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IS SOUTH AFRICA'S INFLATION TARGET TOO PERSISTENT FOR MONETARY POLICY CONDUCT?

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ABSTRACT: Can the South African Reserve Bank's (SARB) substantially control inflation within their set target of 3-6 percent? We sought to investigate this phenomenon by examining multiple threshold effects in the persistence levels of quarterly aggregated inflation data collected between 2003 and 2014. To this end, we employ the three-regime threshold autoregressive (TAR) model of Hansen (2000). We favour this approach over other conventional linear econometric models as it permits us to test for varying persistency within the autoregressive (AR) components of the inflation process. Our empirical explorations reveal that the SARB's set target does indeed lie within a range in which inflation is found to be most persistent. Overall and more importantly, our results suggest that the SARB should either consider revising their set inflation target by redefining the inflation target range to accommodate higher inflation rates or the Reserve Bank should consider abandoning the inflation targeting regime altogether.

Keywords: Inflation persistence, TAR, Monetary Policy, South African Reserve Bank (SARB), Inflation Targeting, Developing Economy.

JEL Classification Code: C22, E30, E31, E52, E58.

1 INTRODUCTION

A substantial body of literature advocates on the pre-assumed advantages of inflation targeting as a superior framework for monetary policy in comparison to other policy alternatives (Levin et. al., 2004; Gurkaynak et. al., 2006; and Goncalves and Salles, 2006). One widely accredited view as to why inflation targeting has gained so many adherents is based upon the perception of monetary policy being unable to simultaneously attain capital mobility, a fixed exchange rate and independent monetary policy. This phenomenon is popularly referred to as a monetary policy 'tri-lemma' and implies that an open economy can achieve only two of the three stated goals at a given time (Zaidi, 2006). Following the Asian crisis in 1998, the International Monetary Fund (IMF) recommended monetary authorities worldwide to adopt a combination of free float exchange rates and inflation rate targets as a means of lessening the probability of a currency crisis while pursuing policy objectives focused on the stability in domestic prices (Ito, 2007). For the specific case of South Africa, financial liberalization and a diluted relationship between the growth in money supply, output growth and prices made previously employed monetary growth targets less useful as policy objectives (Levin et. al., 2004). Moreover, South Africa's financial integration on an internationally platform has resulted in high levels of international capital flows over the last couple of decades or so. This has made it extremely challenging for the SARB to gear monetary policy by targeting monetary aggregates, or by pegging an exchange rate without harming employment and output growth. In light of the aforementioned macroeconomic developments, inflation targets were therefore deemed as being the ideal monetary policy framework.

Within the design of an inflation targeting framework, Central Banks are not only concerned with stabilizing actual inflation around a pre-determined inflation range; but they are also challenged with selecting a pre-determined inflation rate which they could effectively control. It is thus crucial for Central Banks to select an optimal inflation target after conducting a rigorous and comprehensive analysis of inflation dynamics (Odhiambo, 2011). If policymakers, for instance, mistakenly adopt a specific optimal inflation target without a proper understanding of the dynamics of inflation persistence, then any prolonged financial instability associated with the inability to control inflation rates would be an outcome of chasing overambitious policy targets (Orphandes, 2001). By examining specific statistical properties of the autoregressive (AR) process of a univariate series of the inflation rate, policymakers can measure the extent to which the inflation rate is persistent. The underlying notion of highly persistent inflation process implies that monetary authorities do not have

sufficient control over the inflation rate, such that any shock to the inflation variable will result in disequilibrium from the long-run steady-state path. In the opposite case of a lowly persistent process, central banks can be deemed as exerting a controlling influence over the inflation rate since the time series reverts back to long-run equilibrium, even in the face of macroeconomic shocks.

From an academic perspective, a plethora of studies have sought to investigate persistence within inflation data either by adopting a single-country approach (Rangasamy, 2009, and Kang et. al., 2009) or through panel data methods (Kumar and Okimoto, 2007). And even more recently, an accumulating amount of empirical evidence has advocated for nonlinearity existing in the data generating process of the inflation variable. This observation holds true for both developing economies (Khadaroo, 2005 and Mourelle et. al., 2011, Arize and Malindretos, 2012) as well as industrialized countries (Cuestas and Harrison, 2010 and Zhou, 2013). The policy ramifications of nonlinear inflation dynamics are quite intriguing as they imply that the levels of persistence differ at various ranges of the inflation rate. For instance, Khadaroo (2005) employs Hansen's (1996) two-regime self-exciting threshold autoregressive (SETAR) model to investigate the threshold effects in the inflation process for Indian, Singaporean and South African consumer price index (CPI) data between the periods of 1976-2002. Inflation threshold estimates of 3.4%, -1.3% and 14% are obtained for India, Singapore and South Africa respectively. Above the defined inflation threshold point for South African data, the SARC is lower in comparison to inflation rates below this threshold. Conversely, for the cases of both Indian and Singaporean data, the SARC is lower below the established thresholds and turns higher above the threshold. In effect, the implications of the results obtained for South African data puts in question the effectiveness of the SARB's inflation target and whether the specified target of 3-6% creates an economic environment for desirably lower levels of persistence in the inflation process.

And yet it should be noted that the empirical analysis of Khadaroo (2005) was conducted for periods prior to the adoption of the inflation target mandate, a shortcoming which this study attempts to overcome. Our paper hence extends upon the work of Khadaroo (2005) by investigating threshold effects in the AR properties of the inflation process within the context of Hansen's (2000) three-regime TAR framework for aggregated and disaggregated measures of South African monthly inflation data collected between 2002:01-2014:05. One of the principle advantages of this model framework is that it enables us to

directly plug-in the 3 and 6 percent target zones as double inflation thresholds within the TAR model specification. Thereafter we are able to subjectively estimate the SARC of the TAR model for the range of 3-6 percent as well as being further enabled to identify whether persistence is lower or higher in regimes outside the 3-6 percent range. Hence the novelty of our contribution becomes apparent as we are able to directly assess whether the 3-6 inflation target range as set by the SARB indeed encompasses a highly persistence inflation range for both aggregated as well as disaggregated measures of inflation. Therefore, against this backdrop, we structure the remainder of the paper as follows. Section 2 is the literature review which is further divided into two sub sections. Section 3 outlines the empirical three-regime SETAR framework. Section 4 introduces the utilized inflation data and also presents our empirical findings; the paper is concluded in the fifth section of the paper in the form of associated policy implications derived from the empirical analysis.

2 *INFLATION TARGETING IN SOUTH AFRICA*

A dominant trend in the practice of monetary policy has been its dedication to price stability as well as Central Bank independence. Monetary authorities worldwide have undertaken these commitments, either by statutory mandates issued from their governments or by exercises of discretion granted to them by relevant monetary authorities. Amongst a host of other Central Banks, the South African Reserve Bank (SARB) has demonstrated its commitment to both price stability and Central Bank independence through the adoption of an 'inflation-targeting' regime. According to Epstein (2003), an inflation targeting framework is a neo-liberal approach to central banking in which monetary authorities attempt to; keep inflation at a defined low level; reduce central bank support for government deficits; help manage the country's integration into world trade and financial markets; and vigorously reduce the influence of democratic social and political forces on central bank policy. Other commentators, such as Mishkin and Schmidt-Hebbel (2001), have outlined the key elements of a 'full-fledged' inflation targeting regime, as consisting of an institutional commitment to price stability; in the absence of nominal anchors and fiscal dominance; yet dependent on policy instrument independence as well as on policy transparency and policy accountability. As an operative policy instrument for policy conduct in South Africa, the SARB has been granted, at its discretion, the manipulation of short-term nominal interest rates which it uses as a means of achieving a financial stable environment. In turn, a financially stable

environment has been explicitly defined by the SARB as inflation rates ranging between 3-6 percent. So even though financial stability may not exclusively be a panacea for overall economic development, it is highly recognized that without financial stability the sustainment of a conducive economic environment for growth cannot be attained (Swanepoel, 2004).

In February 2000, the former governor of the Reserve Bank, Tito Mboweni, announced the SARB's adoption of formal inflation targeting regime. The pre-announced inflation-target was set at a range of between 3 to 6 percent and this target was to be first met in 2002. The adoption of the inflation targeting (IT) framework has clearly strengthened the SARB's mandate which is primarily built upon four policy pillars namely; policy focus, policy co-ordination, transparency and accountability. Generally, these pillars contribute to the SARB's move away from the previously eclectic monetary policy frameworks. By outlaying an inflation target range, the SARB is granted greater flexibility when implementing monetary policy. Generally under an inflation targeting regime, a particular index must fall within the bands of a specific target range and within a specific time frame as determined by the Minister of Finance. The inflation objective is also publically announced and a clear commitment to achieve this objective is spelt out; thus helping to shape the public's inflation expectations. Ultimately, the forward-looking inflation targeting strategy helps planning as well as providing an anchor for expectations of future inflation to influence price and wage setting decisions (Naraidoo and Gupta, 2010). Moreover, the SARB has opted for a price index that is comprehensive in terms of item and geographical coverage. The chosen CPIX measure covers metropolitan and other urban areas where prices are surveyed, also ensuring a wide geographical coverage of price information as possible (Casteleijn, 1999). The 3-6 inflation target range was established by the government but only after consultation with the SARB and it is believed that the chosen target is not too narrow thus enhancing monetary policy credibility. All-in-all, the selected target demonstrates the Reserve Bank re-owned desire for the inflation process in the new millennium to move the country in a direction of price stability.

Nonetheless, disputes have risen as to the effectiveness of the current design of the inflation targeting regime. Two separate arguments have been put forward by academic researchers, on one hand, as well as by structuralist-based groups such as COSATU, on the other hand. The latter group argues for the complete abandonment of the inflation targeting regime in favour of alternative structural macroeconomic policies such as exchange rates

targets, unemployment targets and dual/mixed policy frameworks. This structuralist argument is that fundamental processes such as openness, political instability and tax policy play a large role in promoting economic growth in developing countries like South Africa as opposed to macroeconomic policy of price stability (Epstein, 2003). Conversely, a handful of research connoisseurs have not necessarily called for the abandonment of inflation targets, but rather advocate for a revision of the current inflation target to accommodate a wider target range. The argument put forth by group of academic connoisseurs is that a wider inflation target may be a more viable policy option for Reserve Bank. All in all, it is noteworthy that both groups commonly argue/contend that current monetary policy conduct in South Africa is too restrictive on the macroeconomy and ultimately such arguments place criticism on the price stabilization orthodox approach of the South African Reserve Bank (SARB) in its conduct of monetary policy. Henceforth, the presented criticism on the effectiveness of the adopted inflation-target regime can be empirically addressed on the basis of whether the current inflation target range set by the Reserve Bank does encompass an inflation range which is highly persistent.

3 STYLIZED FACTS OF INFLATION IN SOUTH AFRICA

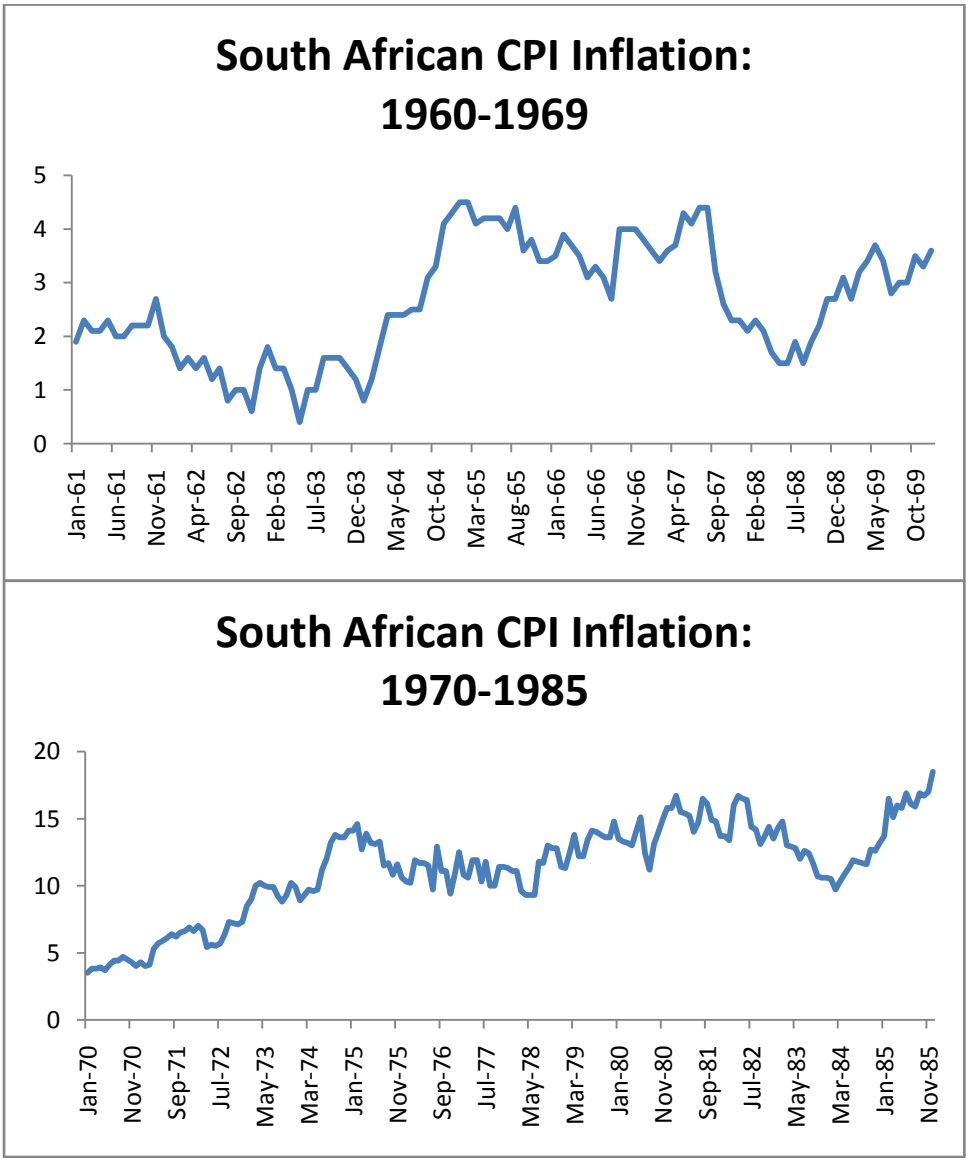
Nell (2000) succinctly summarizes South Africa's inflationary experiences into five distinct regimes which he conveniently classifies as; periods of low inflation (1960-1970); periods of accelerating inflation (1971-1985); high inflation periods[1] (1986-1993); single-digit inflation periods (1994-2001) and the post-inflation targeting era (2002-2014). Table 1 provides a summary of the CPI inflation rate descriptive statistics associated with these periods (whilst Figures 1-5 are the associated time series plots of these inflation periods).

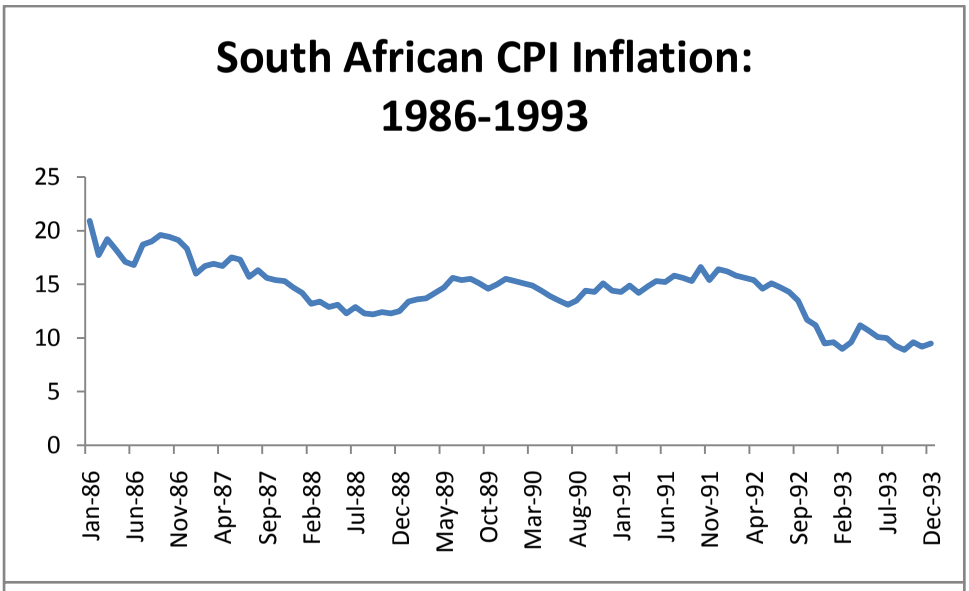
[1] In the original study of Nell (2000), the author categorizes 1986-1993 as a deflationary period. Due to the fact that a very high estimate of average inflation has been computed between these years, this study opts to classify it as a period of high inflation.

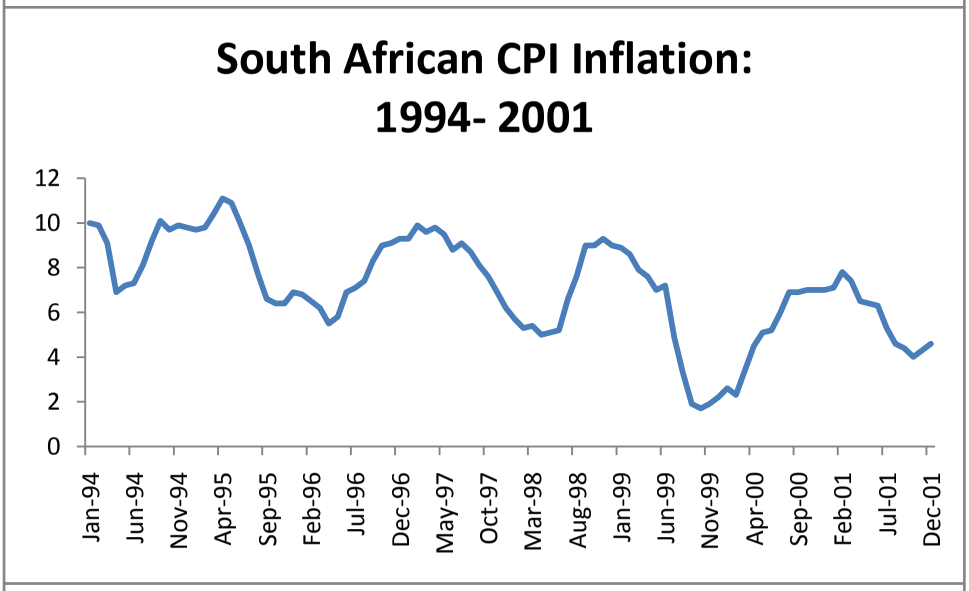
Table 1: Descriptive statistics of CPI inflation: 1960-2014

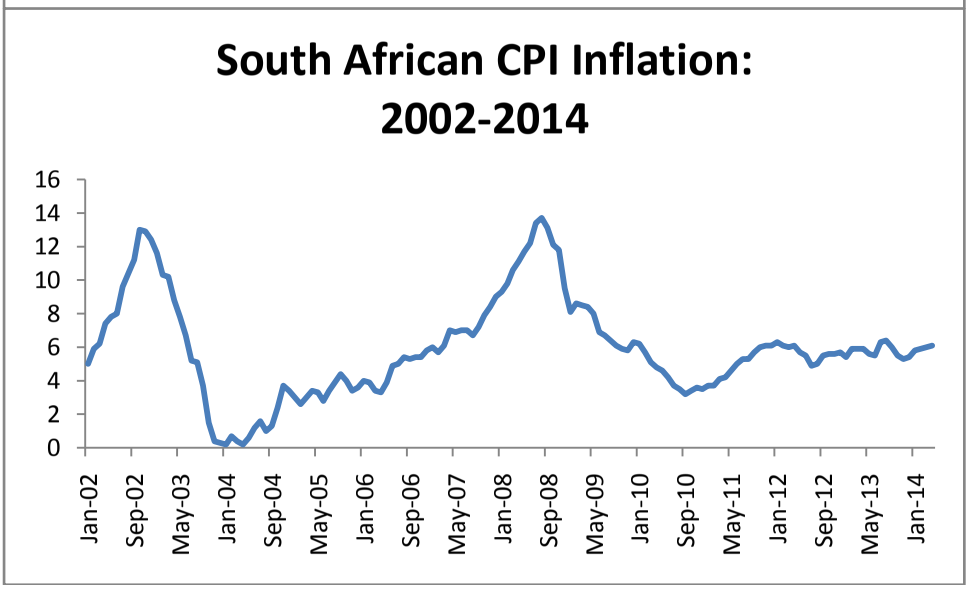
Date/period	Mean	minimum	1st quartile	Median	3rd quartile	Maximum
1960-1970	2.62	0.400	1.675	2.500	3.525	4.500
1971-1985	11.27	3.500	9.60	11.70	13.70	18.50
1986-1993	14.41	8.900	13.10	14.70	15.70	20.90
1994-2001	7.098	1.700	5.650	7.050	9.000	11.100
2002-2014	5.917	0.200	3.900	5.700	7.000	13.700

Source: Authors own calculation based on data obtained from the South African Reserve Bank (SARB) database.




South African CPI Inflation:
1986-1993
25
20
15
10
5
0
Jan-86
Jun-86
Nov-86
Apr-87
Sep-87
Feb-88
Jul-88
Dec-88
May-89
Oct-89
Mar-90
Aug-90
Jan-91
Jun-91
Nov-91
Apr-92
Sep-92
Feb-93
Jul-93
Dec-93


South African CPI Inflation:
1994- 2001
12
10
8
6
4
2
0
Jan-94
Jun-94
Nov-94
Apr-95
Sep-95
Feb-96
Jul-96
Dec-96
May-97
Oct-97
Mar-98
Aug-98
Jan-99
Jun-99
Nov-99
Apr-00
Sep-00
Feb-01
Jul-01
Dec-01


South African CPI Inflation:
2002-2014
16
14
12
10
8
6
4
2
0
Jan-02
Sep-02
May-03
Jan-04
Sep-04
May-05
Jan-06
Sep-06
May-07
Jan-08
Sep-08
May-09
Jan-10
Sep-10
May-11
Jan-12
Sep-12
May-13
Jan-14

The 1960's were characterized by periods of low inflation rates which coincided with inflation rates experienced by South Africa's industrialized trading partners. According to Nell (2000), exchange rate devaluations during the early 1970's and the oil price shock of 1973 and 1979 led to accelerating inflation in the 1970's. An increase in the gold price in 1979 and the legalisation of black trade unions in 1980 also contributed to high inflation rates experienced in the early 1980's (Akinboade et. al., 2002). Following the de Kock Commission's report in 1986, M3 money supply targets became the anchor of monetary policy conduct in South Africa. Concerning inflation in the 1980's and early 1990's, Luca (2006) points out that whilst South Africa's main trading partners experienced decreasing rates of inflation during this period, weaker monetary policy stance and political instability within the economy lead to higher inflation rates. Abolishment of trade sanctions, increased financial liberalization and political settlement contributed largely to the decline of inflation in the 1990's (Aron and Meullbauer, 2007). Casteleijn (2002) also highlights that resulting structural developments associated with the stabilizing of the economy weakened the correlation between money supply growth, inflation and output in the 1990's, thereby probing monetary authorities to question the use of monetary targets as policy guidelines.

Eventually in 2000, the South African Reserve Bank (SARB) announced its adoption of a formal inflation target framework with set targets of 3-6 percent which was then planned to be met in 2002. The post inflation targeting era has been characterized by a record low inflation rate of 0.21 percent in January 2004 to a peak of 13.7 percent in July 2008. The increasing trend of inflation experienced in the South African economy subsequent to adopting the IT framework can be attributed to a number of factors inclusive of rising food, oil and other commodity prices over a period of strong global demand and economic growth. Moreover, the sharp depreciation of local currency experienced from early 2006 to January 2009 further contributed to rising inflation transmitted through an increase in import prices. With the exception of these post-IT era supply shock episodes, inflation has since remained within single-digit figures and has been characterized by unprecedented fluctuations within and outside the target boundaries. Rationally speaking, it is easy to understand why the Reserve Bank choose a relatively low inflation target since high inflation can have an adverse effect on certain accounting measures and taxes, it negatively affects the poor, distorts relative prices and slightly discourages savings and investments, which tends to make economic decisions more difficult in the long run. But the Reserve Bank cannot seem to be controlling the inflation rate, not to mention keeping it within their target region. Currently

the inflation rate is at 6.60 percent, which is approximately 0.60 percent above the target ceiling. Within the 6 month period of observation, the inflation rate has been operating within the upper boundary of the inflation target and has not operated around the lower end of the target a few months prior to that observation. This basically stipulates that the Reserve Bank has barely managed to keep the inflation rate under control for a sustainable period of time; an observation which puts into question as to whether the SARB's inflation target range encompasses a highly persistent inflation range. Our paper empirically addresses this concern using a 3 regime TAR model introduced in the following section of our paper.

4 *EMPIRICAL CONSIDERATIONS*

Consider a univariate time series y_t whose data generating process evolves as a three-regime SETAR similarly to that documented in Hansen (2000):

$$y_t = \begin{cases} \varphi_{11}y_{t-1} + \varphi_{12}y_{t-2} + \varphi_{13}y_{t-3} + \cdots + \varphi_{1p}y_{t-p}I.(y_{t-1} < \lambda_1) \\ \varphi_{21}y_{t-1} + \varphi_{22}y_{t-2} + \varphi_{23}y_{t-3} + \cdots + \varphi_{2p}y_{t-p}I.(\lambda_1 < y_{t-1}) \leq \lambda_2) \\ \varphi_{31}y_{t-1} + \varphi_{32}y_{t-2} + \varphi_{33}y_{t-3} + \cdots + \varphi_{3p}y_{t-p}I.(y_{t-1} > \lambda_2) \end{cases} \quad (1)$$

Alternatively, equation (1) can be re-specified in the following compact regression specification:

$$y_t = \Omega_t(\lambda_1, \lambda_2) + \varepsilon_t \quad (2)$$

Where:

$$\Omega_t = (y_{t-1}, y_{t-2}, \dots, y_{t-p})$$
$$\Omega_t(\lambda_1, \lambda_2) = (\Omega_t I.(y_{t-1} < \lambda_1);\ \Omega_t I.(\lambda_1 < y_{t-1}) \leq \lambda_2);\ \Omega_t I.(y_{t-1} > \lambda_2))$$
$$\varphi_{1i} = \varphi_{11}, \varphi_{12}, \dots, \varphi_{1p}$$
$$\varphi_{2i} = \varphi_{21}, \varphi_{22}, \dots, \varphi_{2p}$$
$$\varphi_{3i} = \varphi_{31}, \varphi_{32}, \dots, \varphi_{3p}$$
$$\beta = (\varphi_{1i}, \varphi_{2i}, \varphi_{3i})$$

In referring to regression equations (1) and (2), the threshold variables (i.e. λ_1, λ_2) which govern the regime switching behaviour of the time series are ordered such that $\lambda_1 < \lambda_2$. Essentially, the SETAR model, as represented in equations (1) and (2), is piecewise econometric specification which allows the slope coefficients (φ_{1i}, φ_{2i}, φ_{3i}) to differ depending upon the values of λ_1 and λ_2. Since, in our case study, the threshold values are known a prior, as in Tong and Lim (1980), then the coefficient values of the regime slope coefficients can be directly estimated via ordinary least squares (OLS) yielding estimates of:

$$\hat{\beta}(\lambda_1,\lambda_2) = (\sum_{i=1}^{n} \Omega_t(\lambda_1,\lambda_2)\Omega_t(\lambda_1,\lambda_2)')^{-1}(\sum_{i=1}^{n} x_t(\lambda_1,\lambda_2)y_t \quad (3)$$

The regression residuals are extracted as:

$$\hat{\varepsilon}(\lambda_1,\lambda_2) = y_t - \Omega_t(\lambda_1,\lambda_2)'\hat{\beta}(\lambda_1,\lambda_2) \quad (4)$$

And the sample variance is defined as:

$$\hat{\sigma}_n^2(\lambda_1,\lambda_2) = \sum_{t=1}^{n} \frac{\hat{\varepsilon}(\lambda_1,\lambda_2)^2}{n-(k+m)} \quad (5)$$

For empirical purposes we re-specify the three-regime SETAR model by placing an inflation series (π_t) as the observable time series consisting of two known inflation thresholds of values 3 and 6, such that $\lambda_1 = 3$, $\lambda_2 = 6$. The resulting estimation SETAR regression can thus be depicted as follows:

$$\pi_t = (\sum_{j=1}^{p} a_k\pi_{t-k})_{I.(3\%>\pi_t)} + (\sum_{j=1}^{p} b_k\pi_{t-k})_{I.(3\%\leq\pi_t<6\%)} + (\sum_{j=1}^{p} c_k\pi_{t-k})_{I.(\pi_t>6\%)} \quad (6)$$

Conventionally, inflation persistence is measured as the SARC of each of the individual regimes of the SETAR process such that inflation persistence under the first regime is given by ($\rho_1 = \sum_{j=1}^{p} a_k$); whereas in the corridor regime persistence is measured as ($\rho_2 = \sum_{j=1}^{p} b_k$) and in the third regime as ($\rho_3 = \sum_{j=1}^{p} c_k$). Thereafter, the inflation process

within each of the regimes is considered or rendered as being persistent if it satisfies the condition ($\rho_i \geq 1$). As conveniently explained by Rangasamy (2009), when the SARC is above unity, then this implies that the series behaves as a non-mean reverting process which does not return back to its equilibrium path in the event of a shock to the variable. Conversely, when the SARC is found to be less than unity (i.e. $\rho_i < 1$), then shocks to inflation will dissipate and the time series will revert to its equilibrium level.

5 *EMPIRICAL ANALYSIS*

5.1 DATA EMPIRICAL

Our empirical dataset comprises of monthly data which has been collected from the SARB website for the periods of between 2003:01 to 2014:04; thus yielding a total of 136 observations for each observed time series. Our dataset includes 4 aggregated measures of inflation, 8 measures of disaggregated time series of commodities and 6 measures of disaggregated measures of service prices. In particular:

- The aggregated measures of inflation are: total consumer prices; total consumer prices of commodities and total consumer prices of services.
- The disaggregated measures of commodities are: food and non-alcoholic beverages; housing and utilities; household contents, equipment and maintenance; health, transport; communication; recreation and culture; and miscellaneous items.
- The disaggregated measures of services: housing and utilities; household contents, equipment and maintenance; transport; communication; recreation and culture; and miscellaneous items.

5.2 EMPIRICAL RESULTS

Table 2 presents the estimation results of the three-regime SETAR regressions for aggregated measures of inflation. By definition ρ_1 represents a measure of inflation persistence for observations below the lower margin of the inflation target (i.e. $\pi < 3\%$), whereas ρ_2 measures persistence of the inflation process within the target (i.e. $3\% < \pi < 6\%$) and ρ_3 measures persistence for inflation rates above the upper margin of the inflation target (i.e. $\pi > 6\%$). In defining these different measures of persistence, we are able to conveniently investigate persistence levels of inflation within and outside the boundaries of the SARB

inflation target mandate. Bearing this analogy in mind, two main conclusions can thus be drawn from our empirical results reported in Table 1. Firstly, it should be noted that for all aggregated measures of inflation, the SARC is above unity in the corridor regime of the SETAR specification (i.e. 3% < π < 6%). In other words, our results emphasize the fact that the Reserve Bank's set target range of 3-6 percent has indeed encompassed a persistent inflation range. Moreover, we observe that inflation persistence is highest within the corridor regime of the SETAR models, that is, with the sole exception of total CPI in which we discover that inflation is most persistent in the lowest regime of the SETAR model (i.e. π < 3%). As a second conclusion, we also observe that the lowest levels of inflation persistence occur within the third regime of the SETAR model specifications (i.e. π > 6%). This finding holds true for all aggregated measures of inflation with the exception of persistence in the inflation of commodity goods in which we find that inflation is least persistence within the lower regime of the SETAR specification (i.e. π < 3%). Moreover, we note that within the third regime of the SETAR model, all SARC estimates are significantly below unity, a finding that indicates that inflation within aggregated items is not persistence. Thus in collectively, summarizing the results reported in Table 2, it would be safe to assume that the Reserve Bank would be more effective at administering inflation rates which are above the upper target zone of 6 percent.

Table 2: Persistence at aggregated inflation

time series	SARC			AIC	MAPE	Residual variance	DW statistic
	ρ_1	ρ_2	ρ_3			$\hat{\sigma}_n^2(\lambda_1, \lambda_2)$	
	π < 3%	3% ≤ π ≤ 6%	π > 6%				
CPIX excl. petrol	0.969	1.073	0.764	-133	15.06%	0.344	1.965
	[26.67%]	[51.11%]	[22.22%]				
total cpi	1.074	1.024	0.967	-140	15.14%	0.3269	2.254
	[12.59%]	[53.33%]	[34.07%]				
total commodities	0.962	1.015	0.988	-33	13.14%	0.7174	2.014
	[16.3%]	[51.11%]	[32.59%]				
total services	0.973	1.069	0.784	-72	14.58%	0.5402	1.987
	[13.33%]	[45.19%]	[41.48%]				

Note: percentage of observations in each regime is reported in []. DW represents the Durbin Watson test statistic for autocorrelation.

Source: Authors using data from the South African Reserve Bank (SARB) database

In proceeding with our analysis, we turn now to our attention to the estimation results reported for disaggregate measures of inflation as provided in Table 3 for commodities and Table 4 for services. In firstly referring to the results reported in Table 3, we note a biasness in the results obtained for disaggregated measures of commodities in comparison to the results obtained for the aggregated measure of total commodities as previously reported in Table 2. In particular, we observe that with the exception of recreation and miscellaneous items, the remaining disaggregated measures of commodity inflation have SARC estimates which are well below unity within all regimes of the SETAR processes. However, in attempting to identify the regime of the SETAR processes which contain the highest SARC, our results then become partially mixed. For instance, we observe that half (4 out of the 8) of the disaggregated measures of commodity prices have the lowest SARC's at inflation rates above 6 percent. These items are clothing, maintenance, communication and recreational goods. Furthermore, we are able to only identify two item in which inflation persistence is minimized in the corridor regime for disaggregated measures of commodities, (i.e. transport and miscellaneous items) and only another two items is inflation persistence minimized in the lower regimes (i.e. food and health items). Conversely, we find that the highest values of the SARC in the lowest regime are found maintenance, transport and communication in the lowest regime; for clothing, health and recreation in the middle regime; and for food and miscellaneous items in the upper regime of the SETAR processes. All-in-all, as a general finding, we find persistence to be relatively lower for disaggregated measures of commodity inflation in comparison to aggregated measure of total commodities.

Table 3: Persistence at disaggregated inflation (commodities)

time series	SARC ρ_1 $\pi < 3\%$	ρ_2 $3\% < \pi < 6\%$	ρ_3 $\pi > 6\%$	AIC	MAPE	Residual variance $\hat{\sigma}_n^2(\lambda_1, \lambda_2)$	DW statistic
food	0.743	0.771	0.960	-39	13.94%	0.6878	1.879
	[28.15%]	[20%]	[51.85%]				
housing	0.931	0.9778	0.508	22	5.678%	1.105	1.968
	[2.0%]	[15.04%]	[82.96%]				
maintenance	0.946	0.856	0.283	-123	55.28%	0.3699	2.015
	[83.7%]	[10.37%]	[5.93%]				
health	0.761	0.930	0.893	15	15.21%	1.025	1.865
	[20.74%]	[48.89%]	[30.37%]				
transport	0.950	0.721	0.727	96	72.88%	1.859	2.154
	[61.48%]	[24.44%]	[14.07%]				
communication	0.994	0.800	0.632	86	30.91%	1.72	2.014
	[82.22%]	[8.15%]	[9.63%]				
recreation	1.000	2.064	0.985	62	42.85%	1.449	2.001
	[80.74%]	[10.37%]	[8.89%]				
miscellaneous	0.911	0.847	1.008	-44	36.24%	0.6623	1.879
	[54.81%]	[28.15%]	[17.04%]				

Note: percentage of observations in each regime is reported in []. DW represents the Durbin Watson test statistic for autocorrelation.

Source: Authors using data from the South African Reserve Bank (SARB) database

In diverting our attention to the empirical estimates obtained for the disaggregate measures of services, as reported in Table 4, our estimation results become even more mixed as well as less definitive. In this regard, our attempts in identifying the overall regimes of the SETAR processes which contain the highest and lowest SARC for disaggregated measures of services becomes futile since we observe that the number of items containing the lowest and highest SARC's are exactly the same for each of the SETAR regimes. For instance, we find that the highest SARC in the lower regime are found for two items (i.e. housing and recreation); the highest SARC in corridor regime are also found for two items (i.e. communication and miscellaneous items); and highest SARC in the upper regime are

similarly found for two items (maintenance and transport). Conversely, we find that the lowest SARC in the lower regime is found for two items (i.e. maintenance and miscellaneous); the lowest SARC in the middle regime are found for two items (i.e. housing and transport) and the lowest SARC in the upper regime are found for two items (i.e. communication and recreation). Given the general ambiguous nature of the aforementioned results, we are left with no option but to conclude that disaggregate measures of inflation persistence tend to be less in comparison to aggregate measures. Such reasoning can be deemed as being plausible as it is reminiscent of Backecby et. al. (2008) who suggest that inflation persistence experienced at the aggregate level may arise, to certain extent, due to aggregation bias and due to the fact that idiosyncratic shocks will tend to disappear when a substantial number of series are aggregated.

Table 4: Persistence at disaggregated inflation (services)

time series	SARC ρ_1 $\pi < 3\%$	ρ_2 $3\% < \pi < 6\%$	ρ_3 $\pi > 6\%$	AIC	MAPE	Residual variance $\hat{\sigma}_n^2(\lambda_1, \lambda_2)$	DW statistic
housing	0.952	0.327	0.713	189	43.91%	3.664	2.045
	[25.93%]	[46.67%]	[27.14%]				
maintenance	0.451	0.875	0.943	46	23.33%	1.284	1.823
	[7.41%]	[42.96%]	[49.63%]				
transport	0.774	0.752	0.784	127	22.61%	2.331	1.956
	[58.52%]	[12.59%]	[28.89%]				
communication	0.935	7.500	0.134	-82	45.7%	0.5002	2.165
	[87.41%]	[3.7%]	[8.89%]				
recreation	0.973	0.716	0.179	110	21.81%	2.054	2.456
	[57.04%]	[33.33%]	[9.63%]				
miscellaneous	0.828	1.036	1.004	-57	16.79%	0.6009%	1.785
	[29.63%]	[40.74%]	[29.63%]				

Note: percentage of observations in each regime is reported in []. DW represents the Durbin Watson test statistic for autocorrelation.

Source: Authors using data from the South African Reserve Bank (SARB) database

6 *CONCLUSION*

The purpose of our current study was to observe threshold effects in the persistence of the inflation process for South Africa between the monthly periods 2003-2014 for both aggregate and disaggregated data series. To this end, we employ Hansesn's (2000) 3-regime SETAR model with two known thresholds. We allow these two threshold points to coincide with the SARB's set inflation target mandate of 3 and 6 percent. As an application of this empirical strategy, we are able to evaluate as to whether or not the SARRB's inflation target encompasses a highly persistent inflation range. Generally, we consider this empirical endeavor as being worthwhile since it bears direct relevance towards monetary policy conduct in the sense of permitting us to determine as to whether the SARB has been able to effectively control inflation within its designated inflation target of 3 to 6 percent.

The overall findings obtained from our empirical analysis can be summarized as follows. Concerning aggregated price measures, we establish that inflation within the time series is highly persistent within the 3-6 percent range as stipulated by the Reserve Bank. In particular, we observe that inflation is most persistent at rates of between 3 and 6 percent for total commodities as well as total services and at rates of below 3 percent for total CPI. Moreover, we also find that the lowest levels of persistent are found at rates above 6 percent concerning all price indices. Collectively, these results imply that when aggregate inflation is within the SARB's inflation target or at rates lower than its lower margin, then monetary authorities have to rely on a more forceful application of interest rates in order to ensure that inflation stays within its target range. Concerning the disaggregated measures of inflation, we note that persistence within these time series substantially diminishes; a result which can be attributed to the existing aggregation biasness in the persistence of South African inflation.

In drawing a final conclusion to our empirical study, our overall results emphasize on the fact that the South African Reserve Bank has not been very successful in stabilizing aggregate inflation subsequent to the adoption of the inflation targeting regime. This fact holds true from both a practical as well as empirical perspective. Hence, our paper joins a host of observers, commentators and other academic connoisseurs in calling for either the abandonment or the revision of the inflation target. In the event that the Reserve Bank opts to revise its inflation target mandate, then it must consider extending its target range to

accommodate higher levels of inflation. Practically speaking, this could be achieved by amending both the lower and upper margins of its current target range. And yet, it could still be questioned, that if the Reserve Bank does opt to alter the margins of the inflation target, at what range(s) should it modify it to? We thus leave such concerns for future research, which we encourage to focus on identifying inflation rates which would stabilize exchange rates, maximize economic growth and minimize unemployment rates.

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