

## *Original Paper*

# Inflation Thresholds, Economic Growth and Investment Planning

## In Uganda

Rogers Matte<sup>1\*</sup>

<sup>1</sup> Macroeconomic Planning Department, National Planning Authority, Republic of Uganda

\* Rogers Matte, Macroeconomic Planning Department, National Planning Authority, Republic of Uganda

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### ***Abstract***

*Economic Planners, monetary policy custodians and civil society in Uganda often disagree on the target for inflation when their development objectives are not harmonised. When development economists argue for increased deficit spending in support of infrastructure development and capital accumulation, they are challenged in regards how much pressure the development budget should put on likely macroeconomic stability, particularly where inflation could rise above the inflation target. This paper examined the effect of inflation on economic growth in Uganda and evaluates the equilibrium rate of inflation in the country, given the macroeconomic environment.*

*Using the threshold model and data for the period 1991-2017 it is established that: a) below 7.3 percent inflation level, the relationship between inflation and economic growth is positive and inflation is not harmful to growth, while at levels above 7.3 percent, inflation was detrimental to economic growth and the relationship become negative; b) at economic growth rates above 7.8 percent, inflation was an incentive for further growth, yet at economic growth rates below 7.8 percent per annum, increases in inflation served as a dis-incentive to economic growth. Therefore Uganda in the current conditions is better off maintaining inflation below 7.3 percent as long as the anticipated economic growth is 7.8 percent.*

### ***Keywords***

*inflation thresholds, economic growth, investment planning*

## 1. Introduction

Over the last decade or so Uganda government has been seeking to develop a private led economy where private investment and export growth drive economic growth through the national development plans and poverty eradication programmes. Attaining a sustained output growth rate capable of delivering the country to middle income status in the medium to long-term was the real sector goal of the country's national development plans (Republic of Uganda, 2015). At the same time it has pursued a monetary policy goal of macroeconomic stability with the inflation targeting framework in the recent years. Price stability is praised for creating a stable environment for decision making by the economic agents in markets. High inflation erodes the value of money and affects economic welfare of low income earners. At the same time, some moderate inflation is favourable for giving signal to market players on supply and demand situation which may affect decision making at agency level. Specific plan scenarios assume stable price levels and this makes the issue of inflation thresholds critical to economic planning, when the structure of the economy is expected to change over time.

The debate regarding the management of inflation, its policies and instruments in Uganda overtime culminated in setting of a medium to long-term target of 5percent core inflation. The major policy framework for inflation in the country since 2011 is inflation targeting. The monetary policy framework uses interest rate to signal and influence macroeconomic activity: prices, inflation, output, or sometimes designated monetary aggregates. There is no direct control over these and Bank of Uganda exerts its influence over the macroeconomic magnitudes by setting the short-term interest rate (Mugume & Namanya, 2014).

Despite adjustments in the central bank interest rate, there is no mention of growth based tools to address inflation. In view of the role of the East African Community integration, the country agreed to the convergence target of 8 percent headline and 5 percent core inflation by 2021. The efforts to remain around the inflation target in some cases has been criticised for contributing to the high interest rates given a high base set by the policy rate. While the relationship between inflation and growth may be dogenous, it is important to understand the relationship in the medium to long-term to clearly visualise the impacts (Vinayagathan, 2013).

### *1.1 Macroeconomic Stability and Economic Growth*

The primary objective of monetary policy in Uganda over the recent years has been to attain low and stable inflation. Close to a decade, the monetary policy stance in Uganda has been guided by policy persistence; the neutral nominal rate which takes into account the real interest rate and the expected inflation; inflation gap; and output gap (National Planning Authority, 2018). Monetary policy stance was contractionary in 2011 and 2015 when inflation was on the rise. The rest of the period saw a relaxation in the policy stance so as to increase money growth. When output is at its potential, and inflation and inflation expectations are at objective levels, the monetary conditions are at neutral levels and do not constrain or stimulate aggregate demand and inflation. In this case real interest rate would be at the neutral rate.

Considering the efforts by the central bank to control inflation using interest rates, the growth effect of inflation on economic growth is more important in the economics of Uganda as a developing country. High lending rates inhibit growth in private investment and the process of value addition, yet these are primary growth objectives. This is because the cost and nature of credit has implications on the ability of the country to service the entire value chain of products prioritised in the national development plan for a country like Uganda. The national development framework expects that the growth of credit would be sufficient to support production of raw materials, value addition and marketing and logistics management along product value chains. This has however not been realised because the nature of credit available in the Ugandan market can to a greater extent serve the interests of the services sector and less the processes of value addition and production of primary inputs, which require lower cost credit because of long gestation periods. The sectors that are served more in current circumstances are more volatile in nature unlike the productive sectors which would provide tangible, stable and sustainable growth (Table 1). This process would be more supportive to the transformation process of the economy with greater bias towards industrialisation, in particular agro-processing and mineral beneficiation.

In comparison with the countries in the sub-Sahara Africa over the past decade, and more so in the last four years, it is observed that interest rates have remained higher in Uganda compared to Kenya, Burundi, Nigeria, South Africa, Democratic republic of Congo and Zambia. Compared to these countries, interest rates in Uganda have remained around 20 percent since the second half of the 1990s unlike other countries where these rates have been moving in response to their economic policies. All in all, interest rates and bank credit policies remain relatively weak channels of monetary policy in Uganda, unlike the exchange rate policies, in stimulating the real sector performance especially the manufacturing sector (Nampewo, Munyambonera, & Mayanja, 2013). Generally, Ugandan interest rates have remained above the rest of the countries in Africa both those with a developed banking sector and those less developed compared to the domestic sectors. The more developed economies in this case include Kenya, South Africa and Nigeria and the less developed ones include Burundi and the Democratic republic of Congo.

Further observed is that the responsiveness of the lending rates in Uganda to changes in the policy interest rates of the central bank, shows greater stickiness on the side of lending rates coming down, yet a rise attracts immediate response. This supports the view that commercial banks in Uganda are more responsive to profit motives than growing the business size, yet they respond positively to policy in a direction that is anti-private investment.

In view of the above observations, the causes of high interest rates in Uganda may be characterised as on the basis of internal characteristics of the banks, and the economy wide macroeconomic environment. While the lending rates are driven by funding costs, operational costs, capital reserve costs, risk cost and bank profits (Bryony, 2012), the macroeconomic environment also presents factors that may affect lending rates. The funding cost takes care of the cost faced by banks to raise the

necessary capital in order to lend; the operational cost presents the fixed costs faced by banks in terms of the overhead running costs; the capital reserve cost is the cost faced by banks in holding the minimum capital reserves as required by regulation; the risk cost captures the loss banks suffer from default. Macroeconomic determinants of high lending rates include: high and variable inflation, growth of output, high money market real interest rates, interest rate uncertainty (inter-bank interest rate volatility), exchange rate volatility (Nampewo, 2013), the share of commercial bank public sector loans, share of development (long-term) to commercial (short-term) assets, and public sector domestic borrowing, among others.

**Table 1. Ten Year Share of Total Private Sector Credit in Uganda by Sector**

<b>Sector</b>	<b>2006/ 07</b>	<b>2007/ 08</b>	<b>2008/ 09</b>	<b>2009/ 10</b>	<b>2010/ 11</b>	<b>2011/ 12</b>	<b>2012/ 13</b>	<b>2013/ 14</b>	<b>2014/ 15</b>	<b>2015/ 16</b>	<b>2016/ 17</b>
Agriculture	6.7	6.0	4.5	6.4	6.7	6.5	7.8	9.6	9.8	10.3	11.5
<i>o/w</i> <i>Production</i>	2.6	2.3	1.4	3.5	3.6	3.4	3.5	3.8	4.4	4.4	4.5
<i>o/w</i> <i>Processing &amp; Marketing</i>	4.0	3.7	3.1	2.9	3.1	3.1	4.3	5.8	5.3	5.9	7.0
Mining and Quarrying	2.4	0.4	0.3	0.8	0.3	0.4	0.3	0.2	0.5	0.6	0.6
<i>Crude Petroleum &amp; Natural Gas</i>	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.4	0.3
<i>Other Mining &amp; Quarrying</i>	0.0	0.0	0.0	0.8	0.3	0.3	0.2	0.1	0.2	0.2	0.4
Manufacturing	14.1	12.4	15.2	13.2	13.7	13.4	14.0	13.2	15.4	14.0	12.8
Trade	15.6	12.2	20.6	20.4	22.5	22.6	21.1	21.6	20.4	19.0	20.1
Transport and Communication	6.1	6.9	5.8	7.7	7.7	6.5	5.8	5.4	5.2	7.0	6.7
Electricity	0.4	0.9	0.6	1.1	0.9	1.0	1.4	1.2	1.7	2.0	1.9

and Water											
Building,											
Mortgage,											
Constructio	11.2	15.1	16.4	18.2	20.1	22.8	22.6	22.7	22.6	22.8	20.6
n and Real											
Estate											
Business											
Services	0.0	0.0	0.0	3.3	4.3	3.6	5.2	4.4	4.7	3.8	4.1
<i>o/w</i>											
<i>Working</i>	0.0	0.0	0.0	1.0	1.4	1.7	2.2	1.9	2.3	2.3	2.3
<i>Capital</i>											
<i>o/w Other</i>	0.0	0.0	0.0	2.3	2.9	1.9	2.9	2.5	2.4	1.5	1.8
Community											
, Social &											
Other	0.0	0.0	0.0	2.9	3.3	3.5	3.1	3.3	3.3	3.4	3.3
Services											
Personal											
Loans and											
Household	17.9	15.4	21.9	21.1	15.8	15.3	13.6	17.2	15.1	15.8	17.7
Loans											
Other											
Services	25.7	30.8	14.6	4.9	4.7	4.3	5.1	1.4	1.4	1.4	0.7
Total	100	100	100	100	100	100	100	100	100	100	100

*Source:* Bank of Uganda.

### *1.2 Trends and Policy Frameworks for Inflation*

Since 1994, inflation in Uganda was highest in 2011 (quarter 4) at 23.6 percent when the CBR was increased to 22 percent. Through this policy there has been a drastic reduction of long term inflation to the long term target although there are episodes of high and low inflation in the short run, which are a result of shocks whose impact is largely dependent on the structure of the economy.

The objective of monetary policy in Uganda has over the last decade been that of maintaining macroeconomic stability without compromising economic growth. The policy framework in place has since 2011 fostered a movement of the interbank money market interest rates in tandem with the central bank rate which in turn were expected to influence other retail interest rates in the economy, both in the short and the long-term. The target for inflation over the medium to long-term has been 5 percent per annum, and the central bank rate has been adjusted accordingly to influence demand for credit and influence the level of economic activity by managing the demand side of the economy. Over the

medium term, inflation oscillated around the target of 5.0 percent pursued by the central bank, especially after the adoption of the inflation targeting framework. When a longer projection is made over a period of about twenty years backwards, the expected inflation raises higher taking into account the levels attained. It is accordingly noted that the country's long run optimal level of inflation lies between 5 and 8 percent. A target of 6.5 percent has also been estimated from threshold models taking into account economic growth in the past and potential output going forward.

### *1.3 Sources and Effects of Inflation in Uganda*

Performance of the global and regional economy affects inflation. Uganda has a trade deficit and heavily imports manufactured commodities from both regional and global markets. Crises in other countries are translated into import prices for the domestic economy. International oil price fluctuations have had a key role in influencing domestic prices. Volatility in the foreign exchange market is another source, especially depreciation fuels inflation. Uganda currency has depreciated significantly in the recent past leading to secondary effects on the domestically produced commodities given a large component of imported raw materials.

Large budget deficits induce increases in interest rates and high cost of private capital, with effects on inflation. There has been an increase in the domestically financed borrowing which leads to the rise in the cost of credit in the banking system, impacting on the cost of access to capital and of production. Delays in execution of public projects for which resources have been borrowed domestically exacerbate this issue and may have led to sub-optimal decisions.

Uganda has underdeveloped commodity value chains and markets which provide an incentive for supply rigidities. The dependence of the food sector on natural factors and the lack of linkages with industry and under developed market institutions affect the variability in food prices in periods of boom and shortage. Further the under developed utilities sector affects production to capacity for some industries therefore affecting the cost of production.

Food and Non-Alcoholic Beverages; Housing, Water, Electricity, Gas and Other Fuels; Transport and education were the major sources of inflation in the country from 2011 to 2017, contributing over 63percent of the price changes. The prices for food and non-alcoholic beverages are associated with the structural nature of agriculture production in the country, with a large percentage resulting from the shortages in supply. Addressing the key real sector factors inhibiting stable supply of food, constraints in the supply of fuel products in the transport sector and educational supplies could potentially reduce inflation from these sources.

The description of inflation dynamics in Uganda during the period 2000-2012 indicated that in the long-run money supply, exchange rate, foreign inflation, terms of trade and real output, foreign prices, exchange rate, growth of domestic credit, rainfall deviation from the long-run mean, the trade and current account balances, fiscal balance, trade openness, and the international interest rate differential determine inflation in Uganda (Opolot & Kyeyune, 2012; Janine, Muellbauer, & Sebudde, 2015). In the short run, inflation is driven by changes in real output, monetary aggregates, the exchange rate, and

foreign prices. The Central Bank of Uganda indicates that core inflation is affected by: international factors (interest rates, inflation, oil prices); exchange rates; output gap and capacity utilization; domestic demand; money supply and credit extension and expectations (Bank of Uganda, 2011). The disequilibria in the money and traded goods markets are significant but the adjustment process is slow. In spite of the fact that inflation has exogenous determinants, such as foreign inflation, there is scope for the central bank to limit the impact of such shocks on inflation by pursuing a tight monetary policy stance. The significance of the interest rate differential in the money-demand equation implies some degree of effectiveness of the monetary policy.

#### *1.4 Effects and the Threshold of Inflation*

Albeit many arguments regarding inflation, there is a view that inflation is useful to economic growth if below some threshold level, and is detrimental when above that threshold level. In particular, inflation influences growth by decreasing productivity growth and investment. Uganda's implied inflation threshold is 5 percent as set in the targeting framework by the central bank—Bank of Uganda, which is the point of variance. This threshold is unique for each economy, as indicated by the variations seen in cross-country studies, between 2 percent and 12 percent in a number of countries, and generally, developed countries have lower thresholds while those for developing countries are higher. A recent study estimated 8.5 percent as the threshold for Uganda based on data for the period 1970-2013 (Yabu & Kessy, 2015), yet the inflation target by BoU is 5 percent. What is not clear is whether this threshold is dynamic. The EAC countries under the programming for the anticipated Monetary Union target to have headline inflation at 8 percent. Whether this target would be changed and how often is not clear either.

In view of the above, development planners and monetary policy custodians disagree on the target for inflation when their development objectives are not harmonised. Whereas development economists may argue for increased deficit spending in support of capital accumulation, they face a challenge in regards how much pressure the development budget should put on likely macroeconomic stability especially where inflation would rise above the inflation target.

#### *1.5 Theoretical Review*

A number of theories explain the link between inflation and economic growth. There is confluence among them that in the short run, inflation induces growth, to the extent that it is positively correlated with growth but in the long run its persistence is detrimental to growth. Table 2 reviews some of the theoretical impacts of inflation.

**Table 2. Theoretical Economic Growth Impacts of Inflation**

<b>Theory</b>	<b>Nature</b>	<b>Inflation and growth</b>	<b>Criticism</b>	<b>Emphasis</b>
Classical	Supply side based	A rise in inflation leads to a fall in the rate of return on	High inflation inhibits financial	Provide incentives for

Theory	Nature	Inflation and growth	Criticism	Emphasis
		individual's real money balances reducing wealth. People will then save more by switching to financial assets in order to accumulate the desired wealth. Higher demand for assets increases their prices, resulting in a decline in the real interest rate. Increased savings result in greater capital accumulation and hence faster output growth	development by making financial intermediation more costly, hits the poor disproportionately because they do not hold financial assets that provide a hedge against it. This hinders long-term economic growth	increased savings and investment so that the economy grows
Keynesian	AD-AS	<ul style="list-style-type: none"> <li>• “ “</li> <li>• Inflation can redistribute profits from workers with low savings propensities to entrepreneurs with high propensities to save and invest, and increases the nominal rates of return relative to the cost; hence increasing growth</li> <li>• During inflationary periods, money is redistributed from holders of money balances to governments (through monetary authorities – inflation tax) to expand public investment programmes, thus increasing growth</li> </ul>	High inflation rates raise the cost and risk of productive capital and may lead to misallocation of funds to less productive investments that act as a hedge against inflation	...
Neoclassical and endogenous growth	inflation affects capital accumulation and investment;	“ “	High inflation leads to speculative trade and capital	...



Theory	Nature	Inflation and growth	Criticism	Emphasis
			outflows affecting growth	
Monetarist	the role played by monetary growth in determining inflation – from the quantity theory of money	There is neutrality of money, with inflation rate having no effect on the growth rate as well as the level of output. In the long run, the growth rate in money mainly affects prices. This is because individuals will anticipate the rate of future inflation and incorporate its effects into their behaviour. Employment and output are not affected		Provide dis-incentive for monetary growth to contain inflation. When profits decline and labour productivity remain unchanged, the prices tend to increase

In view of the above theoretical frameworks, a number of models have been used to analyse the links between inflation and economic growth. These include the Philips curve, the mark-up approach, the quantity theory of money, and the dynamic panel. These are briefly reviewed below.

**Phillips Curve:** If demand increases and the output gap becomes larger, business costs will increase, wages will increase. Companies pass on the higher costs to their customers, thus increasing prices. On the other hand, if demand falls and the output gap becomes smaller, business costs will decline thus wages will be lower. Companies then pass on the lower costs to their customers by reducing prices, hence less inflation. The Philips curve therefore underscores the link between the output gap and the inflation rate, with current inflation explained by current inflation expectations and the output gap.

$$\frac{dP_t}{P_{t-1}} = \alpha + \phi \frac{dP_t^e}{P_{t-1}} + \beta EP_t + \varepsilon_t \quad (1)$$

In the equation above, the LHS is the inflation rate ( $\frac{dP_t}{P_{t-1}}$ ), the current expectation of the future

inflation is the second term on the RHS ( $\frac{dP_t^e}{P_{t-1}}$ ), while the output gap is the third term ( $EP_t$ ). The

signs of the coefficients are all positive in the equation above.

**The Mark-up approach:** Considering Unit Labour Cost (ULC), Price of imported goods (PM), then enterprises will set domestic prices by adding a gross mark-up ( $\alpha$ ) to the cost per unit of output. Here

the CPI combines the price of domestic and imported goods.

$$\log(P_{t+1}) = \alpha + \beta * \log(C * U * M_{t+1}) + \beta * \log(PM_{t+1}) + \xi_{t+1} \quad (2)$$

**The quantity theory of money:** Considering Money supplies (M), Velocity of money (V), Real GDP (Y), then money growth is a key determinant of inflation. By assuming that Money demand remains stable, then we estimate current prices as:

$$1 + \pi_t = \left(1 + \frac{dP_t}{P_{t-1}}\right) = \frac{\left(1 + \frac{dMd_t}{Md_{t-1}}\right) * \left(1 + \frac{dV_t}{V_{t-1}}\right)}{\left(1 + \frac{dY_t}{Y_{t-1}}\right)} \quad (3)$$

**The threshold model:** In this model, the growth rate of real GDP is dependent on inflation, the inflation threshold variable that is exogenous and a time variant, and other explanatory factors. These explanatory factors include the past values of GDP, investment, population growth, openness, terms of trade, and the standard deviations of openness and terms of trade. The model is divided into two using a dummy variable for values of inflation below and above the threshold.

This is a form of nonlinear regression presenting piecewise linear specifications and regime switching that occurs when an observed variable crosses unknown thresholds (IHS Global Inc, 2016). In this model, there are  $T$  observations and  $m$  potential thresholds ( $j=1, 2, \dots, m$ ), implying there are  $(m+1)$  regimes. For all observations in the regimes, there are two sets of regressors: those that vary ( $X$ ) and those that do not vary ( $Z$ ) with the regime. For the threshold variable ( $q_t$ ) threshold values ( $m$ ) exist, such that we can identify them across the arrange  $\gamma_j \leq q < \gamma_{j+1}$ , and  $(\gamma_1 < \gamma_2 < \dots < \gamma_m)$ . For a single threshold and two regimes, we have  $y_t = X_t' \beta + Z_t' \delta_1 + e_t$ , if  $-\infty < q_t < \gamma_1$ ; and  $y_t = X_t' \beta + Z_t' \delta_2 + e_t$ , if  $-\gamma_1 \leq q_t < \infty$ .

For multiple regime specifications, a single equation can be used to combine them. For  $1(\cdot)$  an indicator function for which the expression is true and  $1_j(qt, \gamma)$  carries the value 1 and zero otherwise.

$$y_t = X_t' \beta + \sum_{j=0}^m 1_j(qt, \gamma) * Z_t' \delta_j + \varepsilon_t; \quad (4)$$

This is a nonlinear least squares estimation approach, in which there is need to find the coefficients  $\beta$  and  $\delta$ ; the threshold values  $\gamma$ ; and identify the threshold variable  $qt$  using model selection. The objective threshold function,  $S(\delta, \beta, \gamma)$ , is then minimized with respect to the parameters.

$$S(\delta, \beta, \gamma) = \sum_{t=1}^T \left( y_t - X_t' \beta - \sum_{j=0}^m 1_j(qt, \gamma) * Z_t' \delta_j \right)^2 \quad (5)$$

Eviews provides a userfriendly interface for threshold modelling taking into account the above framework (IHS Global Inc, 2016). This approach is used in comparison with the specification of the function in a loglinear form for the threshold variables and manually estimating the threshold by solving the derivative of the function with respect to the threshold variable.

### 1.6 Major Cross Country and Historical Experience

The study by Adegoke (2012) highlights the key studies that have been conducted on this subject, in which for instance the existence of threshold effects in the inflation-growth relationship of Nigeria, from 1970 to 2003 was established at the level of six per cent. It is albeit noted that the threshold changed as the structure of the economy evolved to eight percent (Adegoke, 2012). Table 3 reviews some of the causes of inflation in selected case studies.

**Table 3. Selected Determinants of Inflation Cross Countries**

Research	Country	Causes of Inflation	Dominant factor
Atta et al. (1999)	Botswana	nominal money supply, nominal interest rate, nominal exchange rate, nominal wages	monetary variables (money supply and interest rates)
Dlamini et al. (2001), Akinboade et al (2004)	Swaziland and South Africa	and South African consumer price index, US exchange rate pass-through	real sector effects (GDP)
Ocran et al (2005)	Ghana		inflation persistence
Khan et al. (2007), Leheyda (2005)	Pakistan and Ukraine	money supply, wages and exchange rates, fiscal policy	price inertia

Source: Haile (n.d.).

In the 1960s there was a view that inflation was positively correlated with economic growth in the short run, and to some degree, in the long run. Consensus in the 1970s and 1980s was that of a positive short run relationship between growth and inflation, such that while stabilisation of hyperinflation had little output costs, sterilisation of mere high inflation was on the otherhand costly. Most recent research since the 1990's was concerned with the longrun relationship and advanced an inverse relationship between inflation and growth.

While investigating the existence of a threshold level for inflation and how any such level affected the growth, a dynamic panel threshold growth regression was used for 32 Asian countries over the period 1980-2009, a threshold of approximately 5.4 percent was estimated. While inflation was found to hurt growth when it exceeded 5.4 percent it had no effect below this level (Vinayagathan, 2013).

### 1.7 Investment Planning, Fiscal Deficits and Inflation

From Uganda's experience, during planning processes planners are concerned about the role of fiscal deficits and external borrowing and the effect of foreign exchange inflows on inflation. The value of investments needs to keep in tandem with the levels of inflation. In the NDPII planning process, it was argued that addressing the effects of inflationary expenditure, given high deficit financing would have a slowdown effect on private sector credit when interest rates are raised. As a consequence, this would

slow down economic growth below desired levels (National Planning Authority, 2015). Further, the planners argued that allowing inflation to increase would have an effect on the depreciation of the shilling, yet the central bank has a limit on issuing liquidity to address the effects of public administration expenditures.

### 1.8 Research Questions

The main research question that this paper seeks to answer is: what is the optimal level of inflation for Uganda above which the development budget may not result into lower economic growth. Secondly, with the current structure of the economy, what is the appropriate level of growth resulting from increased investment that may not lead to higher inflation?

### 1.9 Research Objectives

This paper therefore examines the effect (positive or negative) of inflation on economic growth in Uganda; and evaluates the equilibrium rate of inflation in the country, given the macroeconomic environment.

## 2. Method

This paper adopts the threshold model as illustrated by Yubu and Kessyto estimate the threshold for EAC (Yabu & Kessy, 2015) in a quadratic specification and compares the results with those generated by the threshold regression model as specified in IHS Global Inc (2016). Unlike the method used by Adegoke (2012), the threshold model is more elaborate and does not involve arbitrary selection of the threshold levels. However, we differ from Yubu and Kessy by estimating the ADL rather than the use of error correction and cointegration.

### 2.1 Model Specification

In this model, the threshold level of inflation is obtained is obtained in a combination of linear and squared term for inflation such that the impact of inflation on economic growth with positive effects of inflation switching to negative when inflation exceeds some threshold level. At the threshold level of inflation, the function is at maximum after which the marginal effect of inflation becomes negative.

$$\begin{aligned} DLOG(RGDP)* = & \alpha_1 * INF\_RATE + \alpha_2 * INF\_RATE(-1) + \alpha_3 * (INF\_RATE)^2 + \alpha_4 * DLOG(POPTOT) + \\ & \alpha_5 * DLOG(POPTOT(-1)) + \alpha_6 * DLOG(POPTOT(-3)) + \alpha_7 * PSC\_GR + \alpha_8 * PSC\_GR(-1) + \\ & \alpha_9 * DLOG(INVTit) + \alpha_{10} * DLOG(INVT(-1)) + \alpha_{11} * DLOG(GER) + \alpha_{12} * RER\_GR(-1) + \\ & \alpha_{13} * DLOG(TOT\_2005) + \alpha_{14} * DUMMY1 + Mu \end{aligned} \quad (6)$$

Where  $DLOG(RGDP)*$  is growth rate of real  $GDP$ ,  $INF\_RATE$  is growth rate of  $CPI$  and  $DLOG(POPTOT)$  is population growth rate,  $PSC\_GR$  is private sector credit growth,  $DLOG(INVT)$  is investment growth,  $DLOG(GER)$  is growth in gross external reserves,  $DLOG(TOT\_2005)$  is percentage change in terms of trade at 2005 prices for openness, and  $DUM$  is a dummy variable, which takes zero during inflation targeting and one elsewhere; and  $Mu$  is the error term. The peak of the function identifies the critical point of inflation above which the marginal impact of inflation on growth is negative and is calculated as the inflation threshold level. This is established by finding the partial

derivative of the function of Growth with respect to inflation and setting it to zero. As observed in the Table 5 some of the variables are excluded from the OLS method to estimate manually equation 9, while others are introduced in the threshold method.

$$d\log(\text{RGDP})/d\log(\text{INF\_RATE})=\alpha_1+2\alpha_3*\text{INF\_RATE}=0 \quad (7)$$

This implies that the critical level of inflation is the ratio:  $-\alpha_1/2\alpha_3$ .

## 2.2 Data

The time series data used for this analysis is for the period 1990 to 2017, and the variable definitions and their data sources are described in the Table 4.

**Table 4. Description of Data and Its Sources**

Variable	Data Collected	Sector and Source
Growth rate of real <i>GDP</i>	Real Gross Domestic Product (GDP)	National Accounts data, Uganda Bureau of Statistics (UBOS)
Population growth rate	Population Size	Population Statistics, UBOS
Investment	Gross Fixed Capital Formation	National Accounts Data, UBOS
Terms of Trade (TOT)	Terms of trade	National Accounts data, UBOS
Growth rate of <i>CPI</i>	Consumer Price Index (CPI)	Real Sector Statistics, Bank of Uganda (BoU)
Credit to <i>GDP</i> ratio	Credit to the Private sector	Monetary and Financial Sector Statistics, Bank of Uganda, BoU
Gross External Reserves	Gross External Reserves	External Sector Statistics, Balance of Payments according to 6th Edition of the Manual, BoU
Real Exchange Rates	Real Exchange Rate Index	External Sector Statistics, Balance of Payments according to 6th Edition of the Manual, BoU

## 2.3 Model and Data Diagnostics

Using EViews in built tests for normality, serial correlation, and heteroskedasticity undertaken. In particular, we estimate the Jarque-Bera and probability values for normality; the Breusch-Godfrey statistics for serial correlation, and the Breusch-Pagan-Godfrey statistics for heteroskedasticity. The procedure in EViews Jarque-Bera and probability values is that after estimating the equation, we view/seek residual tests, and then select white heteroskedasticity. Obtained are the test statistic and the probability so that the statistic exceeds (in absolute value) the observed value under the null hypothesis. We reject the null hypothesis that the residuals are normally distributed if the value of the probability is

small, otherwise accept.

The heteroskedasticity demonstrates that there is no autoregressive conditional heteroskedasticity in the residuals. The procedure finds out whether the series are not related to the recent residuals, to safeguard the efficiency of the model. The hypothesis that there is no autoregressive conditional heteroskedasticity in the residuals is tested, and the test statistic is estimated from the regression of the squared residuals on a constant and squares of its lagged values up to an appropriate order.

### 3. Results

This section presents results of the Inflation—Growth trade-offs and its implications for investment planning. The threshold levels of inflation have been obtained in a linearized function and the impact of inflation on economic growth established to show positive effects of inflation switching to negative when inflation exceeds the observed threshold level. Table 5 presents the results of the regression, and the models fulfil the conditions for Normality, Serial Correlation, and Heteroskedasticity Test.

The behaviour of changing marginal effect of inflation is observed and becomes negative after the threshold. Model 1 Used the least squares estimation, equation 5 is estimated from equation 4 to generate data for the threshold.

The threshold variable in the OLS method was the rate of inflation (INF\_RATE) while in the threshold method, both inflation rate and the percentage economic growth rate (DLOG (RGDP)\*100) were used. Both methods present the plausible assigns and statistical significance of the coefficients as indicated in Table 5. While in the OLS method the estimation of the threshold variable is straight forward, in the threshold regression a choice is made based on the significance of the model coefficients. In the threshold model, the choice of threshold variable was the economic growth rate, and the value used was 7.9 percent. In the OLS method, the value estimates using equation 5 is 7.3 percent.

The results from the OLS Method imply that, below 7.3 percent inflation level, the relationship between inflation and economic growth is positive and inflation is not harmful to growth. At levels above 7.3 percent, inflation is detrimental to economic growth and the relationship becomes negative. On the other hand, the threshold method identified two regimes, one in which the economic growth rate is above 7.85 percent, and another where economic growth rate is equal to or less than 7.85 percent.

**Table 5. Results of the Inflation, Growth Thresholds**

Variable	Coefficients	
	Least Squares Method	Threshold Regression Method
<b>Threshold Choice</b>	INF_RATE=-7.3=0.005384/(2*-0.00367)	DLOG(RGDP)*100<7.853817 (17 obs) <=DLOG(RGDP)*100(8 obs)
INF_RATE	<b>0.005384**</b> [0.002037](2.643113)	-0.165432***[0.033270]0.380128***[0.059707](6.3

			(-4.972368)	66513)
INF_RATE(-1)	0.000359[0.000582](0.617014)			
INF_RATE^2	-0.000367***[0.000106](-3.459479)			
DLOG(POPTOT)	8.530238***[2.314828](3.685041)		-193.8198[148.2772] (-1.307145)	
DLOG(POPTOT(-1))			349.1653*[150.1007] (2.326207)	
DLOG(POPTOT(-3))	-8.012950***[2.322137](-3.450679)			
PSC_GR	0.000438*[0.000236] (1.858553)			
PSC_GR(-1)			0.048367***[0.007903] (6.120030)	
DLOG(INVT)	0.234771***[0.050379](4.660058)		17.76013***[3.974106](4.468962)	
DLOG(INVT(-1))			-9.018084**[3.162211](-2.851828)	
DLOG(GER)	-0.051089*[0.024192](-2.111787)		-1.059403*[0.601698](-1.760688)	
RER_GR(-1)			-0.059789*[0.034311](-1.742554)	
DLOG(TOT_2005)			-1.625303[1.588881](-1.022922)	
DUMMY1	0.025210**[0.008824](2.857144)		0.419792[0.454022](0.924608)	
R2	0.82		0.95	
Adj R2	0.72		0.92	
D-W stat	2.55		2.34	
Other Notes	Threshold variable considered (manual): INF_RATE; Sample (adjusted): 1995 2017; Included observations: 23 after adjustments; white heteroskedasticity-consistent standard errors & covariance		Sample (adjusted): 1993 2017; Threshold type: Bai-Perron tests of L+1 vs. L sequentially determined thresholds; Threshold variables considered: INF_RATE, LOG(RGDP)*100; Threshold variable chosen: DLOG(RGDP)*100; Threshold selection: Trimming 0.15, Max. thresholds 5, Sig. level 0.05; Threshold value used: 7.853817; White heteroskedasticity-consistent standard errors & covariances	

### Model Diagnostics

Normality	JarqueBer 1.7034 Prob	0.426686	JarqueBera	Prob:	
	a 14		1.013846	0.6023	
Breusch-Godfrey Serial F-stat	1.344 Prob.	0.2972	F-statistic	Prob. F(2,12)	
Correlation LM Test	756 F(9,13)		0.352411	0.7100	
	Obs*R <sup>2</sup> 4.211 Prob.	0.1218	Obs* R <sup>2</sup>	Prob. $\chi^2(2)$	0.4998
	084 $\chi^2(2)$		1.386919		
Breusch-Pagan-Godfrey F-stat	0.760 Prob.	0.6533	F-statistic	Prob. F(11,13)	

Heteroskedasticity Test	613	F(9,13)	1.411915	0.2740
Obs*R <sup>2</sup>	7.933	Prob.	0.5408	Obs*R <sup>2</sup>
	624	□ <sup>2</sup> (9)	13.60891	Prob. □ <sup>2</sup> (11)
				0.2554

Note. SE [ ]; t-Statistic ( ); Level of significance: “\*”=10 percent; “\*\*”=5 percent; “\*\*\*”=1 percent.

#### 4. Discussion

At very high economic growth rates above 7.8 percent, inflation is an incentive for further growth. However, when growth is below 7.8 percent per annum, increases in inflation serves as a dis-incentive to economic growth. Therefore Uganda in the current conditions is better off maintaining inflation below 7.3 percent as long as the anticipated economic growth is at least 7.8 percent. In comparison with the existing research, this is consistent with the EAC macroeconomic convergence criterion which recommends inflation below 8 percent. As observed earlier in the literature, the study on the founding members of the EAC estimated a threshold of 8.4 percent but was silent on the economic growth threshold in this relationship (Yabu & Kessy, 2015). Further, these findings are consistent with other research conclusion that the threshold at which inflation reduces growth is in the single-digits (Heintz & Ndikumana, 2010; Ghosh & Phillips, 1998; Burdekin, Denzau, Kei, Sitthiyot, & Willett, 2004).

In this framework, the non-threshold factors that significantly affect the threshold relationship include: population growth rate, the total investment, and the accumulation of gross external reserves from the external sector. A dummy variable introduced to identify two economic regimes of inflation targeting and that before inflation targeting is significant in the OLS model unlike the threshold method. In the OLS it signifies the change in policy on inflation management. It would be important to assess the significance for rebasing regime for the economy after 2009.

Population growth while having significant effect on economic growth rate, its marginal impact has mixed results. Population growth in itself may not be important unless it contributes the needed quality labour force that participates effectively in the value chains of economic products. Growing purchasing power per capita coupled with human development is important for sustained economic growth. Lagged population growth could signify the accumulation of human capital in the growth—inflation trade-off as a result of innovations.

Private sector credit induced economic growth in both methodologies. Monetary policy has used changes in credit to influence inflation and create stability in the growth inducing environment. Growth in total current investment is primarily a critical factor for economic growth due to its contribution to capital stock. The accumulation of gross external reserves though significant was a dis-incentive to economic growth, though openness was positive but highly significant. Similarly, current changes in terms of trade were a dis-incentive to economic growth though not significant.

In conclusion, this study has considered the inflation-development nexus in Uganda using data for the period 1991 to 2017. The study methods used estimate threshold variable in a threshold regression. Using the threshold variables of the rates of inflation and economic growth it is found that, below 7.3



percent inflation level, the relationship between inflation and economic growth is positive and inflation is not harmful to growth. Above 7.3 percent, inflation is detrimental to economic growth and the relationship becomes negative. On the other hand, at very high economic growth rates above 7.8 percent, inflation is an incentive for further growth, but at economic growth rates below 7.8 percent per annum, increases in inflation serve as a dis-incentive to economic growth. Therefore Uganda in the current conditions is better off maintaining inflation below 7.3 percent as long as the anticipated economic growth remains below 7.8 percent.

The population growth rate, the total investment, the accumulation of gross external reserves and the economic policy regimes are important for Uganda's growth—inflation nexus. Supply side factors are important in this framework. Therefore, anti-inflationary strategies in the country should take into account the elimination of supply constraints, increasing competition, and increasing capacity and efficiency of investment outputs.

## References

- Bryony, W. (2012). A Decomposition of Ugandan Lending Rates. *Bank of Uganda Working Paper Series No. WP/BoU/2012/07*.
- Burdekin, R. C., Denzau, A. T., Kei, M. W., Sitthiyot, T., & Willett, T. D. (2004). When does inflation hurt economic growth? Different nonlinearities for different economies. *Journal of Macroeconomics*, 3, 519-532. <https://doi.org/10.1016/j.jmacro.2003.03.005>
- Ghosh, A., & Phillips, S. (1998). Warning: Inflation may be harmful to your growth. *International Monetary Fund Staff Papers*, 4, 672-686. <https://doi.org/10.2307/3867589>
- Haile, K. (n.d.). The Determinants of Inflation in Botswana and Bank of Botswana's Medium-Term Objective Range. *Botswana Journal of Economics*, 67-74.
- Heintz, J., & Ndikumana, L. (2010). Is there a case for formal inflation targeting in sub-Saharan Africa? In *African Development Bank Working Paper Series, Working Paper No. 108* (pp. 1-45).
- IHS Global Inc. (2016). *EViews 9 User's Guide II*. Irvine CA: IHS Global Inc.
- Janine, A., Muellbauer, J., & Sebudde, R. (2015). Inflation forecasting models for Uganda: Is mobile money relevant? *CSAE Working Paper WPS/2015-17*, 1-66.
- Mugume, A., & Namanya, C. R. (2014). The Augmented Taylor Rule and setting of Monetary Policy Rates in a Developing and Small Open Economies: Bank of Uganda's Experience. In *Bank of Uganda Working Paper Series, Working Paper No. 08/2014* (pp. 1-37).
- Nampewo, D. (2013). What Drives Interest Rate Spreads in Uganda's Banking Sector? *International Journal of Economics and Finance*, 5(1), 76-85.
- Nampewo, D., Munyambonera, E., & Mayanja, L. (2013). Sectoral effects of monetary policy in Uganda. *Journal of Statistical and Econometric Methods*, 2(4), 17-40.
- National Planning Authority. (2015). *Report on the Tripartite Discussions on the Scenarios of the Macroeconomic Framework for NDPII, 12-19 January 2014*. Kampala: National Planning

- Authority.
- National Planning Authority. (2018). *10 Year Perspective Macroeconomic Situation Analysis (draft Report)*. Kampala: NPA.
- Opolot, J., & Kyeyune, A. M. (2012). Inflation Dynamics in Uganda: The role of disequilibria in the money and traded goods markets. *Bank of Uganda Working Paper No. 02/2012*.
- Republic of Uganda. (2015). *The Second National Development Plan 2015/16-2019/20*. Kampala: National Planning Authority.
- Vinayagathan, T. (2013). *Inflation and Economic Growth: A Dynamic Panel Threshold Analysis for Asian Economies*. Tokyo: National Graduate Institute for Policy Studies.
- Yabu, N., & Kessy, N. J. (2015). Appropriate Threshold Level of Inflation for Economic Growth: Evidence from the Three Founding EAC Countries. *Applied Economics and Finance*, 127-144. <https://doi.org/10.11114/aef.v2i3.966>
- Bank of Uganda. (2011, July 25). *Understanding the Inflation Targeting—Lite Policy Framework*. Bank of Uganda. Retrieved October 20, 2018, from <https://www.bou.or.ug>
- Adegoke, I. A. (2012, June). Inflation and Economic Growth: An Estimate of the Threshold level of Inflation in Nigeria. *AJEP*, 19(1), 81-106.