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Optimal Inflation Threshold for Economic Growth in Malawi

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Abstract: There is near consensus in the literature that high levels of inflation (above 40%) affect economic growth negatively. The effects of low and moderate inflation, however, are ambiguous. Nonetheless, several studies have found that low levels of inflation are positively correlated with economic growth, which suggests the existence of a curvilinear relationship between inflation and economic growth. This study sets out to find the threshold level of inflation that is consistent with optimal and sustainable economic growth in Malawi. Using annual time series data for the period 1980 to 2013 and the Conditional Least Squares method, the study finds an optimal inflation threshold level of 17 percent for the country. The study results show that gains in real GDP growth below the optimal threshold level are greater than gains above the threshold level, which is consistent with the theoretical expectations of the threshold estimation model and other empirical studies. Unlike similar optimal inflation threshold studies, this study carries out structural change tests (using the Vogelsang approach) prior to estimating the threshold model. The data are also tested for unit roots using the Zivot and Andrews test for unit roots with a single structural break, and the Lumsdaine and Papell test for unit roots with multiple structural breaks.

Keywords: *Optimal inflation, economic growth, threshold, structural break, monetary policy*

1. Introduction

Several studies have argued that high inflation rates lead to uncertainty among consumers and producers (see for example, Li, 2006; Ghosh & Phillips, 1998). As these economic agents attempt to protect themselves from the rising price instability, economic activity starts to decrease and growth slows down. Conversely if inflation rates are kept low, economic agents are nearly certain of their long-term expenditure plans. With low inflation rates, nominal and to some extent real interest rates are kept low and both households and firms have access to cheaper credit, which increases investment, consumption and output. Thus, low inflation may be positively correlated with economic growth (see Brook et al., 2002; Almeida et al., 2004; Morar, 2011) while high inflation rates are inversely related to economic growth(see Li, 2006;Ghosh &Phillips, 1998), indicating the existence of an optimal inflation threshold beyond which inflation starts to have a negative effect on economic growth (Busetti et al., 2006; Campillo &Miron; 1997, Ghosh et al., 1996).

While the Reserve Bank of Malawi (RBM) Act of 1989 clearly states that one of the principal objectives of the central bank is to promote economic growth and price stability (low inflation) (Malawi Government, 1989), monetary policy formulation and implementation in Malawi has generally taken the path of learning by doing (Sato, 2001), leading to volatile rates of inflation and economic growth. Malawi's inflation rate rose from an average of 8.9 percent between 1966 and 1976, to about 22 percent between 1986 and 1990. In 1994, the rate of inflation rose to 34 percent before peaking at 83percentin 1995. It dropped to 9.14 percent in 1997 and rose again to 44.8 percent in 1999. It fell to 7.6 percent in 2011, increased to 10.3 percent in January 2012 and went up further to 30.13 percent in the fourth quarter of 2012 and 35.8 percent in June 2013. Real GDP growth, on the other hand, dropped from 6.18 percent between 1966 and 1976 to 2.32 percent between 1986 and 1990. In 1994, it dropped to a low of -10.71 percent before rising to 16.7 percent in the following year (1995). It slowed down again to 3.79 percent in 1997 and 3.04 percent in 1999 before plunging to -9.53 percent in 2010. It rose 4.35 percent in 2011 and dropped again to 1.86 percent in 2012. Clearly, no pattern can be inferred from these figures.

The consensus on the relationship between inflation and economic growth is that high rates of inflation (above 40%) are harmful to growth (see Li, 2006;Ghosh &Phillips, 1998). If inflation is inimical to growth, it readily follows that policymakers should aim at low inflation (Khan & Sedhadji, 2001). However, if a substantial amount of inflation is required for economic growth to take place in an economy, as argued by Tobin (1969) and De Gregorio (1993), then very low inflation may be harmful to growth. What is the optimal inflation threshold? This paper contributes to the literature by estimating the optimal inflation threshold for Malawi, which policymakers in the country can use as a guide to set inflation at a rate that maximises sustainable economic growth. To the best of the authors' knowledge, there is no study that has attempted to find this optimal threshold level of inflation for Malawi. An optimal inflation threshold is the inflation rate at which economic growth is maximised, and it varies across countries (Morar, 2011). Central banks that simply target low inflation with the notion that this improves economic performance, therefore, fail to maximise economic growth because they do not target their economy's specific threshold inflation rate (Morar, 2011). This makes it imperative for monetary authorities, including those in Malawi, to determine the optimal inflation threshold for their economy before setting inflation targets.

Evidence of threshold levels of inflation is mixed and most of it is from cross-country rather than single-country analyses. This is a problem because most cross-country studies are done solely to show the presence of a threshold rather than for guidance on what level of inflation is optimal in a particular country. In addition, the methods used for cross-country studies are too general to make inferences about a single country included in the study (Morar, 2011). Using evidence from cross-country studies can, therefore, be misleading to policy makers trying to target inflation. Following this introduction, the rest of the paper is organised as in five sections. Section 2 is a brief overview of inflation and growth in Malawi. Section 3 is a review of the literature. The threshold estimation model, data sources and estimation technique are discussed in Section 4. Study results and inferences follow in Section 5. Section 6 concludes the paper.

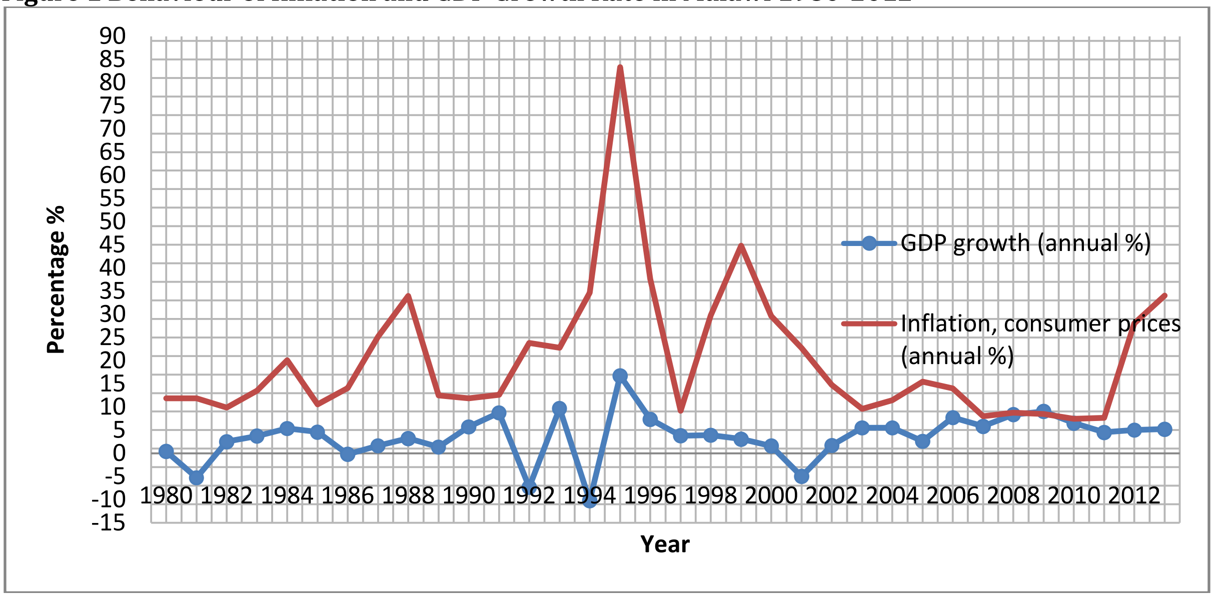
Inflation and Growth in Malawi: Inflation through the 1980s, 1990s and early in the 21stcentury in Malawi, like in many developing countries, has been relatively unstable. From the time Malawi got its independence in 1964, inflation rose from an average of 8.9 percent between 1966 and 1976, to about 22 percent between 1986 and 1990 (Ndaferankhande & Ndhlovu, 2006). The major cause of this increase was the global oil prices shock in the 1970s and the civil war in Mozambique where Malawi's closest sea port is situated. These two events drove up the cost of transport and goods and Malawi suffered a period of cost-push inflation. In 1994 when Malawi switched to a flexible exchange rate regime in accordance with the International Monetary Fund's (IMF) Structural Adjustment Programmes (SAPs), inflation rose to 34 percent from just above 22 percent in 1993. Inflation eventually peaked at 83percentin 1995 due to a combination of events, including the switch in exchange rate regime, political transition (from a single party regime to multiparty democracy), "drought" and financial sector liberalization that occurred during that period (Ndaferankhande &Ndhlovu, 2006). Inflation then fell to 9.14 percent in 1997 with the improving economic situation after the 1995 crisis. Following further devaluation of the Malawian Kwacha combined with fiscal and monetary policy indiscipline, inflation peaked once more at about 44 percent in 1999 (Simwaka et al., 2012).

With regard to controlling inflation, Ngalawa and Viegi (2011) found that monetary factors in Malawi weakly affect consumer prices. This implies that monetary policy does not have a predominant effect on inflation in Malawi. Instead, Ngalawa and Viegi (2011) found food costs to be a more significant determinant of inflation. Complementing these results, Mangani (2011) found that exchange rate policy is more effective at controlling inflation than monetary policy in Malawi. However, Mandiwa (2009) found that using the exchange rate to control inflation risks putting the economy in a currency crisis. Lungu et al. (2012)concur with Ngalawa and Viegi (2011) that food costs are the main drivers of inflation in Malawi. It can safely be concluded, therefore, that inflation is not so much a monetary phenomenon but predominantly a supply-side problem in Malawi. As a result, monetary policy alone cannot help in lowering inflation and maintaining the threshold level of inflation in the country. Though supply-side policies are beyond the scope of the central bank(Sato, 2001), they should be implemented in conjunction with monetary policy to effectively control inflation.

Malawi's monetary policy has been historically unclear, with a vague inflation policy (Sato, 2001). For example, since the turn of the century, monetary authorities in the country have been generalising that single-digit inflation is a desirable target. The country's inflation rate dropped from 22.7 percent in 2001 to 9.6 percent in 2003 before rising to 15.4 percent in 2005 (see Figure 1). It dropped again to 8 percent in 2007 and remained in single digits until 2011. It rose to 21.3 percent in 2012.The RBM set an inflation target of

18.4 percent for the final quarter of 2012 (Chiyembekeza, 2013). Nonetheless, the inflation rate soared way above target to an average of 30.13 percent in the fourth quarter of 2012, and in June 2013, the RBM reported an inflation rate of 35.8 percent. Malawi's inflation rate and GDP trends from 1980 to the first quarter of 2013 can be seen in Figure 1. It is difficult to tell from eye ball observation of Figure 1 what effect inflation has on growth. However, it can be observed that every time inflation reaches a peak, growth falls in the following year. In addition, it seems that inflation may have a lagged negative effect on growth. The trends also show a possibility of structural breaks, which can lead to spurious estimations in a time series model (Andreou &Ghysels, 2009).

Figure 1 Behaviour of Inflation and GDP Growth Rate in Malawi 1980-2012



Source: Graph plotted by authors in Microsoft Excel™ with data from the World Bank (2013)

2. Literature Review

Amongst the early theories, Tobin (1965) presented a model where economic agents save for future consumption from current income by either investing in real capital assets or holding money balances. In the model, an increase in money supply leads to higher economic growth. A monetary expansion causes a higher inflation rate, which reduces the return on holding money balances. Agents seek higher returns and there is a portfolio shift in favour of real capital assets. This increases the level of capital stock in an economy and per capita output in the long run. Tobin's (1965) theory invalidates the super neutrality of money and implies inflation has a positive effect on real output. In contradiction to Tobin (1965), Papademos (2003) discusses theories that have shown a negative relationship between inflation and economic growth through monetary expansion. These theories are more sophisticated than Tobin's (1965) theory in that they incorporate alternative functions of money in the real economy. They use agent utility optimisation functions to explain the relationship between money and growth. In these theories, real money balances and capital assets are seen as complements. Therefore, inflation through monetary expansion reduces investment in capital and subsequently long-term economic growth. Recent theories of inflation and growth have tried to incorporate contemporary endogenous growth theories to cater for growth through human capital, research and development. Gomme (1993) attempted to accommodate money effects in an endogenous growth model. He found that higher inflation through increased money growth decreases returns on employment, leading to a decrease in short-term labour supply. This decrease, in turn, leads to a lower output level and lower economic growth because human capital is reduced by agents having less opportunity for learning by doing while employed (see also, Vaona, 2011). Gomme's (1993) theory shows a decrease in growth due to higher inflation.

Papademos (2003) cautions that the long-term growth hypothesised from models like Tobin's (1965) must be limited to low inflation rates to avoid the incongruous conclusion that hyperinflation leads to a major improvement in growth. The uncertainty from high rates of inflation lowers the rate of productivity. Most theories, therefore, show that monetary policy that yields perpetually higher inflation rates has adverse long-term growth effects. Theory on the inflation-growth nexus is equivocal and points toward a nonlinear effect of inflation on growth and the possibility of a critical point where inflation maximizes economic growth. Fischer (1993), using the growth accounting framework, found that inflation reduces growth by reducing investment and productivity. Li (2006)supports this finding. He divides the transmission from inflation to growth into the inflation-finance nexus, finance-investment nexus and investment-growth nexus. An increase in the rate of inflation hinders financial development. Poor financial development in turn has negative effects on the level and efficiency of investment and eventually decreases growth. Most studies on the optimal inflation threshold for economic growth are cross-country and panel data analyses. For example, Li (2006) studied the relationship between inflation and growth for 90 developed countries and 28 developing countries between 1961 and 2004, and found different forms of nonlinearity in the relationship between inflation and growth. Similarly Khan and Senhadji (2001) conducted a study on 140 countries between 1960 and 1998, and found threshold levels of inflation ranging between 1 percent and 3 percent for developed countries and 7 percent and 11 percent for developing countries. Khan and Senhadji (2001) also found that for both developing and developed countries, inflation has a negative effect and positive effect on economic growth above and below the inflation threshold level, respectively. The purpose of their study was, however, not to determine and recommend a given threshold but rather to show evidence of the inflation threshold effect on economic growth.

Another cross-country study conducted by Ghosh and Phillips (1998)for IMF member countries between 1960 and 1996 also found that for both developed and developing countries, inflation has a nonlinear effect on growth with a positive correlation at low levels of inflation (less than 2 percent to 3 percent) and a negative correlation for rates of inflation above the threshold level. On the whole, the dominant cross-country studies have found mixed results on the inflation-growth nexus below the threshold level. The general paradigm is that there is a negative relationship between inflation and growth above the threshold level (see, Barro, 1995;Sarel, 1996Temple, 2000). In comparison to cross-country studies, there are only a few single-country studies on the optimal inflation threshold for growth. A notable single-country study is that of Mubarik (2005) in which he found a threshold level of 9 percent for Pakistan between 1973 and 2000. Another study on Pakistan using Mubarik's (2005) approach, found a threshold range of 4 percent to 7 percent but for a longer period, 1973-2005 (see Hussain, 2005). These two studies show that the threshold level can vary within a time period for a given country. In addition, Salami and Kelikume (2010), in their study on Nigeria, using Khan and Senhadji's(2001) estimation method, found a threshold level of 8 percent for the period 1970 to 2008 and 7 percent for the period 1980 to 2008. A study on Ghana found a threshold level of 6 percent. After accounting for structural breaks, the threshold level increased to 10 percent(Marbuah, 2011).

Research on optimal inflation threshold levels in Sub-Saharan Africa has also been minimal. While a majority of the research has been carried out using cross-country data (e.g. Bruno &Easterly, 1998;Kremer et al., 2011; Seleteng, 2013) a large part of the few single-country studies have concentrated on South Africa and Nigeria (see for example, Salami & Kalikume, 2010; Morar, 2011). Morar (2011), in a study on South Africa, found a threshold level of 9.5 percent. She also showed that inflation rates between 5.5 percent and 6.5 percent promote economic growth in the country. In Lesotho, Seleteng (2006) found a threshold level of 10 percent during the period 1981 to 2004. Gylfason and Herbertsson (2001) and Morar (2011) provide tabulated summaries of most cross-section, panel and single-country inflation threshold and inflation-growth empirical studies. There is a general consensus from the empirical literature that high rates of inflation above 40 percent per annum have negative effects on economic growth (Temple, 2000). However, evidence showing the effects of moderate and low inflation on economic growth is ambiguous (Barro, 1995).

3. Methodology and Preliminary Analysis

The Threshold Estimation Model: Most studies on the optimal inflation threshold level have relied on the works of Ghosh and Phillips (1998), Sarel (1996), Mubarik (2005), and Khan and Senhadji (2001). Many of the models used are modifications of Khan and Senhadji's (2001) cross-country estimation. A notable single-country modification of Khan and Senhadji's (2001) model is that of Mubarik (2005). This paper follows Mubarik (2005) but adds the terms of trade variable to the control variables as in Leshoro (2012).The model is given by:

$$GROWTH_t = \beta_0 + \beta_1 INF_t + \beta_2 INFK + \beta_3 INV_{t-s} + \beta_4 POP_{t-s} + \beta_5 TOT_{t-s} + GROWTH_{t-p} + \varepsilon_t \quad (1A)$$

where$INFK$ is defined as:

$$INFK = \beta_2 D_t (INF_t - k) \quad (1B)$$

where, $GROWTH_t$ is the growth rate of real GDP, INF_t is the rate of inflation,k is the threshold level of inflation, $INV_t$is investment as a percentage of GDP, POP_t is population growth rate, TOT is the percentage change in terms of trade and ε_t is the error term. Population growth rate is calculated using the log difference of population. D_t is the dummy variable indicating the presence of an inflation rate that is smaller or greater than the threshold level k . More specifically the dummy variable is given by:

$$D_t = \begin{cases} 1: INF_t > k \\ 0: INF_t \leq k \end{cases}$$

In estimating equation (1A) the parameter k represents the relationship between inflation and economic growth and this is given by $\beta_1$for low inflation and $\beta_1 + \beta_2$ for high inflation. The coefficients $(\beta_1 + \beta_2)$ are added to find their effect on growth when inflation is above$k$. The value of k is chosen arbitrarily over a range of values suspected to yield an optimal rate of inflation. A sequence of regressions is estimated for each level of k yielding residual sum of squares (RSS) values for each chosen level. From the sequence, the optimal inflation threshold is the chosen k level that minimizes the RSS or maximizes the coefficient of correlation (R^2) (Mubarik, 2005:40). The model is estimated using the conditional least squares method which entails ordinary least squares (OLS) estimations that yield RSS values as a function of k (Khan and Senhadji, 2001:7).

Data and Variables: Data used in this study are annual time series sourced from the World Economic Outlook (WEO), an IMF database, and World Development Indicators (WDI), a World Bank database of social and economic indicators, for the period 1980 to 2013. While some threshold models have used real GDP growth rate for their dependent variable (see Leshoro, 2012;Kannan & Joshi, 1998;Ahortor et al., 2011), others have used real GDP *per capita* (Morar, 2011). This study uses real GDP growth rate. The inflation rate is obtained from the log difference of the all-items national composite consumer price index (CPI) as suggested by Sarel (1996). The main concern in choosing control variables is selecting variables that are known to cause significant economic fluctuations for a particular economy. Morar (2011: 49-60) presents a detailed discussion on the choice of control variables by various threshold studies. The most common variables include population growth and the level of investment. Based on a report on economic growth drivers in Malawi, terms of trade, investment and population suffice (Ngwira, 2012). Malawi has faced a number of supply shocks within the period being analysed. These shocks impacted the terms of trade negatively and this could have adverse effects on economic growth. Investment is also known and commonly accepted in the literature as a factor that has a significant effect on economic growth. According to Dossani (2012), investment affects growth significantly in Malawi. The effect of population is, however, debatable. Sala-i-Martin (1997)points out that population growth are a significant factor in explaining economic fluctuations.

Preliminary Data Analysis: Descriptive statistics for each variable are shown in Table 1. Real GDP growth rate ranged between -10.89percent and 12.95percent with an average rate of 3.36percent while the rate of inflation ranged from 7.41percent to 83.14percent with an average of 19.8percent for a readjusted sample of 31 observations between 1981 and 2011. In Table 1, Figure 2 and Figure 3, real GDP growth (GROWTH) and inflation (INF) are negatively and positively skewed respectively. Real GDP growth is slightly skewed and is close to having a normal distribution while inflation rate is highly skewed and not normally distributed. The kurtosis level for a normally distributed variable is 3 (DeCarlo, 1997). The kurtosis for real GDP growth, inflation rate, population growth and terms of trade are higher than 3 at 3.81, 9.93, 3.7 and 3.24, respectively.

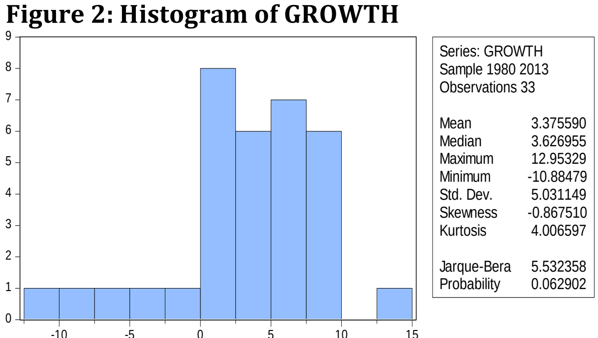
These values are higher than the kurtosis of normally distributed variables while that of investment is lower at 2.02. This indicates that the distributions of real GDP growth, inflation rate, population growth and terms of trade are more likely to have a structural break than equivalent normally distributed data, while the distribution of investment is relatively less likely to have extreme events than a normally distributed variable. The Jarque-Bera P-values show that for inflation rate, there is enough evidence to reject the null hypothesis that the variable is normally distributed, while for all other variables there is not enough evidence to infer that they are not normally distributed.

Table 1: Descriptive statistics

Variable	Mean	Minimum	Maximum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	P-Value
GROWTH	3.3609	-10.8848	12.9533	5.1764	-0.8428	3.8107	4.5189	0.1044
INF	19.8086	7.4100	83.1480	15.5548	2.4029	9.9267	91.8067	0.0000
INV	18.7517	11.5990	28.6600	4.8867	0.3584	2.0187	1.9076	0.3853
TOT	68.9196	46.0783	107.3582	14.1350	0.5269	3.2447	1.5119	0.4696
POP	0.02903	0.0058	0.06128	0.0132	0.8407	3.6975	4.5564	0.1025

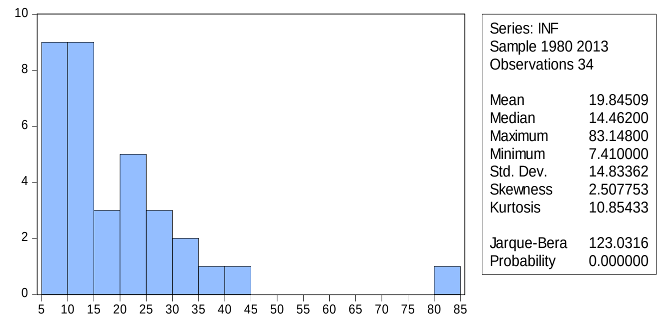
Note: Sample 1981-2011 at 5% significance level

Figure 2: Histogram of GROWTH



Source: Plotted by authors using data from WEO 2013

Figure 3: Histogram of INF



Source: Plotted by authors using data from WEO 2013

Table 2 presents a zero order correlation matrix of the variables. The table shows that all correlations between the control variables are statistically insignificant apart from those between terms of trade and population growth at 0.4912 and terms of trade and investment at -0.4913, which are significant at a 1percent level. Gujarati (2003:359) states that multicollinearity is a problem in a regression if the zero order correlation coefficient between two regressors is above an absolute value of 0.8. The highest statistically significant level of correlation between the independent variables reported in Table 2 is 0.49. Since this value is below 0.8, multicollinearity is not expected to be a problem in our regression.

Table 2: Correlation Matrix

Correlation	GROWTH	INF	INV	POP	TOT
GROWTH	1.0000				
INF	0.0639	1.0000			
INV	-0.0473	-0.2593	1.0000		
POP	-0.0096	-0.2110	-0.1500	1.0000	
TOT	0.0483	-0.0558	-0.4913*	0.4912*	1.0000

Notes: Sample adjusted to 1981-2011; * denotes significant correlation at 1% level

From the foregoing, we suspect the presence of a structural break in the relationship between the regress and the regressors. The consequences of a structural break are poor inferences of economic relationships, misleading policy recommendations, and inaccurate forecasts (Hansen, 2001: 127). To test for structural breaks the study uses the Vogelsang structural break test (see Table 3).The Vogelsang test also identifies dates for the structural breaks. Table 3 shows that the null hypothesis of no structural break in real GDP growth is rejected for GROWTH model A given the variable is stationary. This result infers that if real GDP growth is stationary and the series has no trend or intercept, then there is enough evidence at a 10 percent level of significance to conclude that there is a structural break in growth and the break year is 2006. Similarly, the null hypothesis of no structural break is rejected for inflation rate models B and C showing evidence of structural breaks in 1993 and 1994 at 5 percent and 1 percent level of significance, respectively. Significant evidence of the presence of a structural break in 1987 and 2001 for the stationary case is also shown for terms of trade and population, respectively. On the contrary, evidence shows that INV has no structural break. Though some break date estimates in the descriptive analysis are different, the results of the Vogelsang test confirm expectations of structural breaks in each variable from the descriptive analysis.

Table 3: Vogelsang Structural Break Test

Variable	**Model**	**SUP**		**TB**	**K**	**Null Hypothesis Inference**		
GROWTH	A	9.603***^{s}		2006	3	Reject		
	B	7.331		2000	3	Fail to reject		
	C	1.059		2000	5	Fail to reject		
INF	A	3.325		2002	1	Fail to reject		
	B	18.518**^{s}		1993	1	Reject		
	C	68.972*$^{s\ n}$		1994	5	Reject		
INV	A	6.027		2004	0	Fail to reject		
	B	8.092		1994	0	Fail to reject		
	C	13.046		1994	0	Fail to reject		
TOT	A	13.606**^{s}		1987	0	Reject		
	B	9.399		1995	5	Fail to reject		
	C	8.431		1994	0	Fail to reject		
POP	A	16.263*^{s}		1988	2	Fail to reject		
	B	24.849**^{s}		2001	5	Reject		
	C	24.777*^{s}		2001	5	Reject		
Critical Values		Unit Root				Stationary		
Significance Level		0.01	0.05		0.10	0.01	0.05	0.10
A		22.64	20.23		18.20	14.49	10.85	9.24
B		30.44	27.76		25.27	19.90	15.44	13.62
C		38.43	34.45		31.35	21.65	17.89	16.06

Notes: Critical values obtained from Vogelsang (1997:824-826) for trimming level of 0.01 and maximum lag Kmax=5. (*), (**) and (***) denote significance at 1%, 5%, and 10% and ^{s} and ^{n} denote significance for either stationary or non-stationary critical values respectively. TB is the break date, K is the selected lag length and SUP is the Sup *F test* statistic.

To test for stationarity the study uses the Zivot & Andrews (2002)(ZA) testfor unit roots with a single structural break, and the Lumsdaine and Papell(1997)(LP) test for unit roots with multiple structural breaks. In comparison to other tests, these tests perform fairly well in the presence of structural breaks and they are used with the precautions recommended by Lee and Strazizcich (2003) about endogenous unit root tests (see Table 4 and Table 5 for the stationarity results). The ZA test shows that all variables, apart from investment, are stationary and have structural breaks at the reported break years and respective significance levels. Consistent with these results, the LP test results show that there is evidence of structural breaks in all variables except for investment albeit with marginal differences in the break dates. Based on the ZA and LP test results it can be concluded that the variables of interest in the inflation threshold model, real GDP growth and inflation, are stationary and have structural breaks in 1997 and 1994, respectively. Evidence of stationarity and structural breaks in population and terms of trade is also reported. On the other hand, the results for investment show that it contains a unit root and no structural break. The ADF and KPSS tests are consequently used to test if investment is stationary and the results show significant evidence that investment is a stationary series with no unit root.

Table 4: Zivot-Andrews Unit Root Test

Variable	MODEL	TB	K	$t_{\hat{a}}$	Null Hypothesis Inference
GROWTH	A	1997	0	-7.4248*	Reject
	C	1997	0	-7.5063*	Reject
INF	A	1992	1	-5.3093**	Reject
	C	1994	8	-7.9544*	Reject
INV	A	2004	0	-4.2822	Fail to reject
	C	1995	0	-4.4116	Fail to reject
TOT	A	1993	7	-4.8767**	Reject
	C	1993	7	-5.1032**	Reject
POP	A	2004	2	-4.9409**	Reject
	C	2000	5	-5.5790 *	Reject

Notes:1981-2011. The Critical values are, -5.34, -4.80 and -4.58 for model A and -5.57, -5.08 and -4.82 for model C at 1%, 5% and 10% significance respectively (Zivot and Andrews, 2002). (*), (**) and (***) denote significance at 1%, 5%, and 10% level. Where TB is the break date, K is the selected lag length and $t_{\hat{a}}$ the t test statistic.

Table 5: Lumsdaine-Papell Test

Variable	MODEL	TB 1	TB 2	K	$t_{\hat{a}}$	Inference
GROWTH	AA	1993	2002	0	-8.9190*	Reject
	CC	1993	1997	0	-8.9666*	Reject
INF	AA	1993	2005	5	-9.0348*	Reject
	CC	1994	2006	5	-11.0525*	Reject
INV	AA	1992	2001	7	-5.5562	Fail to reject
	CC	1993	2002	7	-5.9061	Fail to reject
TOT	AA	1996	2008	7	-7.1245**	Reject
	CC	1997	2008	7	-7.5730*	Reject
POP	AA	2000	2003	8	-9.2335 *	Reject
	CC	2001	2007	8	-11.1622*	Reject

Notes: 1980-2013. The critical values are -7.34 (1%), -6.82 (5%), and -6.49 (10%) for model AA and -6.94 (1%), -6.24 (5%), and -5.96 (10%) for model CC (Lumsdaine and Papell, 1997:215-216). (*), (**) and (***) denote significance at 1%, 5%, and 10% level. In the first row **TB** is the break date, **K is** the selected lag length and $t_{\hat{a}}$ the t test statistic.

4. Estimation Results and Inferences

Table 6 shows the inflation threshold estimation results for threshold values of inflation between 7.5percent and 30percent. The regressions were tested for stability using the CUSUM and CUSUM squared test and the results showed that each regression fell within the stability band and was stable. For each regression, inflation rate has a statistically significant negative impact on real GDP growth while the threshold level of inflation (INFK) has a statistically significant positive impact on real GDP growth, ceteris paribus. All the control variables are statistically insignificant. Figure 4 and Figure 5 are the graphs of the sum of squared residuals (RSS) and R^2 respectively. The graphs show that the RSS is minimised and R^2 is maximised at a threshold level of 17percent. This suggests that 17percent is the optimal inflation threshold for economic growth in Malawi. For threshold levels below the optimal rate, the INF coefficients become increasingly negative while the INFK coefficients become more positive. On the other hand, for threshold levels above 17percent the inflation rate coefficients become less negative while the INFK coefficients become less positive. Threshold levels below 9percent show statistically insignificant coefficients for inflation rate but above this level inflation rate is significant for all regressions. K therefore varies positively with the coefficient of inflation rate from each regression starting at a threshold level of 9percent and beyond. The coefficient of inflation rate shows that inflation rate is negatively related to real GDP growth at the 17percent threshold level. For a 1percent decrease in inflation below the 17percent threshold, real GDP growth increases by 1.046percent, ceteris paribus. However, for a 1percent increase in inflation beyond the 17percent threshold, real GDP growth increases by 0.2percent (the sum of the coefficient of INF and INFK at K=17percent). From this observation of the coefficients, it can be said that inflation rates both below and above the optimal inflation threshold level increase economic growth. The impact, however, is different on either side of the optimal inflation threshold. The impact of inflation on economic growth is larger below the optimal inflation threshold and smaller above it.

Table 6: Optimal Inflation Threshold Model

VARIABLE	COEFFICIENT	STD ERROR	T-STAT	P-VALUE	R^2	RSS
INF	-41.97	66.36	-0.63	0.53	0.02	785.33
K7.5*(INF-7.5)	42.00	66.37	0.63	0.53		
INF	-6.18	8.58	-0.72	0.48	0.03	781.56
K8*(INF-8)	6.21	8.59	0.72	0.48		
INF	-5.12	2.56	-2.00	0.06	0.15	686.93
K9*(INF-9)	5.18	2.58	2.01	0.06		
INF	-3.75	1.33	-2.82	0.01	0.25	603.00
K10*(INF-10)	3.84	1.35	2.84	0.01		
INF	-2.71	0.86	-3.16	0.00	0.29	567.30
K11*(INF-11)	2.82	0.88	3.19	0.00		
INF	-2.13	0.62	-3.43	0.00	0.33	538.02
K12*(INF-12)	2.26	0.65	3.48	0.00		
INF	-1.76	0.50	-3.51	0.00	0.34	527.84
K13*(INF-13)	1.90	0.53	3.58	0.00		
INF	-1.45	0.41	-3.49	0.00	0.34	528.30
K14*(INF-14)	1.60	0.45	3.57	0.00		
INF	-1.29	0.36	-3.56	0.00	0.35	519.34
K15*(INF-15)	1.46	0.40	3.66	0.00		
INF	-1.16	0.32	-3.61	0.00	0.36	512.51
K16*(INF-16)	1.35	0.36	3.73	0.00		
INF	-1.05	0.29	-3.63	0.00	0.37	507.95
K17*(INF-17)	1.25	0.33	3.78	0.00		
INF	-0.93	0.26	-3.60	0.00	0.37	508.68
K18*(INF-18)	1.14	0.30	3.77	0.00		
INF	-0.83	0.23	-3.53	0.00	0.36	512.53
K19*(INF-19)	1.04	0.28	3.73	0.00		
INF	-0.74	0.21	-3.47	0.00	0.36	515.32
K20*(INF-20)	0.96	0.26	3.70	0.00		
INF	-0.67	0.19	-3.46	0.00	0.36	512.60
K21*(INF-21)	0.90	0.24	3.73	0.00		
INF	-0.61	0.18	-3.42	0.00	0.36	512.38
K22*(INF-22)	0.85	0.23	3.73	0.00		
INF	-0.56	0.17	-3.38	0.00	0.36	512.02
K23*(INF-23)	0.80	0.21	3.74	0.00		
INF	-0.52	0.16	-3.35	0.00	0.36	511.93
K24*(INF-24)	0.77	0.21	3.74	0.00		
INF	-0.49	0.15	-3.27	0.00	0.36	515.75
K25*(INF-25)	0.75	0.20	3.70	0.00		
INF	-0.46	0.14	-3.22	0.00	0.36	517.78
K26*(INF-26)	0.73	0.20	3.68	0.00		
INF	-0.43	0.14	-3.15	0.00	0.35	521.42
K27*(INF-27)	0.71	0.19	3.64	0.00		
INF	-0.40	0.13	-3.06	0.01	0.34	526.54
K28*(INF-28)	0.68	0.19	3.59	0.00		
INF	-0.37	0.12	-2.95	0.01	0.34	532.81
K29*(INF-29)	0.65	0.19	3.53	0.00		
INF	-0.34	0.12	-2.85	0.01	0.33	538.69
K30*(INF-30)	0.63	0.18	3.47	0.00		

Notes: The dependent variable is GROWTH. (*), (**) and (***) denote significance at 1%, 5% and 10% level respectively.

Figure 4: Graph of Residual Sum of Squares

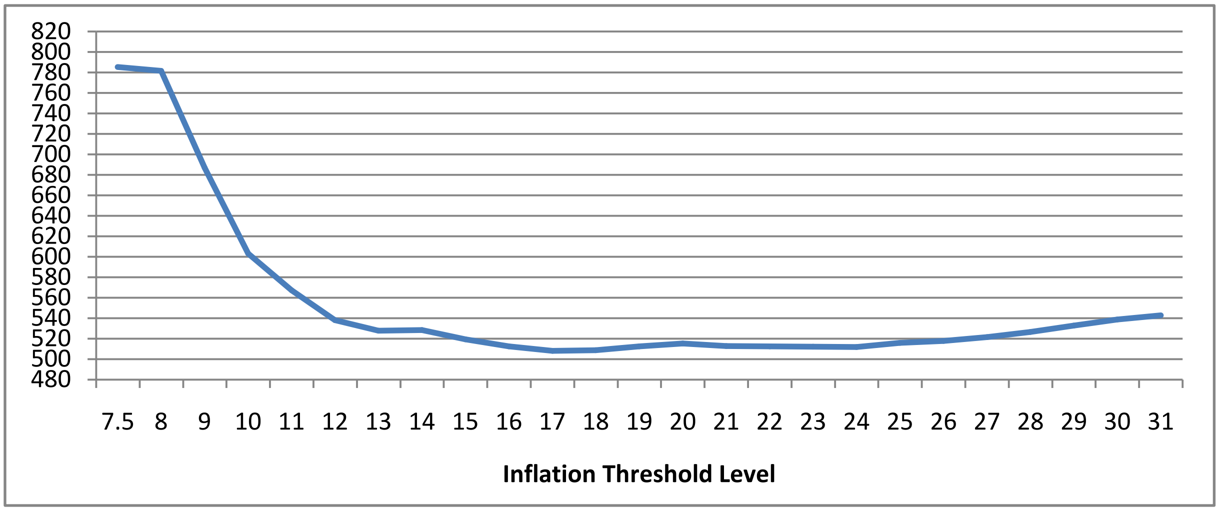
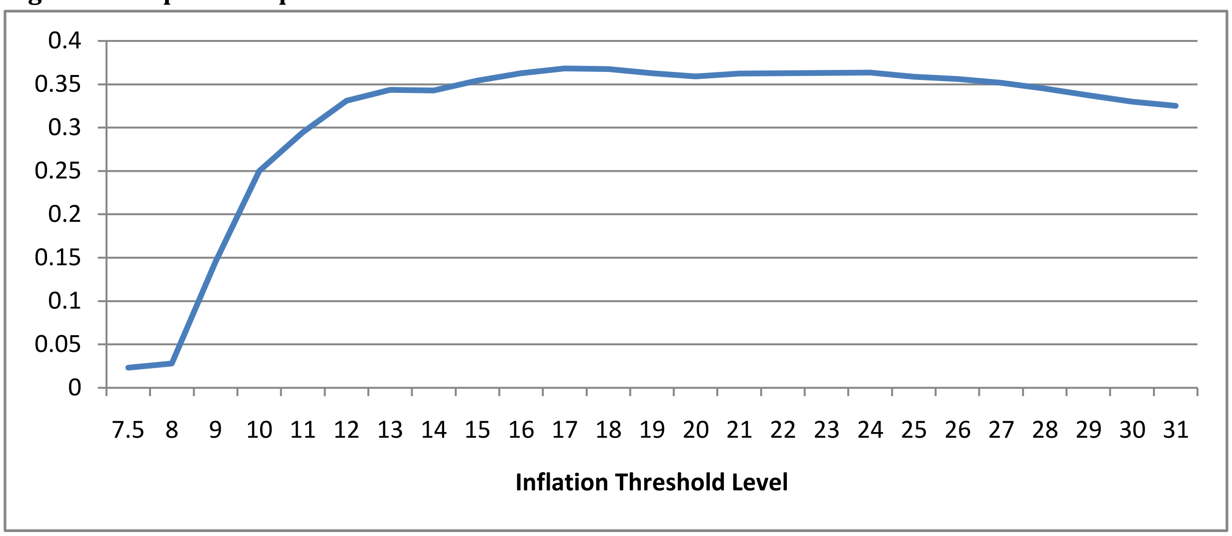


Figure 5: Graph of R-Squared



Monetary authorities in Malawi generalize that single-digit inflation is favourable for improved economic performance and that double-digit inflation hurts economic growth (Cottarelli &Szapary, 1998). It is argued that single-digit inflation as opposed to double-digit inflation is associated with less variability of market prices and with uncertainty, allowing more efficient allocation of resources to investment and production and hence improved output (Nell, 2000). This broad view and evidence showing the negative impact of double-digit inflation on output growth is challenged by the threshold model estimation result of this study. We maintain that authorities in Malawi should set inflation at an optimal rate of 17 percent rather than within the widely advocated single-digit range to maximize and achieve a sustainable real GDP growth rate. In the literature, there are some studies that maintain that inflation should be kept in single digits. Ball (2013)argues that single-digit inflation is favourable, but inflation should be kept below 10 per cent albeit not too close to zero to give policy makers room to stimulate the economy by decreasing interest rates. Akerlof et al. (2000)argue that low single-digit inflation (2 percent to 4 percent) allows wage flexibility for capitalists because at sufficiently low rates of inflation workers do not notice decreases in real wages when their nominal wages increase. Capitalists can decrease real wages by increasing nominal wages at a rate lower than the inflation rate. This allows firms to produce the same level of output at lower real wage rates.

In contrast, some empirical studies have found double-digit inflation rates favourable for increased GDP growth rate but the rates must be low double-digit rates between 10 and 20 percent (Bruno &Easterly,

1998;Gylfason &Herbertsson, 2001). Some panel data research has found optimal inflation thresholds close to 17percent for developing countries (Ibarra &Trupkin, 2011;López-Villavicencio &Mignon, 2011;Seleteng et al., 2011). A number of empirical studies support the optimal rate of 17percent in Malawi but most fail to justify inflation targets of double-digit rates over single-digit rates. Though most evidence supports single-digit inflation, the debate on whether inflation rates between 15percent and 30percent improve economic growth is on-going (Cottarelli &Szapary, 1998). Of the few validations of double-digit inflation, Fischer (1996) states that double-digit inflation is favourable for economic growth if an economy is newly formed or recovering from economic turmoil. Truman (2003)advises that infrastructure in developing economies does not allow for effective maintenance of single-digit inflation through inflation targeting. He argues that these economies need to achieve low double-digit inflation before they begin to target single-digit inflation. Historically, economies that have successfully recovered from periods of high inflation have improved their economic performance by gradually reducing inflation and aiming for low double-digit inflation before achieving single-digit inflation (Corbo & Fischer, 1994). Economists in support of low double-digit inflation also argue, why should an economy suffer output loss and unemployment through disinflation to achieve single-digit rates of inflation if economic growth can be sustained with low double-digit inflation rates(Burton & Fischer, 1998).

There is a profusion of strong theoretical and empirical support for negative effects of double- or multiple-digit inflation on growth. However, evidence of economies that have experienced low double-digit inflation and economic growth simultaneously is also present (see for example, Burton & Fischer, 1998). Based on this evidence and the aforementioned reasons, monetary policy authorities in Malawi can, therefore, initially tolerate a low double-digit inflation rate of 17percent before aiming for single-digit inflation. At the inflation rate of 35.8percent in June 2013, Malawi is recovering from a period of economic instability and from historical volatility of the inflation rate. It can safely be argued that the country does not have the necessary infrastructure to justify single-digit inflation that is consistent with high and sustainable economic growth. Authorities in Malawi should, therefore, target the estimated low double-digit optimal inflation threshold rate of 17percent instead of aiming for single-digit inflation rate, to maximise and to achieve a sustainable economic growth rate. It is also observed from the inflation threshold model that marginal gains in real GDP growth below the optimal inflation threshold level are greater than gains above the optimal threshold level. At first glance, a positive effect on real GDP growth rate above the threshold level seems to be inconsistent with theory and empirical evidence. However, the marginal gains above the threshold level being increasingly less than the gains below, imply decreasing returns of inflation to real GDP growth. The gains in real GDP growth above the threshold level are offset by increasing costs of higher inflation, and this is equivalent to decreasing economic growth above the optimal inflation threshold.

5. Summary and Conclusion

This study set out to find the relationship between inflation and economic growth in Malawi and to establish the optimal inflation threshold for the country. Inflation threshold studies show that the optimal inflation threshold for economic growth varies between countries and depends on country-specific factors. Central banks, therefore, need to determine their country-specific, optimal rates of inflation to achieve an optimal level of sustainable economic growth. Unlike similar optimal inflation threshold studies, this paper carries out structural change tests before estimating the threshold model. The study observes that historically, policy makers in Malawi have struggled to control inflation. Monetary policy in Malawi is weak and the RBM's inflation strategy is elusive (Sato, 2001). Studies on inflation in Malawi show that food costs and exchange rates have a stronger effect on inflation than monetary policy. The study results reveal that the main variables, inflation and real GDP growth, have structural breaks but no unit roots. The tests also find that all the control variables are stationary, indicating that the threshold model can be estimated without expecting spurious results. Using data between 1980 and 2013, the estimation model yields an optimal inflation threshold level of 17 percent for Malawi. The results also show that inflation has an insignificant effect on real GDP growth below 9 percent and that there are greater marginal gains in real GDP growth below than above the optimal inflation threshold.

These results have different implications for the inflation growth relationship in Malawi. Firstly, the optimal inflation threshold of 17 percent may raise concern especially because monetary authorities in Malawi have generalised that double-digit inflation is bad for growth while single-digit inflation enhances growth. However, evidence shows that the effect of inflation on economic growth below a rate of 20 percent is debatable (Bruno &Easterly, 1998). There is also evidence of countries achieving stable economic growth at low double-digit rates (Burton &Fischer, 1998). Accordingly, it is acceptable for policy makers to initially set inflation at the optimal rate of 17percent. Furthermore, the inflation rate of 35.8 percent reported by the RBM in June 2013 is more than double the rate found in this study for optimal and sustainable economic growth. The cost of disinflation from this high rate to a single-digit rate is also likely to be high (Cottarelli &Szapary, 1998). The inflation rate of 35.8 percent is also clearly inconsistent with the RBM objective of maintaining price stability and sustainable economic growth (Malawi Government, 1989). It is, therefore, advisable for authorities to gradually reduce inflation and initially target the current optimal threshold rate of 17 percent. The result that gains in real GDP growth below are greater than gains above the optimal threshold level shows that the empirical outcomes of this paper are in line with the theoretical expectations of the threshold estimation model and other empirical studies.

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