Dynamic Impact of Money Supply on Economic Growth in South Africa. An ARDL Approach

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DYNAMIC IMPACT OF MONEY SUPPLY ON ECONOMIC GROWTH IN SOUTH AFRICA: AN ARDL APPROACH

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ABSTRACT: This study investigates the dynamic impact of broad money supply (m3) on economic growth (GDP) per capita in South Africa using time-series data from 1980 to 2016. The study has employed the autoregressive distributed lag (ARDL)-bounds testing approach to cointegration and error correction model to investigate the impact of m3 on GDP per capita. The model is specified with four macroeconomics variables, namely, Gross Domestic Product (GDP) per capita, Broad money supply (M3), Interest rate (INT), Inflation rate (INF). The findings reveal that there is statistically significant positive relationship between money supply and economic growth both in short run and long run. The government of South Africa should maintain consistency and follow "the Taylor[1] rule" to allow money supply to increase at a steady rate keeping pace with the economic growth. In respect to such rule will help South Africa Reserve Bank to avoid the inefficiencies that caused by execution of discretionary policy.

Keywords: Economic growth; Money supply; Inflation rate; Interest rate; Autoregressive Distributed Lag (ARDL).

JEL Classification Code: B22; C22; E51; E52; E58; O40

[1] Taylor rule is a reduced form approximation of the responsiveness of the nominal interest rate, as set by central bank, to changes in inflation, output, or other economic condition.

1. Introduction

The impact of money supply on economic growth (GDP) per capita has received little coverage in the literature of South African context. Most of the studies on the similar topic are focused in other countries. Yet, it is equally significant to establish the impact of money supply on economic growth in South Africa for policy makers to effectively harness and augment economic growth.

The link between money supply and output has been getting increasing attention in recent times for the importance role it plays in economic growth in the emerging and industrialized economies (Hussan and Haque, 2017). Some Keynesians think that "money does not matter", hence irrelevant to influence economic growth, while in the other hand, some monetarists believe that "money does matter". However, the new Keynesians argue that in the short-run, changes in the money supply seem to affect the real variables like GDP and employment levels because of price-rigidity (Price-stickiness) and imperfect information flow in the market. (Hussan *et al*. 2017). Steve (1997) and Domigo (2001), explain that there may not be possibility of economic growth without an appropriate level of money supply, credit and appropriate financial conditions and general.

The South African economy has undergone a substantial transformation since the advent of democracy[2]. It recorded an average rate of economic growth of 3.3 % per annum in real terms over the period 1994 to 2012, a remarkable improvement on the 1.4% average annual growth registered during the period 1980 to 1993. However, the pace of growth fell somewhat short of the 3.6% average recorded by the world economy[3]. South Africa's gross domestic product by 2012 was 77% larger in real term relative to 1994, with the corresponding increase for the global economy having been 90%. On per capita basis, the country's real GDP was 31% higher by the end of the period. (Industry Development Corporation, 2013). Currently in South Africa the strongest growth rate is with agriculture, forestry and fishing making the largest upward contribution, namely field crops and horticultural products. GDP growth rate in South Africa

[2] South Africans also elect provincial legislatures which govern each of the country's nine provinces. Since the end of apartheid in 1994 the African National Congress (ANC) has dominated South Africa's politics.

[3] The world economy or global economy is the economy of the world, considered as the international exchange of goods and services that is expressed in monetary units of account (money).

average 2.84% from 1993 until 2017, reaching an all time of 7.60% in the fourth quarter of 1994 and a record low of -6.10% in the first quarter of 2009[4]. On the other side, the broad money supply (m3) in South Africa increased to R3 240 868 million in July from R3 206 208 million in June of 2017. Money supply in South Africa averaged to R6464434.84 million from 1965 until 2017, reaching an all-time high of R3 240 868 million in July of 2017 and a record low of R4796 million in March of 1965[5].

Given the critical role money supply plays in pursuit of an economic growth, this study, therefore seeks to investigate the dynamic impact of broad money supply on economic growth with Autoregressive Distribution Lag (ARDL) approach to cointegration in South Africa during 1980 to 2016. The model is specified with four macroeconomics variables, namely, Gross Domestic Product (GDP) per capita, Broad money supply (M3), Interest rate (INT) and Inflation rate (INF).

The rest of the paper is set out as follows: Section two provides a brief review of literature; Section three outlines estimation techniques. The fourth section presents the results and analysis, while the fifth section concludes the study.

[4] https://tradingeconomics.com/south-africa/gdp-growth

[5] https://tradingeconomics.com/south-africa/gdp-growth

2. Empirical Literature Review

The literature on the dynamic impact of money supply and economic growth is still at the nascent stage in South Africa. Of the few studies that have attempted to analyze relationship between money supply and economic growth, the results are mixed. Some studies have found positive relationship between money supply and economic growth, while others have found insignificant relationship between these variables.

Hussain and Haque (2017), researched about the empirical analysis of the relationship between money supply and per capita GDP growth rate for Bangladesh, using vector error correction model (VECM) model. They ascertain that the money supply has significant role on the growth rate. The same results are proven by other researchers. Like Chaitipa, Chokethaworna, Chaiboonsrib and Khounkhalaxc (2015), investigated the money supply influence on economic growth for Authorized Economic Operators (AEO) open region in the period 1995-2013, using Autoregressive Distribution Lag (ARDL) model. They found money supply is associated with economic growth. Ogunmuyiwa and Ekone (2010), looked between money supply and economic growth for Nigeria, employed error correction model over the period 1920-2006. The results of their study depicts that money supply is positively related to growth. Another research, focused on money supply, inflation and economic growth (Babatude and Shuaibu, 2011). They found positive and significant relationship between money supply and economic growth for Nigeria between 1975 and 2008 and employed ARDL model. Chude and Chude (2016), also research the impact of broad money supply and economic growth for Nigeria during 1987 to 2010 and they used ARDL model, their finding showed money supply and gross domestic product are closely related. Mohammad, Wasti and Hussain (2009), investigated an empirical investigation between money supply, government expenditure, output and price for Pakistan for the period of 1977 to 2007, the econometrics model used was Johanson cointegration model. They found that money supply (m2) is positively impact on economic growth. Furthermore, Hameed and Amen (2011), investigated the impact of monetary policy on gross domestic product (GDP), for Pakistan and they found growth in money supply greatly affects GDP. Ihsan and Anjum (2013) examined the impact of supply (m2) and GDP for Pakistan and they found money supply is affected by GDP.

Zapodeanu and Cociuba (2010) investigated linking money supply with the gross domestic product for Romania over 10 year's period, using Engle-Granger and ARIMA model. They ascertain money supply and gross domestic product are in a close relationship. Maitra (2011) investigated the anticipated money, unanticipated money and output variation for Singapore during 1971 to 1972, using cointegration model. They found out money supply and output are cointegrated. Aslam (2016) also investigated impact of money supply on economic for Sri Lanka over the period 1959-2013, employed multivariate econometrics variable. He found that money supply has kept positive impact on the economic growth.

On the other hand, there are few studies found statistical insignificant and negative impact between money supply and economic growth. These studies are Adusei (2013) investigated financial development and economic growth for Ghana over the period 1971-2010, employed Fully Modified Ordinary Least Squared (FMOLS). They found financial development (including money supply) undermines economic growth. These results were proven correct by other few studies. Gatawa, Abdulgafar and Olarinde (2017), investigated the impact of money supply, inflation on economic growth for Nigeria in the period 1973-2013 and they used VECM. Their findings showed broad money supply and interest were negatively related to economic growth. Another study attest on the same result was the paper of Ihsan and Anjum (2013) examined the impact of money supply (m2) on GDP for Pakistan between 2000 and 2011, used economic indicators and they found statistically insignificant and negative impact of money supply on economic growth. And lastly, Ehigiamusoe (2013) researched about the link between money markets and economic growth for Nigeria over the period 1980-2012, employed VECM. He ascertains the link between the money market and real sector of the economy remains very weak. Table 1 Summarises the studies that have investigated the impact of money supply on economic growth and their findings.

Table 1: Summary of Empirical Studies on the Impact of M3 on GDP.

Author(s)	**Title**	**Region/ Country**	**Impact**
Hussain and M. Haque (2017).	Empirical of the relationship between money supply and per	Bangladesh.	Money supply has important on the growth rate.

	capita GDP growth rate.		
Chaitipa. *et al*.(2015).	Money supply influence on economic growth.	AEO open region.	Money supply was associated with economic growth.
Babatunde, *et al.* (2011).	Money supply, Inflation and economic growth.	Nigeria.	Positive and significant relationship between money supply and economic
Chude, *et al.* (2016).	Impact of broad money supply on economic growth.	Nigeria.	Money supply and gross domestic product are closely related.
Mohammad, *et al*. (2009).	An empirical investigation between money supply; government expenditure; output and prices.	Pakistan.	Money supply (m2) is positively impact on economic growth.
Hameed, *et al.* (2011).	Impact of monetary policy on gross domestic product (GDP).	Pakistan.	Growth in money supply greatly affects GDP.
Ihsan, *et al.* (2013).	Impact supply (m2) on GDP.	Pakistan.	Statistically insignificant and negative relationship between money supply and economic growth.
Aslam (2011).	Impact of money	Sri Lanka.	Money supply has

	supply on economic growth.		kept positive impact on the economic growth.
Zapodeanu, *et al*. (2010)	Linking money supply with the Gross Domestic Product.	Romania.	Money supply and gross domestic product are in a close relationship.
Maitra, (2011).	Anticipated money, unanticipated money and output variation.	Singapore.	Money supply and output are cointegrated.
Adusei, *et al*. (2013)	Financial development and economic growth	Ghana	Financial development undermines economic growth.
Ehigiamusoe, (2013).	The link between money market and economic growth.	Nigeria.	The link between money market and real sector of the economy remain very weak.
Gatawa, *et al*. (2017).	Impact of money supply and inflation on economic growth.	Nigeria.	Broad money supply and interest rate were negatively related to economic growth.

3. Estimation Techniques

This study is built on the ARDL – bounds test approach to cointegration. The ARDL approach has been designated for many outstanding benefits. The ARDL technique utilises a single reduced form of equation to examine the cointegration of the variables as opposed to the conventional Johansen test that employs a system of equation. Another benefit, it is robust in

small sample (Odhiambo, 2009a, Solarin and Shahbaz, 2013). Whereas, other approaches to cointegration have a restrictive assumption concerning the other of integration (Pesaran *et al.,* 2001: 290; Solarin and Shahbaz, 2013). Another advantage of using the ARDL approach to cointegration is that it does not require the underlying variables to be integrated of similar order, for example, integrated of order zero *I(O),* integration of order one *I(1)* or fractionally, for it to be applicable. It also provides unbiased estimates of the long- run model, even in cases where some variables are endogenous (Odhiambo, 2009a). Lastly, it does not rely on the properties of unit root dataset. Given these advantages, the study employed the ARDL bound testing approach to cointegration. To ascertain the long run relationship (i.e cointegration), the null hypothesis is tested against its counterparts (i.e alternative hypothesis of cointegration). The computed F-statistic is compared to the critical values provided by Pesaran *et al.* (2001). When the F-statistics is greater than the Critical value (see Pesaran, 2001:230), we reject the null hypothesis of no cointegration. On the other hand, when the F-statistics is less than critical value lower bound, we conclude there is no cointegration. However, when the F-statistics value is in between the upper and lower bound, the results are inconclusive.

Variables

The dependent variable is Gross Domestic Product (GDP) per capita at constant 2010 is used as an indicator for economic growth. Predictors variables are money supply (M3); Interest rate (INT) and Inflation rate (INF). Variable descriptive is given in the subsequent Table 2.

Table 2: Variable Definition

Variable	**Description**
M3	Broad Money supply
GDP	Gross Domestic Product per capita
INT	Interest rate
INF	Inflation rate

3.1 Cointegration

Following Odhiambo (2008) and Narayan and Smyth (2008), the ARDL-bounds specification for Model 1 are given Equation 1-4.

ARDL Specification for Model 1 (GDP, M3, INT and INF)

$$\Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta GDP_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta M3_{t-i} + \sum_{t=0}^{n} \alpha_3 \Delta INT_{t-i} + \sum_{t=0}^{n} \alpha_4 \Delta INF_{t-i} + \beta_1 GDP_{t-1} + \beta_2 M3_{t-1} + \beta_3 INT_{t-1} + \beta_4 INF_{t-1} + \mu_{1t} \dots\dots\dots\dots\dots\dots\dots (1)$$

$$\Delta M3_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta GDP_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta M3_{t-i} + \sum_{t=0}^{n} \alpha_3 \Delta INT_{t-i} + \sum_{t=0}^{n} \alpha_4 \Delta INF_{t-1} + \beta_1 GDP_{t-1} + \beta_2 M3_{t-1} + \beta_3 INT_{t-1} + \beta_4 INF_{t-1} + \mu_{2t} \dots\dots\dots\dots\dots\dots\dots (2)$$

$$\Delta INT_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta GDP_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta M3_{t-i} + \sum_{t=0}^{n} \alpha_3 \Delta INT_{t-i} + \sum_{t=0}^{n} \alpha_4 \Delta INF_{t-1} + \beta_1 GDP_{t-1} + \beta_2 M3_{t-1} + \beta_3 INT_{t-1} + \beta_4 INF_{t-1} + \mu_{3t} \dots\dots\dots\dots\dots\dots\dots (3)$$

$$\Delta INF_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta GDP_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta M3_{t-i} + \sum_{t=0}^{n} \alpha_3 \Delta INT_{t-i} + \sum_{t=0}^{n} \alpha_4 \Delta INF_{t-1} + \beta_1 GDP_{t-1} + \beta_2 M3_{t-1} + \beta_3 INT_{t-1} + \beta_4 INF_{t-1} + \mu_{4t} \dots\dots\dots\dots\dots\dots\dots (4)$$

Where α_0 is a constant, $\alpha_1 - \alpha_4$ and $\beta_1 - \beta_4$ are regression coefficients, and $\mu_{1t} - \mu_{4t}$ are white noise error terms

3.2 Data Source

The study used time- series data from 1980 to 2016 to investigate the causal relationship between money supply and economic growth in South Africa. The data was obtained from the South

African Reserve Bank (SARB) and World Bank Development Indicators. Data analysis was done using Eviews 9.0.

4. Empirical Analysis

4.1 Unit root tests

First step we undertaken in the study was to check whether the variables have unit root or not. This was examined using the Augmented Dickey Fuller, Phillips and Perron and Dickey Fuller Generalised Least Squares unit root tests for the four variables. The results are illustrated in Table 3.

Table 3: Unit root tests

	Levels			**First difference**		
Variable	**ADF**	**PP**	**DF-GLS**	**ADF**	**PP**	**DF-GLS**
LGDP	-0.0354	-0.2472	-0.7289	-4.2473*	-4.2215**	-4.3510*
LMS	-1.5298	-0.5712	-1.9282	-3.3558***	-3.7155***	-3.2716***
INT	-2.7487	-2.7566	-2.8259	-6.8979*	-7.0838*	-5.9870*
INF	-1.1016	-2.8051	-2.8183	-4.9768*	-9.1120*	-3.2556**
,**,represent 1%,5% & 10% significance levels, respectively**						

Source: Authors' computation

The above results depicts that we cannot reject the null hypothesis of non-stationary *((I(1))* at levels for all the variables. Therefore, the variables were differenced once to be stationary *(I(0))* and that resulted to the null hypothesis to be rejected (i.e no stationary**).** In overall the variable are stationary in first difference. The results confirm the aptness of the ARDL-bounds test for cointegration and granger-causality analysis.

4.2 ARDL-Bound Test Approach to Cointegration

Having established that the variables are stationary, the next step is to examine the long run relationship between economic growth, money supply, interest rates and inflation. But before determining whether the variables are integrated, it is necessary to determine the optimal lag length. The Akaike information criterion is employed to find the optimal lag length and the results are illustrated in Table 4. The optimal lag length p*=3 is chosen (see Table 4).

Table 4: Selection order criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-79.75927	NA	0.001621	4.927016	5.106588	4.988255
1	110.2776	324.1806	5.56e-08	-5.310449	-4.412590*	-5.004253
2	132.3945	32.52478	4.27e-08	-5.670264	-4.054117	-5.119111
3	156.0967	29.27925*	3.03e-08*	-6.12337*	-3.788904	-5.327229*

Note: Authors' calculations

The ARDL bounds tests was employed to examine the existence of a long run relationship among the variables and the results are illustrated in Table 5. The Table 5 below depicts the evidence of the existence of the long run relationship (i.e cointegration) between money supply and economic growth. The F-statistics results of the function of the impact of money supply on economic growth shows cointegration (i.e F-statistics of 20.77 falls above the upper bound of critical value of 6.36 at 1 percent level of significance). We then infer that there is a long run relationship between money supply and economic growth in South Africa.

Table 5: Bound F-test for Cointegration

Predictor variable	Function		F-Statistic		Cointegration Results	
GDP	F(GDP|M3,INT,INF)		20.19***		Cointegrated	
M3	F(M3|GDP,INT,INF)		5.79**		Cointegrated	
INT	F(INT|GDP,M3,INF)		7.33***		Cointegrated	
INF	F(INF|GDP,M3,INF)		6.45***		Cointegrated	
Asymptotic Critical value						
Pesaran *et al.* (2001:300) critical values, Table: CI(iii) Case(III)	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	5.15	6.36	3.79	4.85	3.17	4.14

Note: *, ** and *** denote stationary at 10%, 5% and 1%significance levels respectively.

Long –Run Coefficients

Table 6: Long run results

Dependent Variable = LGDP			
Long Term Results			
Regressor	**Coefficients**	**Standard Error**	**T-statistics**
Constant	1.87	3.8618	0.4850
LMS	0.58*	0.3978	1.4653
INT	-0.055	0.1244	-0.4409
INF	-0.06**	0.0963	0.5772
R-squared	0.99		
Durbin Watson Stat	1.94		
Where *,**,***represent 1%,5% & 10% significance levels, respectively			

Source: Authors' calculations

The estimated coefficients suggest that money supply has a statistically significant positive effect on economic growth, which is in line with theoretical argument that money supply boosts economic growth. More specifically, the long run elasticity of money supply is 0.58, which implies that a 1% increase in money supply leads to about 0.58% increase in economic growth, ceteris paribus. The results coincide with the findings of (see Hussia, et al.(2017); Chaitip, et al. (2015); Ogunmuyiwa, *et al*.(2010); Babatude, et al.(2011); Chude, et al.(2016); Mohammad, et al.(2009); Hameed, et al.(2011); Ihsan, et al. (2013); Zapodeanu, et al. (2010); Maitra, (2011); Aslam, (2016)).

Short-Run Coefficients

Table 7 Short-run results

Regressor	**Coefficient**	**Standard error**	**T-statistics**
LMS	0.24*	0.0490	4.9118
INF	0.01	0.0005	3.1471
INT	-0.001	0.0005	-2.2927

ECM_{t-1}	-0.24*	0.0023	-10.7665
R^2	0.78		
D.W test	1.94		
* ,**,*** represent 1%,5% & 10% significance levels, respectively			

Source: Authors' calculation

The short run results are illustrated in Table 7. The results suggest that money supply has a positive and significant impact on economic growth. The results further suggested that inflation has a positive effect on economic growth but it is not significant at 5% level of significance. Lastly, interest rates have a negative but insignificant impact on economic growth in the short run.

Based on the results illustrated in Table 7, the estimated coefficient of the ECM_{t-1} is -0.24. Since the error correction term is negative and significant, this implies that the results support the existence of a long run between the variables. The results indicate that departure from long-term growth path due to a certain shock is adjusted by 24% each year.

Table 8 Short-run diagnostics

Short run diagnostics		
Test	**F-statistics**	**P-value**
Normality	1.1389	0.5658
Heteroskedasticity	0.8457	0.5601
Serial correlation	0.2452	0.7844

Source: Authors' calculation

The diagnostic tests results are illustrated in Table 8. It was validated that the error terms of the short run models are free of heteroscedasticity, have no serial correlation and are normally distributed. It was also discovered that the Durbin Watson statistics is greater than the R^2, which implies that the short run models are not spurious.

The stability of the long run parameters were tested using the cumulative sum of recursive residuals (CUSUM) and CUSUM of recursive squares (CUSUMQ). The results are presented in Figures 4.1 and 4.2 below. The results fail to reject the null hypothesis at 5 percent

level of significance because the plots of the tests fall within the critical limits. Therefore, it can be realised that our selected ARDL model is stable.

Figure 4.1 CUSUM

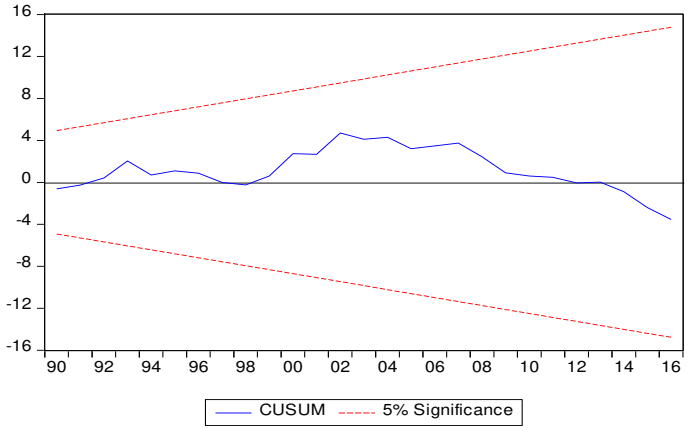
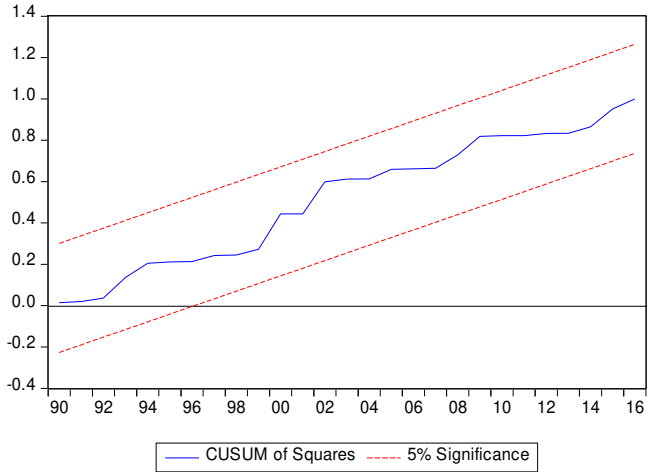


Figure 4.2 CUSUMQ Test



5. Conclusion

This paper has examined the dynamic impact of money supply (M3) on economic growth (GDP per capita) in South Africa using time-series data from 1980 to 2016. The study has employed the recently developed Autoregressive Distributed Lag (ARDL) modeling approach to estimate both the short and long run elasticities of the selected macroeconomics variables (i.e. Broad money supply (M3); Interest rate (INT; Inflation rate (INF) and Gross Domestic Product (GDP) per capita). The study results reveal that there is statistically significant positive relationship between money supply and economic growth both in short run and long run. These results shown by this study are proven by many other studies.

These results have a paramount importance in policy implication in South Africa. The authors of the paper came up with recommendations that would be of great importance in the monetary policy makers. The government of South Africa should maintain consistency and follow "the Taylor[6] rule" to allow money supply to increase at a steady rate keeping pace with the economic growth. In respect to such rule will help South Africa Reserve Bank to avoid the inefficiencies that caused by execution of discretionary policy. In addition to that, the government has to promote friendly and open agreement to attract short term and long term investment that will be quick to be converted into cash. In that respect the crises of unemployment and poverty would be alleviated in South Africa. Since this study shows very clear that money supply is a good vehicle to convey the economy of South African into the right direction, the government (monetary policy makers) should implement.

One limitation of this paper is that it has relied on data from the World Bank (for GDP per capita, INT, and INF) and South African Reserve Bank (for M3). Thus, the validity of the findings and conclusions is limited to the extent to which these data are plausible. We would, therefore, recommend a follow-up study using a dataset gathered by a different but equally reliable institution. In addition, our study has focused on South Africa one of the African country. It would, therefore, be advisable for future researchers to consider using our methodology to study other African countries. Notwithstanding these limitations, the paper makes a significant contribution to the monetary policy makers.

[6] Taylor rule is a reduced form approximation of the responsiveness of the nominal interest rate, as set by central bank, to changes in inflation, output, or other economic condition.

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