect, however, was not detected in data from the 1950s and the 1960s. Based on those data, the view that prevailed in the economic profession was that the effect of inflation on growth was not particularly important. Until the 1970s, many studies found this effect to be non-significant, and in fact some found it to be positive. For example earlier works by Dorrance (1963) and Johnson (1967) found the relationship between inflation and economic growth to be either non-significant or positive. In General the empirical evidence was, at its best, mixed.

The change in view came only after many countries experienced severe episodes of high and persistent inflation in the 1970s and the 1980s. These high inflation episodes were usually associated with general decline in the macroeconomic performance and with balance of payments crisis. As more data became available during this period, studies

confirmed that inflation had a negative effect on economic growth.

Using data of 47 sample countries for the period 1950-1977, Komendi and Meguire (1985) developed a model that allowed them to examine the economic and non-economic determinants of growth. It was found that an increase of inflation by 1% reduces the economic growth by 0.57%.

Using a regression analog of growth accounting, Fischer (1993) presented cross-section and panel regressions showing that growth is negatively associated with inflation, large budget deficit, and distorted foreign exchange markets. Supplementary evidence suggests that the causation runs from macroeconomic policy to growth.

Using data for around 100 countries from 1960 to 1990, Barro (1995) assessed the effects of inflation on economic performance. The regression results showed that an increase in the average inflation rate by 10 percentage points per year is estimated to lower the growth rate of real per capita GDP (on impact) by 0.2 to 0.3 percentage points per year.

Regional empirical studies confirmed the existence of negative relationship between inflation and economic growth: De Gregorio (1992) for Latin America; Fischer, et al (1997) for transition economies. The main finding of these studies was that inflation impedes efficient resource allocation by distorting the signaling role of price changes and producing a variety of output reducing inefficiencies.

It emerged from the above studies that the effect of inflation on economic growth is positive or non-significant at low rates, but this effect becomes significantly negative at higher rates. It follows from these findings that policy makers should aim at low rate of inflation to foster economic growth. But how low should inflation be? In other words, at what level inflation becomes harmful to output growth. The answer to the latter question depends on the structure and the level of development of the economy and will differ from one country to another.

Several empirical studies conducted since the mid-1990s have examined this issue focusing specifically on whether the relationship between inflation and economic growth is non-linear. It was hypothesized that if such relationship exists, it should be possible to estimate the threshold at which the sign of the relationship between the two variables switches from positive to negative. Fischer (1993) was the first to investigate the possibility of non-linearity in the relationship between inflation and economic growth using both cross-sectional and panel data for 93 countries including developing and industrial countries. He found a positive relationship between inflation and economic growth at low inflation rates, but the relationship became negative as inflation rose. Moreover, using the two structural breakpoints, 15% and 40%, it was found that the strength of the relationship weakens for inflation rates above 40%.

After the results of Fischer (1993) there has been many studies showing that the relationship between inflation and long-run growth was characterized by non-linearity and the existence of threshold effects.

Using panel data of 87 countries covering the period 1970-1990, Sarel (1996) explored the possibility of nonlinear effects of inflation on economic growth. It was found that the function that relates growth rates to inflation contains a structural break. When inflation was low, it had no-significant negative effect on economic growth, and the effect may even be slightly positive. But when inflation was high, it had a negative effect on growth. The point of the structural break was estimated to occur when the average annual rate of inflation is 8. It was also pointed out that if a structural break exists, failing to take it into account introduces a significant bias in the estimated effect of inflation. This paper demonstrated that when the structural break is taken into account, the estimated effect of inflation on economic growth increases by a factor of three. The existence of such a structural break also suggests a specific numerical target for policy: always keep inflation below the structural break

Using a data set consisting of 3,603 annual observations on real per capita GDP growth, and period average consumer price inflation, corresponding to 145 countries, over the period 1960 to 1996, Ghosh and Phillips (1998) found that low inflation (about 2 to 3% a year) was associated with more rapid output growth, the relationship is reversed at higher rates. It was also found out that the relationship is convex; so that the decline in growth rate is associated with an increase in inflation from 10 to 20% is greater than the fall in growth following a move in inflation from 40 to 50%. Using the data covering 140 developing and industrialized countries for the period 1960 to 1998, Khan and Senhadji (2001) reexamined the issue of the existence of threshold effects in the relationship between inflation and growth. The empirical results strongly suggest the existence of a

threshold beyond which inflation exerts a negative effect on growth. The threshold is lower for industrial than developing countries; the estimates are 1-3 percent and 7-11 percent for industrial and developing countries respectively.

Using a data set of 80 countries between 1961 and 2000, Pollin and Zhu (2005) consistently found that higher inflation is associated with moderate gains in GDP growth up to roughly 15-18 percent inflation threshold. Their results also strongly suggested that for middle and low-income countries; allowing inflation to be maintained in the range of 10 percent or somewhat higher is likely to be consistent with higher rates of economic growth.

Most of above studies were cross-country studies. However there are a number of studies that estimated the inflation threshold on individual countries:

Using Malawian data from 1981 to 2014, Nkume and Ngalawa (2014) found a threshold level of 17% beyond which the inflation has adverse impact on economic growth. Using the data set spanning the sample period 1968-2010 for Rwanda, Rutayisire (2013) estimated inflation threshold level of 14.9%. Ademola and Taiwo (2006) Using Nigeria data for the period 1970 to 2003, found the inflation threshold level of 6 percent. Using data for Pakistan from 1961 to 2008, Iqbal and Nawaz (2010) investigated the nexus among inflation, economic growth and investment. They also tested for the existence of a second threshold in the relationship and they found 6% as the first threshold and has a positive but insignificant impact on economic growth; the second threshold was 11%. In the investment-inflation relationship only one threshold level of 7% was found.

In summary, on the basis of the above empirical literature review on the relationship between inflation and economic growth, several empirical studies were conducted since the mid-1990s to examine whether the relationship between inflation and economic growth is non-linear, thus the impact of inflation on economic growth is not universal such that at some levels inflation is harmful to growth while at some levels it is not. It was hypothesized that if such relationship exists, it should be possible to estimate the threshold at which the sign of the relationship between the two variables switches from positive to negative. Fischer (1993) was the first to investigate the possibility of non-linearity in the relationship between inflation and economic growth. He found a positive relationship between inflation and economic growth at low inflation rates, but the relationship became negative as inflation rose. Following Fischer's work, a number of empirical studies, both cross-country and country specific studies were conducted to estimate the threshold at which the sign of the relationship between the two variables switches from positive to negative. Most studies found that there was a threshold effect in the inflation and economic growth relationship. Other studies like Iqbal and Nawaz (2010) went on to test the existence of a second threshold and they also tested the existence of threshold effects in the inflation-investment relationship. From the empirical literature one could see that the findings of the inflation thresholds were different across countries; this is due to the fact that the threshold is not immutable and it varies according to the time frame attached and due to heterogeneous factors pertaining to each country, hence the difference.

## CHAPTER FOUR

### METHODOLOGY

#### 4.1 General Growth Model

The relationship between inflation and economic growth can be derived using the standard growth equation Barro (1991) and Sala-i-Martin (1997)

$$d \log Y = X\beta + \varepsilon \quad (1)$$

Where  $Y$  is real output,  $X$  is a set of explanatory variables,  $\beta$  is slope coefficients attached with explanatory variables and  $\varepsilon$  is the error term. This basic growth equation is extended to capture the link between inflation and economic growth by using the following equation:

$$d \log Y = \alpha_0 + \alpha_1 Inf + X\beta + \varepsilon \quad (2)$$

Where  $d \log Y$  is growth rate of real GDP,  $Inf$  is growth rate of CPI.

However, in growth theory, the determination of the main sources of growth is problematic. Thus, there is a challenge of employing analysis on models based on endogenous, neoclassical and neo-Keynesian growth theories. The problem with these models is that they do not produce an exact list of explanatory variables. For example, the theories agree that the level of technology is an important determinant of growth, but there is no single way to measure the technological variable. Sala-i-Martin (1997) listed

such potential candidates as: market distortions, distortionary taxes, maintenance of property rights and degree of monopoly.

The choice of explanatory variables can be based on theory or empirical growth literature. In the empirical literature, Levine and Renelt (1992) and Sala-i-Martin (1997) argue that despite the existence of a huge set of explanatory variables that can be used in the growth regression, only a few of them may be significant. They further proposed checking the robustness of the regressors econometrically; since some variables may be significant with one set of explanatory variables, but become insignificant with others.

As a result of Sala-I-Martin's test for robustness, the following explanatory regressors have been identified as among the most important determinants of growth: investment, population growth, inflation rate, government expenditure, trade openness and growth rate of terms of trade. These variables have in common that they are systematically correlated with growth. Financial development is another variable that has been emphasized by many empirical studies in the growth process, therefore this variable has also been considered in this study. Therefore, besides inflation, the empirical analysis of this research for the case of Malawi will rely on the above results and uses the following basic model:

$$d \log Y = \alpha_0 + \alpha_1 INF_t + \beta_1 INV_t + \beta_2 POP_t + \beta_3 FD_t + \beta_4 OPEN_t + \varepsilon_t \quad (3)$$

Where  $d \log Y$  is growth rate of real GDP,  $INF_t$  is growth rate of CPI which is measured by the first log difference of CPI, thus,  $INF_t = d \log CPI$  and  $POP_t$  is population growth rate measured by the first log difference of total population,  $INV_t$  stands for investment

proxy by gross fixed capital formation as a share of nominal GDP,  $FD_t$  is financial development measured as a ratio of M2 to nominal GDP,  $OPEN_t$  is openness measured by the ratio of imports plus exports to nominal GDP and  $\varepsilon_t$  is the error term.

As put by Sarel (1996), the CPI is used to reduce the problem of negative correlation between inflation and growth rates, which not directly caused by inflation effects on growth. It is better to use CPI data than implicit GDP deflators in this type of study because changes in GDP deflators are, by construction, negatively correlated with the growth rates. Suppose, for example, that there are two periods and a measurement error overestimates the output volume in the second period. In this case, the growth rates between the two periods will be overestimated, while the change in the implicit GDP deflator between the two periods will be underestimated. If the output volume is underestimated in the second period, the growth rate between two periods will be underestimated, while the change in the implicit GDP deflator between the two periods will be overestimated. In both cases, the measurement error will induce a negative correlation between real growth rates and GDP deflators. Because CPI indices are calculated independently of output volume, their use should prevent this problem.

The log transformation eliminates at least partially, the strong asymmetry in the inflation distribution (Sarel, 1996). In the class of nonlinear models, Gosh and Phillips (1998) show that the log transformation provides the best fit. Finally the log transformations can be justified by the fact that its implications are more plausible than that of a linear model.

## 4.2 Non-linear regression model

The threshold model was developed by Khan and Senhadji (2001) for the analysis of threshold level of inflation for industrialised and developing countries. Using the same model, Nkume and Ngalawa (2014) estimated a threshold level of inflation for Malawi. In this model only one threshold level was captured. Following the work of Iqbal and Nawaz (2010) this model is extended with the possibility of two threshold level in inflation growth nexus. By introducing two threshold level of inflation; following final regression model is designed:

$$d \log Y = \alpha_1 + \alpha_2(Inf) * I(Inf < \pi_1) + \alpha_3(Inf) * I(\pi_1 \leq Inf \leq \pi_2) + \alpha_4(Inf) * I(Inf > \pi_2) + \beta_1 POP + \beta_2 INV + \beta_3 FD + \beta_4 OPEN + \varepsilon \quad (4)$$

Where dependent variable and the control variable are defined as the same in equation 3 while  $\pi_1$  and  $\pi_2$  are two threshold level of inflation.  $I(Inf < \pi_1)$ ,  $I(\pi_1 \leq Inf \leq \pi_2)$  and  $I(Inf > \pi_2)$  are indicators which take the value of one if the term between parentheses is true and zero otherwise. This model specifies the effects of inflation with three coefficients:  $\alpha_2, \alpha_3$  and  $\alpha_4$ .  $\alpha_2$  Denotes the effects of inflation below the first threshold level  $\pi_1$ ,  $\alpha_3$  denotes the effect of inflation on economic growth between  $\pi_1$  and  $\pi_2$ , and  $\alpha_4$  denotes the effect of inflation on economic growth exceeding the second threshold level  $\pi_2$ .

Identification of threshold is based on the methodology defined by Khan and Senhadji (2001). Regression equation is estimated for different values of threshold which is chosen in an ascending order. The optimal threshold is obtained by finding the value that maximizes  $R^2$  and that minimizes the residual sum of squares (RSS). The search for

optimal threshold for wider range is tedious. However, Hansen (2000) proposed to search optimal value only in the region where we expect the threshold should be.

Theoretical literature indicates that investment might be the channel through which inflation hits economic growth. The following linear model specification is used to measure the relationship between investment and inflation:

$$INV = \delta_0 + \delta_1 Inf_t + \delta_2 INV_{t-1} + \varepsilon_t \quad (5)$$

Where *INV* is the gross fixed capital formation as a share of GDP and the first lag of *INV* is included to control the economic conditions in the last period. With the possibility of two thresholds in investment inflation nexus, following model is designed:

(6)

Selection of threshold level is based on the similar procedure explained for inflation and economic growth.

### 4.3 Data Sources

This study will use secondary data obtained from the World Development Indicators (WDI). The study employs annual time series data for the period 1980-2014 and uses E-views 9.0 for the actual analysis.

## **CHAPTER FIVE**

### **RESULTS AND DISCUSSIONS**

#### **5.1 Preliminary Data Analysis**

Descriptive statistics for each variable are shown in the table below. Growth rate ranged between -10.24 percent and 16.72 percent with an average rate of 3.59 percent, where as inflation ranged from 7.41 percent to 83.32 percent with an average of 20.35 percent. Growth rates are negatively skewed, thus, it has extreme values (outliners) below the mean, where as inflation is positively skewed meaning it has outliners above the mean. The kurtosis level for a normally distributed variable is 3. The kurtosis for GDP growth, inflation, financial development, trade openness and population growth is greater than 3 at 4.39, 10.57, 4.65, 6.54 and 3.94 respectively. Investment is lower at 2.5. This shows that the distributions of GDP growth, inflation, financial development, trade openness and populations are more likely to have a structural break than equivalently normally distributed data.

**Table 1: Descriptive Statistics**

|                  | <b>GROWTH</b> | <b>INF.</b> | <b>FD</b> | <b>INVEST</b> | <b>OPENNESS</b> | <b>POP.<br/>GROWTH</b> |
|------------------|---------------|-------------|-----------|---------------|-----------------|------------------------|
| <b>Mean</b>      | 3.5941        | 20.3530     | 0.2200    | 16.2040       | 0.6683          | 2.9310                 |
| <b>Median</b>    | 3.8438        | 14.3958     | 0.2007    | 14.6360       | 0.6463          | 2.8604                 |
| <b>Maximum</b>   | 16.7288       | 83.3258     | 0.4335    | 26.7740       | 1.3021          | 6.2510                 |
| <b>Minimum</b>   | -10.2402      | 7.4116      | 0.1353    | 9.3150        | 0.4796          | 0.1519                 |
| <b>Std. Dev.</b> | 5.1306        | 14.8486     | 0.0714    | 4.5882        | 0.1784          | 1.3711                 |
| <b>Skewness</b>  | -0.4933       | 2.4320      | 1.4714    | 0.7629        | 1.7870          | 0.5088                 |
| <b>Kurtosis</b>  | 4.3968        | 10.5745     | 4.6455    | 2.5156        | 6.5415          | 3.9406                 |

## 5.2 Times series properties

Since the Ordinary Least Squares have been used as the estimation technique, there is a need to make sure that all the variables included in the different models are stationary in order to have consistent results and avoid spurious regressions. Hence, the time series properties of the variables have been investigated and the order of integration of each variable has been determined by the application of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests with “constant” and “constant and trend”. The distribution theory supporting the Dickey-Fuller tests assumes that the errors are statistically independent and have a constant variance (Enders, 2015). In using this methodology care must be taken to ensure that the error terms are uncorrelated and have a constant variance. Phillips and Perron developed a generalization of Dickey-Fuller procedure that allows for fairly mild assumptions concerning the distribution of the errors. There is no requirement that the disturbance term is serially uncorrelated or homogeneity. Instead of the Dickey-Fuller assumptions of independence and homogeneity, the PP test allows the disturbances to be weakly dependent and heterogeneously distributed. Hence, these tests are complementary, as the PP generalizes the ADF test and provides robust estimates in the presence of serial correlation, time

dependent heteroscedasticity and structural break in the time series. The results of the unit root tests are presented in the table below.

**Table 2: Unit Root Tests**

| Variables | Order of Integration | ADF test  |                     | PP test    |                     |
|-----------|----------------------|-----------|---------------------|------------|---------------------|
|           |                      | Intercept | Trend and Intercept | Intercept  | Trend and Intercept |
| $Y_t$     | I(0)                 | -7.7205** | -7.8227**           | -7.6125**  | -8.3122**           |
| $INV_t$   | I(1)                 | -6.9808** | -6.8966**           | -11.1848** | -11.2320**          |
| $\pi_t$   | I(1)                 | -7.2216** | -7.0968**           | -10.8969** | -10.8353**          |
| $OPEN_t$  | I(1)                 | -7.2151** | -7.5605**           | -7.4590**  | -8.1231**           |
| $FD_t$    | I(1)                 | -5.4612** | -5.9579**           | -5.4680**  | -5.9854**           |
| $POP_t$   | I(2)                 | -5.064**  | -4.750**            | -3.511**   | -3.698**            |

Note: \*\* indicates that the null hypothesis of non-stationarity is rejected at all levels of significance.

For almost all the variables (Inflation, Investment, Population, Openness, and Financial Development) I used in this paper, the null hypothesis of non-stationarity has not been rejected, meaning that they are not stationary. However, the presence of unit root was rejected when those variables were differenced. Only GDP growth rate was stationary in level. For the sake of brevity, only the results for the unit root tests of differenced variables and their order of integration have been reported in the Table above.

### 5.3 Model Estimation

Nonlinear model, thus, a model that shows nonlinear relationship between inflation and economic growth has been estimated using equation (4). First, we estimate the equation (3) with one threshold level. Though estimating the equation with one threshold level seems redundant but it helps since the search for two optimal levels is tedious, however, Hansen (2000) proposed to search optimal value only in the region where we expect the threshold should be. With the possibility of one threshold level, we reformulate equation (3) as follows:

$$d \log Y = \alpha_1 + \alpha_2 (Inf) * I(Inf < \pi_1) + \alpha_3 (Inf) * I(Inf > \pi_2) + \beta_1 POP + \beta_2 INV + \beta_3 FD + \beta_4 OPEN + \varepsilon$$

#### 5.3.1 Inflation-Growth Nexus

We apply the range of threshold from 8 to 83 since they are the minimum and maximum levels of inflation respectively during the period under analysis and choose the value that minimizes the residual sum of squares (RSS). The results on the table below indicates that the value of  $\pi_1$  is 11 percent and inflation below 11 percent has positive and significant effect on economic growth. For 1 percent increase in inflation, real GDP growth will increase by 0.72 percentage points. When it exceeds the threshold level of inflation, the impact of inflation on economic growth diminishes though still positive i.e. 0.18 percentage points. This result is in line with findings of Gosh and Phillips (1998), while it slightly differs from Khan and Senhadji (2001) whose results indicated a statistically insignificant relationship between inflation and growth rates below inflation threshold level. Though the impact above the threshold level did not turn negative, there is still some adverse effect as the growth will be lower as compared to the growth below the

threshold level. This result is similar to the results that Nkume and Ngalawa (2014) found, as the impact of inflation on economic growth above the threshold level did not turn negative but still the impact was still adverse since the growth rate beyond the threshold level declined. Though the impact of the inflation above the 11% threshold level in this paper is somehow similar to what Nkume and Ngalawa (2014) found; the threshold levels are different and this is due to the fact that some of the variables that I included in this paper are different from what was included in Nkume and Ngalawa (2014). For example in their work Nkume and Ngalawa (2014) included terms of trade which was found to be insignificant and it was not included in this paper though theory recommends it. Of all the control variables only trade openness was found to be significant. Though surprisingly investment was insignificant but this is also in line to what Nkume and Ngalawa (2014) found.

**Table 3: Estimation with Single Threshold Level (Dependent=GDP Growth)**

| <b>Variable</b>                 | <b>Coefficient</b> | <b>Std. Error</b> | <b>t-Statistic</b> | <b>Prob.</b> | <b>R-Squared</b> | <b>RSS</b> |
|---------------------------------|--------------------|-------------------|--------------------|--------------|------------------|------------|
| <b>INF <math>\leq</math> 11</b> | 0.7235             | 0.2756            | 2.6256             | 0.0141       | 0.4045           | 496.98     |
| <b>INF &gt;11</b>               | 0.1808             | 0.0889            | 2.0335             | 0.0519       |                  |            |
| <b>INV</b>                      | 0.2246             | 0.1822            | 1.2325             | 0.2284       |                  |            |
| <b>OPEN</b>                     | -21.3828           | 7.239             | -2.9538            | 0.0064       |                  |            |
| <b>POP</b>                      | 25.8579            | 60.5518           | 0.427              | 0.6727       |                  |            |
| <b>FD</b>                       | 3.3756             | 29.6238           | 0.1139             | 0.9101       |                  |            |
| <b>C</b>                        | -5.3662            | 4.4828            | -1.1971            | 0.2417       |                  |            |

Considering that the empirical estimation of the model indicates that of all the control variables only trade openness was statistically significant at any level of inflation rate. This prompted a reexamination of the model with only trade openness to see what

significant effect it could have on the estimated relationships. It was however found out that the results are not significantly altered by re-specification. For the sake of brevity only the results under which the optimal inflation threshold is found are presented on the table 4 below:

**Table 4: Single Inflation Threshold Estimation with only Trade Openness as Control Variable (Dependent = GDP Growth)**

| Variable                        | Coefficient | Std. Error | t-statistic | Prob.  | R-Squared | RSS    |
|---------------------------------|-------------|------------|-------------|--------|-----------|--------|
| <b>INF <math>\leq</math> 11</b> | 0.6861      | 0.2632     | 2.6062      | 0.0141 | 0.3672    | 528.12 |
| <b>INF &gt; 11</b>              | 0.1499      | 0.0782     | 1.9163      | 0.0649 |           |        |
| <b>OPEN</b>                     | -17.8827    | 5.7451     | -3.1127     | 0.0041 |           |        |
| <b>C</b>                        | -0.3526     | 1.8982     | -0.1857     | 0.8539 |           |        |

The existence of a second threshold in the relationship between inflation and growth is tested using equation (4) and we find that the residual sum of squares (RSS) and R-squared are minimized and maximised respectively at inflation between 11 and 13. Then we carry out a significant test of one threshold against two thresholds. The results do not support the existence of a second threshold as we have failed to reject the null hypothesis that there is no second threshold. For the sake of brevity, only the the outcome where the RSS was minimised is presented in the table above.

The idea behind the two threshold levels is that inflation can be divided into three parts. As inflation rises from zero to a certain level which is regarded as the first or low threshold level, we expect its impact on growth to be negligible or even positive. As inflation crosses the low threshold level we expect an adverse impact on the GDP growth up to a certain level which is the second threshold level. When inflation crosses the second threshold level, the marginal adverse impact of growth diminishes. Thus, the

inflation growth relationship flattens when the economy has high inflation. Intuitively, we can say that once inflation exceeds the second threshold level, all the damage to the economy has already been done, and then perfect foresight dynamics comes into being, thus, people will start incorporating the rising level of inflation in their expenditure or investment plans. When these occur, further increases in inflation have no additional detrimental effects on economic growth (Iqbal & Nawaz, 2010).

Therefore the failure of the results to support the existence of the second threshold in the case of Malawi implies that there is no such thing as perfect foresight dynamics when it comes to inflation in the case of Malawi, such that inflation above the 11% threshold will have an adverse impact on economic growth in Malawi.

**Table 5: Estimation with Two Threshold Levels (Dependent = GDP Growth)**

| Variable                     | Coefficient | Std. Error | t-Statistic | Prob.  | R <sup>2</sup> | RSS    |
|------------------------------|-------------|------------|-------------|--------|----------------|--------|
| <b>INF &lt; 11</b>           | 0.8249      | 0.3318     | 2.4861      | 0.0197 | 0.4118         | 490.95 |
| <b>INF ≥ 11 and INF ≤ 13</b> | 0.3351      | 0.2876     | 1.1652      | 0.2545 |                |        |
| <b>INF &gt; 13</b>           | 0.2099      | 0.1037     | 2.0234      | 0.0534 |                |        |
| <b>INV</b>                   | 0.2135      | 0.1856     | 1.1507      | 0.2603 |                |        |
| <b>OPEN</b>                  | -21.0703    | 7.3529     | -2.8656     | 0.0081 |                |        |
| <b>POP</b>                   | 27.4865     | 61.3976    | 0.4477      | 0.6581 |                |        |
| <b>FD</b>                    | 7.9303      | 31.0685    | 0.2553      | 0.8005 |                |        |
| <b>C</b>                     | -6.1879     | 4.7676     | -1.2979     | 0.2057 |                |        |

### 5.3.2 Inflation-Investment nexus

Theoretical literature has suggested that investment might be the channel that link inflation to economic growth. The linear model is estimated by using equation (5) to uncover the relationship between inflation and investment. Results indicate that inflation has a negative but statistically insignificant relationship with investment. A trend variable was added to see if time had an impact and it is insignificant.

**Table 6: Linear Estimation Results (Dependent = Investment as % of GDP)**

| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
|----------|-------------|------------|-------------|--------|
| INF      | -0.059444   | 0.060621   | -0.980586   | 0.3346 |
| INV(-1)  | 0.466889    | 0.148208   | 3.150236    | 0.0037 |
| TREND    | 0.106361    | 0.069267   | 1.535535    | 0.1351 |
| C        | 8.017517    | 2.863768   | 2.799639    | 0.0089 |

Nonlinear model of investment and inflation is estimated using equation 6. By applying the same process as given by inflation and economic growth, it appears that there are no threshold effects in the relationship between inflation and economic growth since the variable of inflation is statistically insignificant even at 11 percent where the residual sum of squares (RSS) is minimized. Hence, there is no threshold effect in the inflation-investment relationship.

**Table 7: Estimation with Threshold Effects (Dependent = Investment)**

| <b>Variable</b>                 | <b>Coefficient</b> | <b>Std. Error</b> | <b>t-Statistic</b> | <b>Prob.</b> | <b>R-Squared.</b> | <b>RSS</b> |
|---------------------------------|--------------------|-------------------|--------------------|--------------|-------------------|------------|
| <b>INF <math>\leq</math> 11</b> | -0.25954           | 0.245457          | -1.05737           | 0.2991       | 0.386964          | 427.6569   |
| <b>INF &gt; 11</b>              | -0.09121           | 0.071663          | -1.27271           | 0.2132       |                   |            |
| <b>INV(-1)</b>                  | 0.478612           | 0.149584          | 3.199623           | 0.0033       |                   |            |
| <b>TREND</b>                    | 0.117181           | 0.070783          | 1.65548            | 0.1086       |                   |            |
| <b>C</b>                        | 8.630249           | 2.968484          | 2.907292           | 0.0069       |                   |            |

## **CHAPTER SIX**

### **CONCLUSION**

#### **6.0 Summary**

With emphasis on the effects of inflation on economic growth. The overarching objective of this study was to analyse the relationship among inflation, economic growth and investment. In order to achieve this, the study used a threshold estimation model developed by (Khan and Senhadji, 2001). A well-known single country modification of Khan and Senhadji (2001) model is that of Nkume and Ngalawa (2014) as well as (Mubarik, 2005). This paper followed the work of Iqbar and Nawaz (2010) so as to extend the work done by (Nkume and Ngalawa, 2014). Using the data from 1980 to 2015, the estimation model revealed that the first inflation threshold for Malawi is 11 percent and the results do not support the existence of a second threshold in the relationship between inflation and economic growth. The results also indicated that inflation has a negative but insignificant impact on investment and that there are no threshold effects in the relationship between inflation and investment. Of all the control variables, only trade openness was found to be significant and it affects growth negatively.

### **6.1 Policy Recommendations**

The analysis shows that it is desirable to keep the inflation below 11 percent and therefore monetary authorities should concentrate on the policies that keep inflation rate below the first threshold because it may be helpful for the achievement sustainable economic growth. Monetary policy must be designed to stabilise the prices and curb inflation. Low inflation is also helpful since it minimises the uncertainties in the financial market which in turn boost investment in the country. Better coordination between monetary and fiscal policies is required to achieve both objectives, thus, to achieve sustainable economic growth and low inflation.

### **6.2 Limitations of the study**

The limitation of this study was the methodology, the methodology and the choice of thresholds is somehow controversial though it has been accepted by many prominent authors. Such that the threshold is not immutable, thus it varies over time.

### **6.3 Suggestions for further research**

Further research could be conducted to empirically verify the results that were found in this study by employing a two stage least square (2SLS) method. 2SLS is a statistical technique which is an extension of the Ordinary Least Squares (OLS) method. It is used when dependent variable's error terms are not correlated with the independent variables; therefore in this case, OLS method method produces biased and inconsistent estimates.

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## APPENDICES

### **Appendix 1: Unit Root Results (ADF Tests)**

| Variables              | Level     |                     |                | First Difference |                     |            |
|------------------------|-----------|---------------------|----------------|------------------|---------------------|------------|
|                        | Intercept | Intercept and Trend | Result         | Intercept        | Intercept and Trend | Result     |
| <b>GDP growth rate</b> | -7.6717   | -7.9012             | Stationary     |                  |                     |            |
| <b>Inflation</b>       | -3.1932   | -3.6240             | Stationary     |                  |                     |            |
| <b>Investment</b>      | -3.1570   | -3.5327             |                |                  |                     |            |
| <b>Openness</b>        | -1.1365   | -2.9084             | Non-Stationary | -7.4798          | -7.7715             | Stationary |
| <b>FD</b>              | 0.4770    | 0.0186              | Non-Stationary | -5.3099          | -5.9489             | Stationary |
| <b>Pop. Growth</b>     | -7.3279   | -7.1703             | Stationary     |                  |                     |            |

*Note:* For the intercept only, 5 percent and 1 percent critical values are -2.954 and -3.646 respectively, and -3.552 and -4.262 respectively when a trend is included.

## **Appendix 2: Unit Root Results (PP Tests)**

| <b>Variables</b>       | <b>Level</b>     |                            |                | <b>Level</b>     |                            |                |
|------------------------|------------------|----------------------------|----------------|------------------|----------------------------|----------------|
|                        | <b>Intercept</b> | <b>Intercept and Trend</b> | <b>Result</b>  | <b>Intercept</b> | <b>Intercept and Trend</b> | <b>Result</b>  |
| <b>GDP growth rate</b> | -7.5746          | -8.8327                    | Stationary     |                  |                            |                |
| <b>Inflation</b>       | -3.0807          | -3.0700                    |                | -10.8969         | 10.8350                    |                |
| <b>Investment</b>      | -3.1843          | -3.5327                    | Stationary     |                  |                            |                |
| <b>Openness</b>        | -0.8271          | -2.8177                    | Non-Stationary | -7.9389          | -8.9608                    | Stationary     |
| <b>FD</b>              | 0.4656           | -0.0186                    | Non-Stationary | -5.3216          | -5.9547                    | Stationary     |
| <b>Pop. growth</b>     | -2.1246          | -2.1875                    | Non-Stationary | -2.3805          | -2.3805                    | Non-Stationary |

*Note:* For the case of intercept only, 5 percent and 1 percent critical values are -2.954 and -3.646 respectively, and -3.552 and -4.262 respectively when a trend is included.

### **Appendix 3: Estimation Results for Single Threshold Level**

| <b>Variable</b>                 | <b>Coefficient</b> | <b>Std. Error</b> | <b>t-Statistic</b> | <b>Prob.</b> | <b>R Squared</b> | <b>RSS</b> |
|---------------------------------|--------------------|-------------------|--------------------|--------------|------------------|------------|
| <b>INF <math>\leq</math> 8</b>  | 0.6404             | 0.4546            | 1.4088             | 0.1703       | 0.3118           | 574.38     |
| <b>INF &gt; 8</b>               | 0.0842             | 0.0834            | 1.0093             | 0.3218       |                  |            |
| <b>INV</b>                      | 0.1693             | 0.2019            | 0.8386             | 0.4091       |                  |            |
| <b>OPEN</b>                     | -19.8832           | 8.0517            | -2.4694            | 0.0201       |                  |            |
| <b>POP</b>                      | 8.0088             | 64.5212           | 0.1241             | 0.9021       |                  |            |
| <b>FD</b>                       | -10.4497           | 34.0205           | -0.3072            | 0.7611       |                  |            |
| <b>C</b>                        | -1.1098            | 4.5333            | -0.2448            | 0.8084       |                  |            |
| <b>INF <math>\leq</math> 9</b>  | 0.7506             | 0.3392            | 2.2131             | 0.0355       | 0.3696           | 526.15     |
| <b>INF &gt; 9</b>               | 0.1206             | 0.0828            | 1.4569             | 0.1567       |                  |            |
| <b>INV</b>                      | 0.1089             | 0.1967            | 0.5535             | 0.5845       |                  |            |
| <b>OPEN</b>                     | -17.6975           | 7.8027            | -2.2681            | 0.0315       |                  |            |
| <b>POP</b>                      | 18.5854            | 62.0484           | 0.2995             | 0.7668       |                  |            |
| <b>FD</b>                       | -13.5070           | 31.7454           | -0.4255            | 0.6739       |                  |            |
| <b>C</b>                        | -1.5977            | 4.3270            | -0.3692            | 0.7148       |                  |            |
| <b>INF <math>\leq</math> 10</b> | 0.7298             | 0.3017            | 2.4192             | 0.0226       | 0.3866           | 511.98     |
| <b>INF &gt; 10</b>              | 0.1526             | 0.0860            | 1.7733             | 0.0875       |                  |            |
| <b>INV</b>                      | 0.1808             | 0.1863            | 0.9707             | 0.3403       |                  |            |
| <b>OPEN</b>                     | -19.6963           | 7.4420            | -2.6466            | 0.0134       |                  |            |
| <b>POP</b>                      | 32.4180            | 62.0361           | 0.5226             | 0.6055       |                  |            |
| <b>FD</b>                       | -7.9463            | 30.5868           | -0.2598            | 0.7970       |                  |            |
| <b>C</b>                        | -4.0122            | 4.4064            | -0.9105            | 0.3706       |                  |            |
| <b>INF <math>\leq</math> 11</b> | 0.7235             | 0.2756            | 2.6256             | 0.0141       | 0.4045           | 496.98     |
| <b>INF &gt; 11</b>              | 0.1808             | 0.0889            | 2.0335             | 0.0519       |                  |            |
| <b>INV</b>                      | 0.2246             | 0.1822            | 1.2325             | 0.2284       |                  |            |
| <b>OPEN</b>                     | -21.3828           | 7.2390            | -2.9538            | 0.0064       |                  |            |
| <b>POP</b>                      | 25.8579            | 60.5518           | 0.4270             | 0.6727       |                  |            |
| <b>FD</b>                       | 3.3756             | 29.6238           | 0.1139             | 0.9101       |                  |            |
| <b>C</b>                        | -5.3662            | 4.4828            | -1.1971            | 0.2417       |                  |            |
| <b>INF <math>\leq</math> 12</b> | 0.4365             | 0.2895            | 1.5078             | 0.1432       | 0.3145           | 572.13     |
| <b>INF &gt; 12</b>              | 0.1505             | 0.1022            | 1.4717             | 0.1527       |                  |            |
| <b>INV</b>                      | 0.1879             | 0.1983            | 0.9474             | 0.3518       |                  |            |
| <b>OPEN</b>                     | -21.1464           | 7.8272            | -2.7017            | 0.0118       |                  |            |
| <b>POP</b>                      | 9.4459             | 64.4339           | 0.1466             | 0.8845       |                  |            |
| <b>FD</b>                       | 10.5001            | 32.0711           | 0.3274             | 0.7459       |                  |            |
| <b>C</b>                        | -3.5214            | 4.7568            | -0.7403            | 0.4655       |                  |            |
| <b>INF <math>\leq</math> 13</b> | 0.4653             | 0.2960            | 1.5722             | 0.1276       | 0.3189           | 568.40     |
| <b>INF &gt; 13</b>              | 0.1661             | 0.1071            | 1.5510             | 0.1325       |                  |            |
| <b>INV</b>                      | 0.2037             | 0.1959            | 1.0401             | 0.3075       |                  |            |
| <b>OPEN</b>                     | -21.5690           | 7.7594            | -2.7797            | 0.0098       |                  |            |

|                                 |          |         |         |        |        |        |
|---------------------------------|----------|---------|---------|--------|--------|--------|
| <b>POP</b>                      | 14.1928  | 64.4570 | 0.2202  | 0.8274 |        |        |
| <b>FD</b>                       | 15.3576  | 32.5753 | 0.4714  | 0.6411 |        |        |
| <b>C</b>                        | -4.3927  | 4.9462  | -0.8881 | 0.3823 |        |        |
| <b>INF <math>\leq 14</math></b> | -0.0216  | 0.3559  | -0.0606 | 0.9522 | 0.2724 | 607.27 |
| <b>INF <math>&gt; 14</math></b> | 0.0460   | 0.1264  | 0.3641  | 0.7186 |        |        |
| <b>INV</b>                      | 0.2416   | 0.2047  | 1.1802  | 0.2482 |        |        |
| <b>OPEN</b>                     | -23.1821 | 8.2744  | -2.8017 | 0.0093 |        |        |
| <b>POP</b>                      | 6.1621   | 66.3501 | 0.0929  | 0.9267 |        |        |
| <b>FD</b>                       | 0.7736   | 36.0376 | 0.0215  | 0.9830 |        |        |
| <b>C</b>                        | -0.8634  | 5.2849  | -0.1634 | 0.8714 |        |        |
| <b>INF <math>\leq 15</math></b> | -0.0076  | 0.3640  | -0.0208 | 0.9835 | 0.2718 | 607.78 |
| <b>INF <math>&gt; 15</math></b> | 0.0490   | 0.1308  | 0.3748  | 0.7107 |        |        |
| <b>INV</b>                      | 0.2435   | 0.2083  | 1.1690  | 0.2526 |        |        |
| <b>OPEN</b>                     | -22.9744 | 8.1633  | -2.8143 | 0.0090 |        |        |
| <b>POP</b>                      | 5.7081   | 66.3442 | 0.0860  | 0.9321 |        |        |
| <b>FD</b>                       | 0.8316   | 37.3270 | 0.0223  | 0.9824 |        |        |
| <b>C</b>                        | -0.9762  | 5.2917  | -0.1845 | 0.8550 |        |        |
| <b>INF <math>\leq 16</math></b> | -0.0076  | 0.3640  | -0.0208 | 0.9835 | 0.2718 | 607.78 |
| <b>INF <math>&gt; 16</math></b> | 0.0490   | 0.1308  | 0.3748  | 0.7107 |        |        |
| <b>INV</b>                      | 0.2435   | 0.2083  | 1.1690  | 0.2526 |        |        |
| <b>OPEN</b>                     | -22.9744 | 8.1633  | -2.8143 | 0.0090 |        |        |
| <b>POP</b>                      | 5.7081   | 66.3442 | 0.0860  | 0.9321 |        |        |
| <b>FD</b>                       | 0.8316   | 37.3270 | 0.0223  | 0.9824 |        |        |
| <b>C</b>                        | -0.9762  | 5.2917  | -0.1845 | 0.8550 |        |        |
| <b>INF <math>\leq 17</math></b> | -0.0076  | 0.3640  | -0.0208 | 0.9835 | 0.2718 | 607.78 |
| <b>INF <math>&gt; 17</math></b> | 0.0490   | 0.1308  | 0.3748  | 0.7107 |        |        |
| <b>INV</b>                      | 0.2435   | 0.2083  | 1.1690  | 0.2526 |        |        |
| <b>OPEN</b>                     | -22.9744 | 8.1633  | -2.8143 | 0.0090 |        |        |
| <b>POP</b>                      | 5.7081   | 66.3442 | 0.0860  | 0.9321 |        |        |
| <b>FD</b>                       | 0.8316   | 37.3270 | 0.0223  | 0.9824 |        |        |
| <b>C</b>                        | -0.9762  | 5.2917  | -0.1845 | 0.8550 |        |        |
| <b>INF <math>\leq 18</math></b> | -0.0076  | 0.3640  | -0.0208 | 0.9835 | 0.2718 | 607.78 |
| <b>INF <math>&gt; 18</math></b> | 0.0490   | 0.1308  | 0.3748  | 0.7107 |        |        |
| <b>INV</b>                      | 0.2435   | 0.2083  | 1.1690  | 0.2526 |        |        |
| <b>OPEN</b>                     | -22.9744 | 8.1633  | -2.8143 | 0.0090 |        |        |
| <b>POP</b>                      | 5.7081   | 66.3442 | 0.0860  | 0.9321 |        |        |
| <b>FD</b>                       | 0.8316   | 37.3270 | 0.0223  | 0.9824 |        |        |
| <b>C</b>                        | -0.9762  | 5.2917  | -0.1845 | 0.8550 |        |        |

**Appendix 4: Estimation Results for Single Threshold Level with only Trade Openness as the Control Variable**

| <b>Variable</b>                 | <b>Coefficient</b> | <b>Std. Error</b> | <b>t-statistic</b> | <b>Prob.</b> | <b>R-Squared</b> | <b>RSS</b> |
|---------------------------------|--------------------|-------------------|--------------------|--------------|------------------|------------|
| <b>INF <math>\leq</math> 8</b>  | 0.6694             | 0.4095            | 1.6349             | 0.1125       | 0.2904           | 592.25     |
| <b>INF <math>&gt;</math> 8</b>  | 0.0792             | 0.0735            | 1.0774             | 0.2899       |                  |            |
| <b>OPEN</b>                     | -18.6757           | 6.0739            | -3.0748            | 0.0045       |                  |            |
| <b>C</b>                        | 1.9083             | 1.6048            | 1.1891             | 0.2437       |                  |            |
| <b>INF <math>\leq</math> 9</b>  | 0.7525             | 0.305             | 2.4676             | 0.0195       | 0.3552           | 538.14     |
| <b>INF <math>&gt;</math> 9</b>  | 0.1192             | 0.0737            | 1.6168             | 0.1164       |                  |            |
| <b>OPEN</b>                     | -17.7685           | 5.8034            | -3.0618            | 0.0046       |                  |            |
| <b>C</b>                        | 0.6793             | 1.6851            | 0.4031             | 0.6897       |                  |            |
| <b>INF <math>\leq</math> 10</b> | 0.703              | 0.2817            | 2.4957             | 0.0183       | 0.3575           | 536.23     |
| <b>INF <math>&gt;</math> 10</b> | 0.1343             | 0.0763            | 1.7593             | 0.0887       |                  |            |
| <b>OPEN</b>                     | -18.1674           | 5.7839            | -3.141             | 0.0038       |                  |            |
| <b>C</b>                        | 0.1967             | 1.7959            | 0.1095             | 0.9135       |                  |            |
| <b>INF <math>\leq</math> 11</b> | 0.6861             | 0.2632            | 2.6062             | 0.0141       | 0.3672           | 528.12     |
| <b>INF <math>&gt;</math> 11</b> | 0.1499             | 0.0782            | 1.9163             | 0.0649       |                  |            |
| <b>OPEN</b>                     | -17.8827           | 5.7451            | -3.1127            | 0.0041       |                  |            |
| <b>C</b>                        | -0.3526            | 1.8982            | -0.1857            | 0.8539       |                  |            |
| <b>INF <math>\leq</math> 12</b> | 0.4374             | 0.2696            | 1.6223             | 0.1152       | 0.2876           | 594.53     |
| <b>INF <math>&gt;</math> 12</b> | 0.128              | 0.0892            | 1.4346             | 0.1617       |                  |            |
| <b>OPEN</b>                     | -17.1439           | 6.1742            | -2.7767            | 0.0094       |                  |            |
| <b>C</b>                        | 0.186              | 2.3285            | 0.0799             | 0.9368       |                  |            |
| <b>INF <math>\leq</math> 13</b> | 0.4221             | 0.2696            | 1.6223             | 0.1152       | 0.2876           | 594.53     |
| <b>INF <math>&gt;</math> 13</b> | 0.1286             | 0.091             | 1.4125             | 0.1681       |                  |            |
| <b>OPEN</b>                     | -16.9529           | 6.2222            | -2.7246            | 0.0106       |                  |            |
| <b>C</b>                        | 0.1253             | 2.4213            | 0.0518             | 0.9591       |                  |            |
| <b>INF <math>\leq</math> 14</b> | 0.0059             | 0.3016            | 0.0196             | 0.9845       | 0.2342           | 639.17     |
| <b>INF <math>&gt;</math> 14</b> | 0.0353             | 0.1028            | 0.3437             | 0.7335       |                  |            |
| <b>OPEN</b>                     | -19.1126           | 6.971             | -2.7417            | 0.0102       |                  |            |
| <b>C</b>                        | 3.2448             | 2.9696            | 1.0927             | 0.2832       |                  |            |

### Appendix 5: Estimation Results for Two Threshold Levels

| <b>Variable</b>                                              | <b>Coefficient</b> | <b>Std.<br/>Error</b> | <b>t-Statistic</b> | <b>Prob.</b> | <b>R-Squared</b> | <b>RSS</b> |
|--------------------------------------------------------------|--------------------|-----------------------|--------------------|--------------|------------------|------------|
| <b>INF &lt; 11</b>                                           | 0.7527             | 0.3172                | 2.3729             | 0.0253       | 0.4054           | 496.23     |
| <b>INF <math>\geq</math> 11 and INF <math>\leq</math> 12</b> | 0.2357             | 0.2926                | 0.8056             | 0.4278       |                  |            |
| <b>INF &gt; 12</b>                                           | 0.1886             | 0.0989                | 1.9074             | 0.0676       |                  |            |
| <b>INV</b>                                                   | 0.2177             | 0.1888                | 1.1531             | 0.2594       |                  |            |
| <b>OPEN</b>                                                  | -21.2014           | 7.4285                | -2.8541            | 0.0084       |                  |            |
| <b>POP</b>                                                   | 25.5335            | 61.6810               | 0.4140             | 0.6823       | 0.4118           | 490.95     |
| <b>FD</b>                                                    | 4.3799             | 30.5914               | 0.1432             | 0.8873       |                  |            |
| <b>C</b>                                                     | -5.5113            | 4.6234                | -1.1920            | 0.244        |                  |            |
| <b>INF &lt; 11</b>                                           | 0.8249             | 0.3318                | 2.4861             | 0.0197       |                  |            |
| <b>INF <math>\geq</math> 11 and INF <math>\leq</math> 13</b> | 0.3351             | 0.2876                | 1.1652             | 0.2545       |                  |            |
| <b>INF &gt; 13</b>                                           | 0.2099             | 0.1037                | 2.0234             | 0.0534       | 0.4094           | 492.89     |
| <b>INV</b>                                                   | 0.2135             | 0.1856                | 1.1507             | 0.2603       |                  |            |
| <b>OPEN</b>                                                  | -21.0703           | 7.3529                | -2.8656            | 0.0081       |                  |            |
| <b>POP</b>                                                   | 27.4865            | 61.3976               | 0.4477             | 0.6581       |                  |            |
| <b>FD</b>                                                    | 7.9303             | 31.0685               | 0.2553             | 0.8005       |                  |            |
| <b>C</b>                                                     | -6.1879            | 4.7676                | -1.2979            | 0.2057       |                  |            |
| <b>INF &lt; 11</b>                                           | 0.5846             | 0.4094                | 1.4278             | 0.1653       | 0.4048           | 496.76     |
| <b>INF <math>\geq</math> 11 and INF <math>\leq</math> 14</b> | 0.0345             | 0.3275                | 0.1053             | 0.9169       |                  |            |
| <b>INF &gt; 14</b>                                           | 0.1423             | 0.1225                | 1.1617             | 0.2559       |                  |            |
| <b>INV</b>                                                   | 0.2401             | 0.1879                | 1.2778             | 0.2126       |                  |            |
| <b>OPEN</b>                                                  | -22.2963           | 7.6051                | -2.9318            | 0.0069       |                  |            |
| <b>POP</b>                                                   | 27.0690            | 61.5060               | 0.4401             | 0.6635       | 0.4048           | 496.76     |
| <b>FD</b>                                                    | -3.0833            | 33.1224               | -0.0931            | 0.9265       |                  |            |
| <b>C</b>                                                     | -4.3430            | 5.0544                | -0.8592            | 0.3981       |                  |            |
| <b>INF &lt; 11</b>                                           | 0.6868             | 0.4421                | 1.5536             | 0.1324       |                  |            |
| <b>INF <math>\geq</math> 11 and INF <math>\leq</math> 15</b> | 0.1454             | 0.3413                | 0.4262             | 0.6735       |                  |            |
| <b>INF &gt; 15</b>                                           | 0.1707             | 0.1306                | 1.3066             | 0.2028       | 0.4048           | 496.76     |
| <b>INV</b>                                                   | 0.2298             | 0.1920                | 1.1970             | 0.2421       |                  |            |
| <b>OPEN</b>                                                  | -21.5531           | 7.5439                | -2.8570            | 0.0083       |                  |            |
| <b>POP</b>                                                   | 25.8674            | 61.6917               | 0.4193             | 0.6784       |                  |            |
| <b>FD</b>                                                    | 1.6059             | 34.3905               | 0.0467             | 0.9631       |                  |            |
| <b>C</b>                                                     | -5.1067            | 5.1675                | -0.9882            | 0.3321       |                  |            |

**Appendix 6: Estimation Results with Threshold Effects in the Inflation-Investment Relationship**

| <b>Variable</b>                 | <b>Coefficient</b> | <b>Std. Error</b> | <b>t-statistic</b> | <b>Prob.</b> | <b>R-Squared</b> | <b>RSS</b> |
|---------------------------------|--------------------|-------------------|--------------------|--------------|------------------|------------|
| <b>INF <math>\leq</math> 8</b>  | -0.3487            | 0.4133            | -0.8436            | 0.4058       | 0.3827           | 430.66     |
| <b>INF <math>&gt;</math> 8</b>  | -0.0725            | 0.0639            | -1.1355            | 0.2655       |                  |            |
| <b>INV (-1)</b>                 | 0.5144             | 0.1638            | 3.1395             | 0.0039       |                  |            |
| <b>TREND</b>                    | 0.1216             | 0.0731            | 1.6635             | 0.1070       |                  |            |
| <b>C</b>                        | 7.3737             | 3.0278            | 2.4353             | 0.0213       |                  |            |
| <b>INF <math>\leq</math> 9</b>  | -0.2591            | 0.3305            | -0.7837            | 0.4395       | 0.3801           | 432.47     |
| <b>INF <math>&gt;</math> 9</b>  | -0.0779            | 0.0682            | -1.1419            | 0.2628       |                  |            |
| <b>INV (-1)</b>                 | 0.5064             | 0.1630            | 3.1070             | 0.0042       |                  |            |
| <b>TREND</b>                    | 0.1243             | 0.0758            | 1.6390             | 0.1120       |                  |            |
| <b>C</b>                        | 7.6286             | 2.9623            | 2.5752             | 0.0154       |                  |            |
| <b>INF <math>\leq</math> 10</b> | -0.2753            | 0.2727            | -1.0095            | 0.3211       | 0.3860           | 428.36     |
| <b>INF <math>&gt;</math> 10</b> | -0.0869            | 0.0697            | -1.2465            | 0.2226       |                  |            |
| <b>INV (-1)</b>                 | 0.4976             | 0.1538            | 3.2358             | 0.0030       |                  |            |
| <b>TREND</b>                    | 0.1201             | 0.0717            | 1.6756             | 0.1046       |                  |            |
| <b>C</b>                        | 8.1214             | 2.8830            | 2.8170             | 0.0086       |                  |            |
| <b>INF <math>\leq</math> 11</b> | -0.2595            | 0.2455            | -1.0574            | 0.2991       | 0.3870           | 427.66     |
| <b>INF <math>&gt;</math> 11</b> | -0.0912            | 0.0717            | -1.2727            | 0.2132       |                  |            |
| <b>INV (-1)</b>                 | 0.4786             | 0.1496            | 3.1996             | 0.0033       |                  |            |
| <b>TREND</b>                    | 0.1172             | 0.0708            | 1.6555             | 0.1086       |                  |            |
| <b>C</b>                        | 8.6302             | 2.9685            | 2.9073             | 0.0069       |                  |            |
| <b>INF <math>\leq</math> 12</b> | -0.1810            | 0.2597            | -0.6969            | 0.4914       | 0.3770           | 434.62     |
| <b>INF <math>&gt;</math> 12</b> | -0.0846            | 0.0806            | -1.0493            | 0.3027       |                  |            |
| <b>INV (-1)</b>                 | 0.5031             | 0.1679            | 2.9959             | 0.0056       |                  |            |
| <b>TREND</b>                    | 0.0953             | 0.0738            | 1.2905             | 0.2071       |                  |            |
| <b>C</b>                        | 8.4339             | 3.0272            | 2.7861             | 0.0093       |                  |            |
| <b>INF <math>\leq</math> 13</b> | -0.2169            | 0.2673            | -0.8116            | 0.4236       | 0.3798           | 432.63     |
| <b>INF <math>&gt;</math> 13</b> | -0.0941            | 0.0838            | -1.1223            | 0.2710       |                  |            |
| <b>INV (-1)</b>                 | 0.5119             | 0.1672            | 3.0610             | 0.0047       |                  |            |
| <b>TREND</b>                    | 0.0853             | 0.0782            | 1.0910             | 0.2843       |                  |            |
| <b>C</b>                        | 8.7809             | 3.1573            | 2.7811             | 0.0094       |                  |            |
| <b>INF <math>\leq</math> 14</b> | -0.2456            | 0.2550            | -0.9629            | 0.3435       | 0.3840           | 429.73     |
| <b>INF <math>&gt;</math> 14</b> | -0.1055            | 0.0865            | -1.2195            | 0.2325       |                  |            |
| <b>INV (-1)</b>                 | 0.5086             | 0.1593            | 3.1932             | 0.0034       |                  |            |
| <b>TREND</b>                    | 0.0839             | 0.0759            | 1.1056             | 0.2780       |                  |            |
| <b>C</b>                        | 9.3028             | 3.3534            | 2.7741             | 0.0096       |                  |            |