Estimating threshold level of inflation in Swaziland: inflation and growth

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Abstract

The objective of this study is to estimate optimal threshold effect of inflation for the economy of Swaziland. The study applied the liner OLS and Two-Stage least squares (2SLS) methods to determine the optimal effect of inflation on growth. It used annual data for the period 1980 to 2015. The results of liner OLS method show that the estimated optimal threshold level is at 12%. The results show that inflation rate beyond optimal level of 12% decrease growth by 1.02%. Similar results were also found in applying 2SLS method, where inflation exerted a negative impact beyond threshold point by 18.5%. These findings on Swaziland economy have crucial implications for monetary policy makers in terms of keeping inflation below the threshold point to sustain a positive economic growth in the long run.

JEL classification: B22, C01, E31, O40

Keywords: economic growth, inflation, threshold level

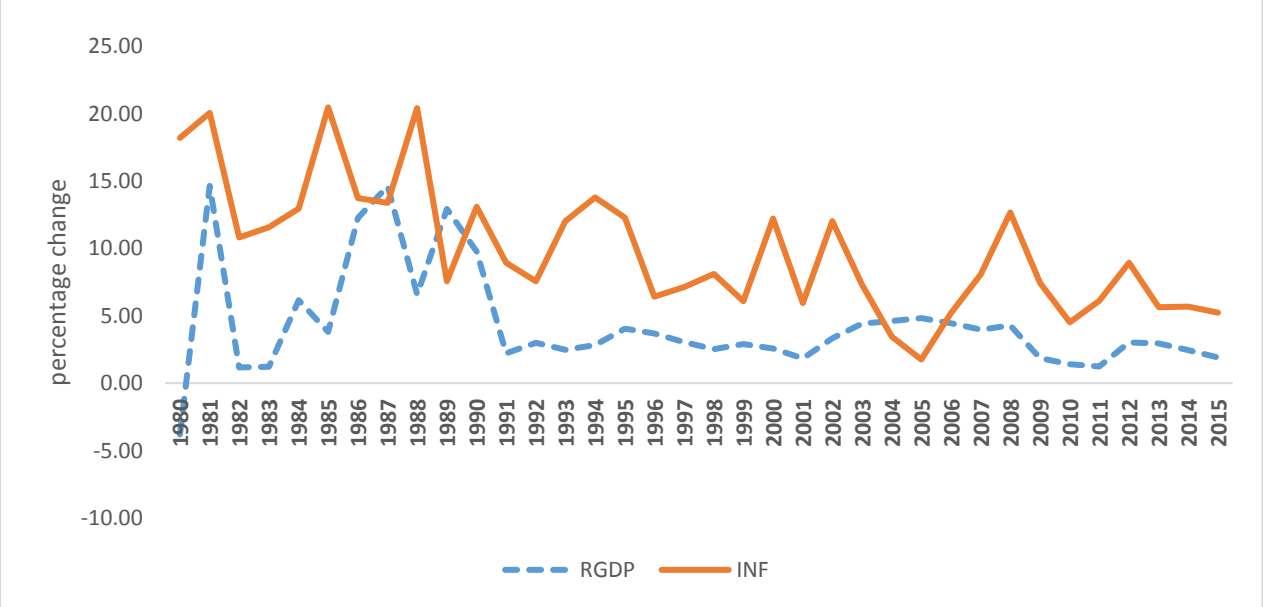
1. Introduction

The interest of each economic policy maker is to sustain high economic growth with stable price levels. Inevitably, it is well known that policy makers are expected to make tradeoff in maintain policies that combat inflation without harming potential economic growth. Hasanov (2011) explained that to maintain suitable economic growth and price levels simultaneously, can be hard to accomplish for economic policy makers. Although there is a vast debate about the negative effect of inflation on output growth, however there appears to be a consensus among economists that macroeconomic stability, specifically defined as low inflation, is negatively related to economic growth (Sindano, 2014). According to Bawa and Abdullahi (2012) severe inflation has several consequences such that firstly, it impose welfare cost to the society. Secondly, it discourage savings and investment by creating uncertainty about the future prices. Thirdly, it cost the low income households by reducing their purchasing power. Finally, it minimise the country‘s exports competitiveness due to relative prices and negatively impact on the trade account.

Literature clearly indicates some frameworks concerning the relationship between inflation and economic growth. The study by Seleteng (2005) highlighted some theories such as Keynesian theory and monetarism which can be used to predict the expected relationship between inflation and economic growth. The Keynesian theory suggest that there is positive relationship between inflation and output in the long run. This could be due to some firms may agree to supply some goods at the later stage. The other possibility is that during full employment in aggregate demand (AD) and aggregate supply (AS) model, continuous increase in AD will lead to inflationary state. The theory on monetarism suggest that in the long run prices are affected by an excessive supply of money. This notion of theory was pioneered by Friedman (1956) in his quantity theory of money. In nutshell, theoretical framework regarding price levels and

economic growth suggests that there is a possible positive association among the variables. An analysis on the relationship between inflation and economic growth in Swaziland is of paramount importance. Like many developing economies, Swaziland citizens are faced with higher prices in their everyday life. Figure 1 depicts the relationship between inflation and economic growth in Swaziland for the period 1980 to 2015. Inflation rate trended in double digits and was detrimental to economic growth during the period 1980 to 1990. During the period 1990 to 2004 inflation rate grew above economic growth with approximately an average growth rate of 6% per year. During the periods, respectively 1988 and 1990, Swaziland's economic growth rate was above 6%. This was the highest growth experiences in Swaziland. The economy of Swaziland witnessed low economic growth during 2010 and 2011, and this was due to the aftermath of the financial crisis (UNECA[1], 2016). It can be concluded from the figure that there is positive relationship between inflation and economic growth for the period 1980 to 2015.

Figure 1: Swaziland's inflation rate and real GDP growth rate for the period 1980 to 2015



Source: Own compilation using data from IMF

[1] United Nations Economic Commission for Africa

In a small developing economy like Swaziland, unstable price levels have a prospective detrimental effect on economic growth in the long run. Extensive empirical studies on determining the optimal threshold point of inflation in Swaziland are scarce, and limited to one study by Mkhatshwa, Tijani and Masuku (2015). The study indicates that there is a long run relationship between inflation and economic growth in Swaziland. The study used non-liner OLS to estimate 12% optimal threshold level of inflation that discouraging economic growth in Swaziland. In the essence of the role and the importance of inflation in an economy, it is imperative to investigate the threshold point of inflation on economic growth. The main purpose of this study is to examine whether there is any optimal threshold effect of inflation on economic growth in Swaziland. This study contributes to the literature firstly by using different control variables following the ones used and explored Mubarik (2005), Seleteng (2005) and Khan and Senhadji (2001). Lastly, unlike the study of Mkhatshwa, Tijani and Masuku (2015) that used non-linear method, the current study uses linear approach by applying basic OLS and Two-Stage Least Squares (2SLS). The rest of this study is organised as follows. Section 2 presents empirical literature on inflation and economic growth. Section 3 provides model specification. Section 4 discusses methodology and data. Section 5 reports estimation results. Lastly, Section 6 conclude the study.

2. Empirical literature

There is a large literature investigating empirical and theoretical relationship between inflation and output growth. However, this vast literature consists of two types of studies that investigate the relationship between inflation and economic growth. One set of studies specifically concentrate on the relationship between inflation and output growth. This kind of studies predominately presume that there is a negative relationship between inflation and output

growth. Another set of studies argue that there an optimal level where inflation may be harmful to output growth. This current study will focus on studies that investigated the optimal level of inflation on economic growth. Vinayagathasan (2013) studied inflation and growth for 32 Asian countries. The study used panel dynamic threshold model for the period 1980 to 2009. The study found that inflation hurts economic growth when it exceeds 5.43%. The results also indicated that inflation rate below 5.43% did not have any effect on growth. Alkahtani and Elhendy (2014) examined the optimal level of inflation rate in the Kingdom of Saudi Arabia. The study found that the optimal level of inflation that is harmful for economic growth in Saudi Arabia ranged from 3% to 4%.

Yabu and Kessy (2015) investigated threshold level of inflation for economic growth of three founding East African Community (EAC) member states. These member states are Kenya, Tanzania and Uganda. The paper applied panel analysis methods such as random effects (RE) and seemingly unrelated regression (SUR) for the period 1970 to 2013. The results indicate that the average rate of inflation beyond 8.46% is harmful to economic growth. Recent empirical study by Bhusal and Silpakar (2011) explored the nexus between inflation and economic growth and to determine the threshold level of inflation for Nepal. The results of the study show that the threshold value of inflation is found to be 6% for Nepal. Bawa and Abdullahi (2012) studied an optimal threshold effect of inflation on economic growth in Nigeria. The results shown a threshold inflation level of 13% for Nigeria, which implies that below this level, inflation has insignificant impact on economic growth.

There is a general consensus that policy makers and central bankers acknowledge that the main objective of macroeconomic policies is to achieve a high output growth rate while maintaining

a low inflation rate. Rutayisire (2013) investigated the relationship between inflation and growth in the economy of Rwanda for the period spanning from 1968 to 2010. The study used the quadratic model to determine whether there is a turning point level of inflation, at which the inflation starts to negatively impact on output growth. Rutayisire (2013) found out that estimated inflation threshold level is 14.97%. Inflation rate of above 14.97% is detrimental to output growth of Rwanda. Makuria (2013) studied the relationship between inflation and economic growth in Ethiopia. The study used a quarterly dataset from 1992Q1 to 2010Q4. The study applied Engle-Granger and Johansen co-integration tests and determine if there is a long-run relationship between inflation and economic growth. The study found that estimated threshold model suggests 10% as an optimal level of inflation level. Quartey (2010) investigated the revenue maximizing and the 'growth maximizing' rate of inflation for Ghana. The results of the study revealed that the turning point or growth maximizing rate of inflation is 22.2% in the long run. In addition, Marbuah (2010) investigated the nexus between inflation and growth in Ghana to determine the optimal inflation threshold. The study used the basic OLS and Two-stage least squares to determine the threshold between inflation and economic growth. The results of the study indicated that the threshold of inflation rate was between 6% and 10%.

Younus (2012) explored the inflation-economic growth linkage in Bangladesh for the period 1976 to 2012. The study used a non-liner OLS approach and the results indicated that the optimal level of inflation ranged between 7% and 8%. Inflation rate beyond 8% is detrimental to economic growth. Furthermore, Biswas, Masuduzzaman and Siddique (2016) proclaimed that inflation and economic growth are the most crucial variables in macroeconomics. This authors study examined inflation-growth nexus empirically in Bangladesh using annual data for the period 1977 to 2015. The results of this study indicated that a threshold level of inflation

is 6.25%. This implies that inflation rate higher than that level have affects economic growth negatively. Sindano (2014) studied inflation and economic growth relationship and determine whether a threshold effect exists for conducive for economic growth in Namibia. The study adopted a quadratic model to investigate the threshold inflation in Namibia for the period 1980 to 2012. The results study indicated that the optimal level of inflation is 12%. Inflation rate above 12% is not conducive for economic growth in Namibia.

It is evident from the above empirical studies that inflation rate negatively affects economic performance. The empirical studies also confirmed the existence of the threshold effect. There are country specific studies such as Rutayisire (2013) and Makuria (2013) and panel data studies such as Vinayagathasan (2013) and Yabu and Kessy (2015) supporting the negative impact of inflation on economic growth. Empirical studies used mainly two econometric approaches to investigate inflation threshold effect on economic growth. These econometric approaches are non-liner and ordinary least squares. Most empirical studies focused on developing countries and predicted double-digit inflation threshold. This double-digit inflation threshold level of above 10% was estimated in countries such as Nigeria, Rwanda, Ethiopia, Ghana and Namibia. These results are consistent with those of Khan and Senhadji (2001) who indicated that developing countries should keep inflation between 11% and 12% in order to sustain positive economic growth.

3. Model specification

The study adopt the famous threshold model applied by various studies such as Khan and Senhadji (2000), Mubarik (2005), Nasir and Nawaz (2010). This study simplifies the build of the model by firstly concentrating on the variables of interest. Therefore, the simplified model is as follows:

$$\ln(RGDP_t) = a_0 + \beta_1 \ln(\pi_t) + \delta_t \quad (1)$$

Where $lnRGDP_t$ represents real GDP growth, π_t is the inflation rate and δ_t is the error term. An extra inflation variable is added to equation (1) in order to estimate the threshold level. The model is re-specified as follows:

$$\ln(RGDP_t) = a_0 + \beta_1(\pi_t) + \beta_2 D_i(\pi_t - \pi^*) + \delta_t \quad (2)$$

Where the notation D_i it represent the dummy variable for extra inflation, π^* is an expected threshold inflation. The value of an expected inflation is chosen arbitrarily for estimation purposes in ascending order to estimate the threshold model. The dummy variable takes the following categories,

$$D_i = \begin{cases} 1, if\ \pi_t > \pi^* \\ 0, if\ \pi_t \leq \pi^* \end{cases} \quad i = 1 \ldots N; t = 1 \ldots T \quad (3)$$

The term $D_i = 1$ represents inflation above the threshold level, whereas $D_i = 0$ indicates otherwise. When the term $D_i = 1$ is introduced in equation (2), it is therefore re-specified as follows:

$$\ln(RGDP_t) = a_0 + \beta_1(\pi_t) + \beta_2(\pi_t - \pi^*) + \delta_t \quad (4)$$

Therefore equation (4) indicates that the effect of inflation and extra inflation on output growth are represented by β_1 and β_2. The effect of inflation on output growth is given by β_1 if the country is faced by less or equal to threshold inflation and $\beta_1 + \beta_2$ when the country experience higher inflation rate. Furthermore, equation (4) can be re-arranged to incorporate the control variables as follows:

$$\ln(RGDP_t) = a_0 + \beta_1(\pi_t) + \beta_2(\pi_t - \pi^*) + \beta_3 X_t + \delta_t \quad (5)$$

Where X_t represents the control variables. This study uses variable such as population growth (lnpop). According to Solow (1956) an increase in the population growth will increase the amount of labor and thus both the absolute level of output and the steady state output growth rate. Therefore, there is an expected positive impact of population growth as a supply to labour force which will eventually have a positive impact to output growth. Investment growth (lninv) was also incorporated as one of the control variable. According to Salai-i-Martin (1997) investment plays an important role in accelerating economic growth.

4. Methodology and data

To estimate equation (5) and determine the optimum level of inflation in Swaziland, univariate characteristics of the variables need to be established. It is important to test whether the variables are stationary or non-stationary. The current study uses the famous unit root test which is augmented Dickey-Fuller developed by Dickey and Fuller (1970). Therefore, after determining the order of intergration then the study applies the handy tests such as correlation coefficient and causality test between the variables of interest. The purpose for application of correlations is to determine if there is high correlation which might imply the possibility of multicollinerity. The data used in this study is given in Table 1 below and they are all online downloaded dataset.

Table 1: Variables description and source

Abbreviation	Variable description	Source
$RGDP_t$	Real GDP (constant 2000 US$)	International Monetary fund, *World Economic Outlook Database*
$\ln(POP_t)$	Population	World Bank , dataset African *Development Indicators (ADI)*
$\ln(INV_t)$	Total investment	International Monetary fund, World Economic Outlook Database
$\ln(INF_t)$	Inflation, average consumer prices (Index)	International Monetary fund, *World Economic Outlook Database*

The study adopts linear OLS to estimate the optimal threshold level of inflation on growth. The value of an expected inflation, which is the lag length (k), is selected arbitrarily for the

estimation. The optimal point is determined by finding the lag that minimizes the residual sum of squares (RSS). According to Khan and Senhadji (2000) inflation is not an exogenous variable in the growth-inflation model, and suggested that the estimated parameters may be biased. The study also adopts the 2SLS to check whether there are possibility of specification bias in estimating equation (5). In both estimations of OLS and 2SLS were subject to diagnostic tests to certify any violation of linear assumptions.

4. Estimation results

Table 2 presents the ADF unit root results for all the variables incorporated in the study at levels and first difference.

Table 2: ADF unit root results

Variable	Model	ADF t-statistics	p-value
$RGDP_t$	Intercept	-1.620	0.460
	Trend and Intercept	-4.124	0.014**
$\ln(POP_t)$	Intercept	-3.694	0.008**
	Trend and Intercept	-1.196	0.895
$\ln(INV_t)$	Intercept	-1.299	0.618
	Trend and Intercept	-1.741	0.710
$\ln(INF_t)$	Intercept	-3.223	0.027**
	Trend and Intercept	-4.566	0.004***
$RGDP_t$	Intercept	-4.021	0.004**
	Trend and Intercept	-4.067	0.016**
$\Delta\ln(POP_t)$	Intercept	-4.267	0.002**
	Trend and Intercept	-5.430	0.000***
$\Delta\ln(INV_t)$	Intercept	-5.952	0.000***
	Trend and Intercept	-5.899	0.000***
$\Delta\ln(INF_t)$	Intercept	-7.534	0.000***
	Trend and Intercept	-7.428	0.000***

Notes:*/**/*** statistically significant at 10%, 5%, 1%

The result indicates that at the p-value of 0.014 for RGDP variable is less than 5% significance level, meaning that the RGDP series is stationary in levels. At the p-value of 0.008 lnPOP is stationary at 1% significance level, therefore it is said that the series is intergrated of order zero or I(0). Based on the ADF unit root results investment is stationary at first difference, therefore it is said the variable is I(1). The results on using intercept, and testing on trend and intercept, the variable inflation is stationary at levels. The variable is statistically significant at 5% with the p-value of 0.027. Table 3 presents correlation analysis results for all the variables incorporated in the study.

Table 3: Correlation analysis results

	RGDP	LnPOP	LnINV	LnINF
RGDP	**1.000**	-0.294	0.089	0.234
LnPOP	-0.294	**1.000**	-0.288	-0.693
LnINV	0.089	-0.288	**1.000**	0.208
LnINF	0.234	-0.693	0.208	**1.000**

Table 3 presents the correlation matrix of the variables. It shows that there is a positive correlation relation between RGDP and LNINV with a coefficient of 0.089. The correlation correlation between RGDP and LNINF is also positive. However, the correlation between RGDP and LNPOP the is negative. The variables LNINV and LNINF have a negative correlation with LNPOP. Table 4 present Pairwise Granger Causality results for real GDP and inflation as the variables of interest in the study.

Table 4: Pairwise Granger Causality results

Null Hypothesis:	Obs	F-Statistic	P-value
LnINF does not Granger Cause RGDP	35	4.992	0.032**
RGDP does not Granger Cause LnINF		0.197	0.659

Notes:*/**/*** statistically significant at 10%, 5%, 1%

The study used Akaike Information Criteria (AIC) and Schwarz information criterion (SIC) to select the optimum lag length. Therefore, the criterions selected 1 as the optimum lag length used to determine Granger causality test. The test results indicates that based on the p-value the study reject the null hypothesis that inflation does not Granger Causes output growth, as p value is 0.032. This implies that causality runs from inflation to output growth, which is statistically significant at 5%. Alternatively, the study fail to reject the null hypothesis that output growth does not Granger Causes inflation. In conclusion, this causality result implies that there is unidirectional causality running only from inflation to output growth.

Table 5: OLS threshold estimation results
Dependent variable: RGDP

Variables	Threshold level (%)	coefficient	t-statistics	RSS
LOGPOP		-4.092	-0.730	482.200
LOGINV		-0.243	-0.181	
LOGINF	1	10.943	0.833	
LOGINF-1		-8.302	-0.807	
C		-2.227	-0.271	
LOGPOP		-5.574	-1.041	492.344
LOGINV		0.029	0.021	
LOGINF	2	0.236	0.018	
LOGINF-2		0.149	0.015	
C		3.036	0.272	
LOGPOP		-5.567	-1.040	492.323
LOGINV		0.024	0.018	
LOGINF	3	0.259	0.055	
LOGINF-3		0.114	0.038	
C		3.090	0.417	

LOGPOP		-4.985	-0.934	481.346
LOGINV		-0.510	-0.351	
LOGINF	4	-2.760	-0.661	
LOGINF-4		2.128	0.841	
C		8.367	1.002	
LOGPOP		-4.895	-4.895	488.176
LOGINV		-0.154	-0.154	
LOGINF	5	-0.583	-0.583	
LOGINF-5		0.639	0.639	
C		4.967	4.967	
LOGPOP		-4.894	-0.907	484.692
LOGINV		-0.143	-0.107	
LOGINF	6	-0.545	-0.243	
LOGINF-6		0.624	0.699	
C		5.011	0.827	
LOGPOP		-5.314	-0.963	491.778
LOGINV		0.057	0.043	
LOGINF	7	0.189	0.086	
LOGINF-7		0.171	0.189	
C		3.224	0.578	
LOGPOP		-4.683	-0.842	487.447
LOGINV		0.092	0.070	
LOGINF	8	-0.077	-0.039	
LOGINF-8		0.456	0.558	
C		3.581	0.662	
LOGPOP		-4.087	-0.744	478.044
LOGINV		-0.087	-0.067	
LOGINF	9	-1.197	-0.492	
LOGINF-9		1.473	0.963	
C		5.889	0.970	
LOGPOP		-4.213	-0.789	468.886
LOGINV		-0.054	-0.042	
LOGINF	10	-1.323	-0.593	
LOGINF-10		1.780	1.245	
C		6.089	1.056	
LOGPOP		-3.978	-0.732	473.103
LOGINV		0.070	0.054	
LOGINF	11	-0.560	-0.287	
LOGINF-11		1.450	1.122	
C		4.496	0.836	
LOGPOP		-8.579	-0.718	**228.080****
LOGINV		-11.101	-1.690	
LOGINF	**12**	-1.031	-0.075	
LOGINF-12		0.010	0.006	
C		42.099	1.320	
LOGPOP		-4.286	-0.758	485.423
LOGINV		-0.070	-0.053	
LOGINF	13	-1.887	-0.483	
LOGINF-13		0.308	0.664	
C		9.268	0.847	

Notes:*/**/*** statistically significant at 10%, 5%, 1%

** RSS at minimum value

Table 5 above shows the result of estimating the optimal threshold level of inflation for Swaziland. Following the previous studies the threshold level is determined where RSS is minimized and R-squared is maximized which is at 12% level. At this level it means that if Swaziland inflation level is beyond 12%, this will negatively shock output growth by -1.02% = (-1.031397 + 0.010438). In addition, the estimation of an optimal threshold level is also illustrated in Figure 2. The results shows the optimal point at the level that minimize RSS. The figure was computed measuring threshold level on the horizontal axis and RSS on the vertical axis. Therefore, it is clearly indicated that the threshold level occurs where RSS is at its minimum. The study also applied the diagnostic tests for only the equation that provides an optimal inflation level. However, only few tests were conducted which are normality, no serial correlation and no heteroscedasticity (see Appendix 1). All the test carried out satisfied all liner regression assumptions.

Figure 2: The value of k versus the residual sum of squares (RSS)

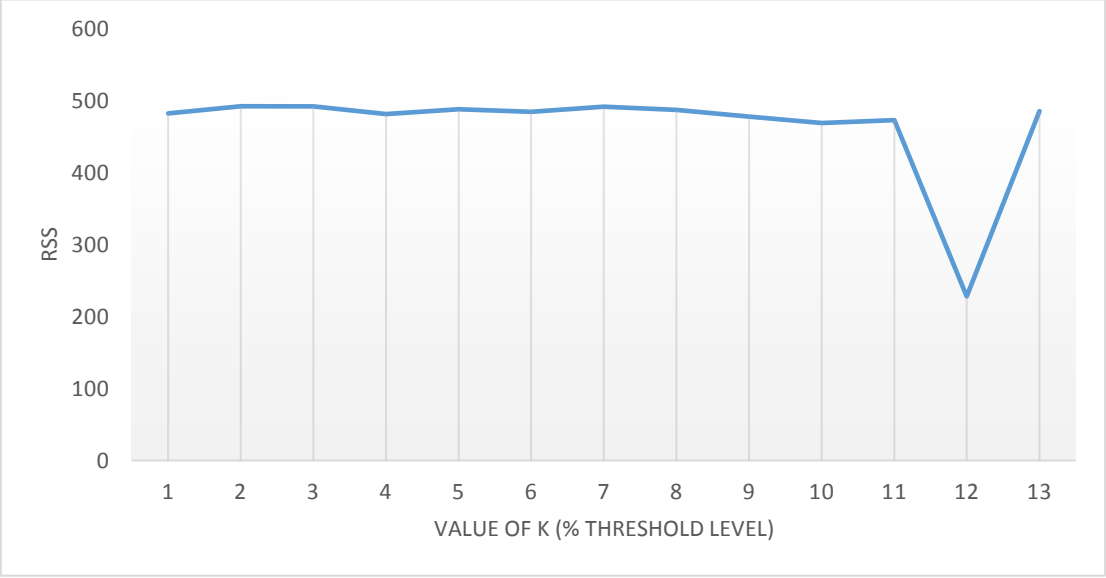


Table 6: 2SLS threshold estimation results
Dependent variable: RGDP

Variables	Threshold Level (%)	coefficient	t-statistics	RSS
LOGPOP	1	-0.823	-0.021	642.521
LOGINV		-1.645	-0.218	
LOGINF		70.142	0.249	
LOGINF-1		-55.198	-0.248	
C		-31.174	-0.227	
LOGPOP	2	-9.801	-0.500	5426.712
LOGINV		-4.654	-0.082	
LOGINF		-224.773	-0.085	
LOGINF-2		175.535	0.085	
C		176.304	0.087	
LOGPOP	3	-3.270	-0.022	16716.680
LOGINV		-7.468	-0.047	
LOGINF		-138.185	-0.048	
LOGINF-3		94.020	0.048	
C		169.194	0.049	
LOGPOP	4	-7.629	-0.733	452.589
LOGINV		-1.863	-0.265	
LOGINF		-11.667	-0.290	
LOGINF-4		7.967	0.296	
C		23.357	0.336	
LOGPOP	5	-1.046	-0.023	932.422
LOGINV		-2.160	-0.187	
LOGINF		-12.162	-0.202	
LOGINF-5		7.876	0.206	
C		28.446	0.229	
LOGPOP	6	-7.756	-0.817	404.676
LOGINV		-0.446	-0.190	
LOGINF		-3.205	-0.287	
LOGINF-6		2.218	0.313	
C		10.393	0.423	
LOGPOP	7	-3.200	-0.100	772.053
LOGINV		0.893	0.252	
LOGINF		-6.582	-0.218	
LOGINF-7		4.909	0.227	
C		12.428	0.290	
LOGPOP	8	19.501	0.053	5898.422
LOGINV		2.284	0.088	
LOGINF		-17.424	-0.080	
LOGINF-8		15.936	0.082	
C		26.995	0.091	
LOGPOP	9	-36.340	-0.105	6976.642
LOGINV		2.504	0.080	
LOGINF		33.441	0.076	
LOGINF-9		-29.937	-0.075	
C		-58.094	-0.072	
LOGPOP	10	-14.040	-0.767	831.083
LOGINV		0.400	0.196	
LOGINF		5.910	0.220	
LOGINF-10		-5.843	-0.213	
C		-7.296	-0.150	
LOGPOP	11	-5.942	-0.422	370.526
LOGINV		0.375	0.289	
LOGINF		-3.505	-0.303	
LOGINF-11		5.426	0.327	
C		8.841	0.468	
LOGPOP	**12**	-12.536	-0.511	**175.064** ***
LOGINV		0.248	0.013	
LOGINF		-21.383	-0.411	
LOGINF-12		2.789	0.350	
C		61.490	0.665	

LOGPOP	13	13.665	0.067	2863.406
LOGINV		-1.883	-0.105	
LOGINF		-48.179	-0.117	
LOGINF-13		6.428	0.117	
C		135.940	0.120	

Notes:*/**/*** statistically significant at 10%, 5%, 1%
** RSS at minimum value
Instrument specification: RGDP(-1) LOGPOP LOGINV LOGINF

Table 6 present the results for 2SLS. To examine the robustness of the estimated inflation threshold level this study re-estimate equation (5) for the period 1980 to 2015. The purpose of estimating 2SLS is in order to avoid possible specification bias of estimations. Similarly, results from 2SLS are consistent with those of OLS estimation. It can be observed in the table that the optimal threshold level is 12%, which is determined where RSS is at minimal point. At this level it means that if Swaziland inflation level is beyond 12%, it will negatively impact economic growth by -18.59% = (2.789 - 21.383). The study also applied the diagnostic tests for only the equation that provides an optimal inflation level. However, only few tests were conducted (see Appendix 2). All the test carried out satisfied the assumptions of classical liner regression.

5. Conclusion

The main objective of this study was to estimate optimal threshold effect of inflation in Swaziland. Firstly, the study performed the preliminary analysis such as unit root testing, correlation analysis and pairwise granger causality analysis. The causality results indicated that causality is running from inflation to economic growth. The study used liner approach of OLS and 2SLS for the period 1980 to 2015 to investigate the threshold between inflation and economic growth. In application of OLS the study found that the optimal threshold point is 12%. It shows that any point beyond this level will impair economic growth by 1.02%. Similar

robustness results were also attained in applying 2SLS method, which indicates negative inflation effect beyond threshold point by 18.5%. In both estimation techniques, they were subject to diagnostic tests and results shown no sign of violation of liner regression assumptions. The determination of threshold level of 12% is consistent with work done by Mkhatshwa, Tijani and Masuku (2015). In addition, this optimal threshold of 12% was relatively estimated by the study of Khan and Senhadji (2000) for developing countries.

These findings on Swaziland economy may have crucial implications for monetary policy makers in terms of keeping inflation below the threshold level point to sustain a positive economic growth in the long run. The recommendation to monetary policy makers in Swaziland is to carefully reconsider the monitoring of inflation for Swaziland, which is directly driven by South African Reserve Bank (SARB) authorities through Common Monetary Area (CMA) agreement. The target for SARB is to sustain inflation between 3% and 6%, hence the upper band 6% is if far low compared to estimated 12% for conducive economic growth for Swaziland.

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Appendix 1: OLS estimation diagnostic test results

Diagnostic Test	Test statistics (p-value)	conclusion
Normality *(Jarqua-Bera test)*	0.357 (0.836)	Residual are normally distributed
Serial correlation *(Breusch-Godfrey LM Test)*	1.477 (0.477)	No serial correlation
Heteroscedasticity *(Glejser test)*	5.959 (0.202)	No heteroscedasticity

Appendix 2: 2SLS estimation diagnostic test results

Diagnostic Test	Test statistics (p-value)	conclusion
Normality *(Jarqua-Bera test)*	0.578 (0.748)	Residual are normally distributed
Serial correlation *(Breusch-Godfrey LM Test)*	1.521 (0.467)	No serial correlation
Heteroscedasticity *(Glejser test)*	2.344 (0.672)	No heteroscedasticity