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Assessing the effectiveness of the monetary policy instrument during the inflation targeting period in South Africa

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Abstract

This paper assesses how inflation react to monetary policy shocks in South Africa during the inflation targeting period by making use of the structural vector error correction model (SVECM). The results of the impulse response function obtained from the SVECM show that, on average, contractionary monetary policy that intends to curb inflationary pressure has been impotent in South Africa. However, the contractionary monetary policy shocks managed to reduce output. The paper suggests that it is time a dual target, inflation and output, be considered in South Africa to avoid the harm caused on output growth from monetary policy actions related to the constraint of inflation targeting.

Keywords: inflation targeting policy, structural vector error correction model, South Africa

JEL classification: C50, E52, E58

1. Introduction

Inflation targeting has become a monetary policy of choice in several countries since the 1990s. The policy was pioneered in New Zealand in 1990. As for emerging markets, Chile was the first country to adopt inflation targeting in 1991 (Mishkin, 2000). With regards to the operations of inflation targeting policy, monetary authority sets an explicit target for inflation rate and communicates the target to the public. Moreover, the monetary authority makes use of the main policy instrument, the interest rate, to control the level of inflation. The conventional practice for the control of inflation is that the central bank, the monetary authority, raises the interest rate to cool down the economy to subdue inflationary pressure. Thus, inflation targeting central banks rely on interest rate, especially contractionary monetary policy, to compel inflation to remain within the target. However, Stiglitz (2008) noted that this practice is always not successful, especially in emerging and developing economies, as these economies often miss the target due to circumstances beyond the control of their central banks. Consequently, for Stiglitz, inflation targeting policy has failed in emerging markets and developing economies.

A number of authors attribute the failure of monetary policy instruments to contain inflationary pressure in emerging and developing economies to their vulnerability to global shocks (Mishkin and Schmidt-Hebbel, 2007; Blanchard and Gali, 2007). Commodities and trade shocks have been found to be larger and more persistent and have contributed to the macroeconomic volatility in emerging and developing countries (Mendoza, 1995).

Among other things, the effectiveness of a monetary policy is assessed by its ability to control inflation, albeit in the presence of external shocks (See for example, Clarida, Gali and Gertler, 1999; Rasche and Williams, 2005). It is then important to evaluate how monetary policy instruments has fared in affecting inflation in emerging markets in general and in South Africa during the inflation targeting period. With a potent monetary policy instrument, it is expected that contractionary monetary policy shocks should be able to reduce inflationary pressure.

South Africa adopted inflation targeting as the anchor of monetary policy in February 2000. The initial target, decided by the Minister of Finance in collaboration with the South African Reserve Bank (SARB), was to achieve an average inflation rate of between six and three percent interval in 2002. The SARB has used the repo rate as the policy instrument to control the level of inflation and contain it within the chosen interval. The effectiveness of the policy instrument to control the level of inflation has been widely criticised not only in the South African context but also internationally. With the critics pointing out from a substantial lag for monetary policy changes to affect inflation to the inability of the policy instrument to effectively affect inflation level (see Bernanke and Woodford, 1997 and Mishkin, 2002). Since early 2007 the annual inflation rate in South Africa has evolved outside the interval of three to six percent. The continual increase in the repo rate to curtail the inflation rate has accelerated its trend rather than subduing it. The aim of this study is therefore to assess the extent to which the monetary policy instrument, the repo rate, has managed on average to influence inflation rate and economic activities in South Africa. This paper uses the structural vector error correction model (SVECM) to characterise the dynamics of inflation to monetary policy instrument shocks. Furthermore, this study also assesses the responses of the credit extended to the private sector and the real domestic product (GDP) to monetary policy instrument shocks. The remaining of the paper is structured as follows: Section 2 the theories and literature review on inflation targeting policy. Section 3 discusses the trend of inflation and the monetary policy instrument in South Africa. Section 4 discusses the data and methodology of the SVEC model. Section 5 focuses on empirical results and discussion on the findings of the paper. Section 6 concludes the paper.

2. Literature review

Inflation rate targeting (IT) was first adopted as monetary policy by the Reserve Bank of New Zealand in 1990, followed by the Bank of Canada in 1991, and the Bank of England in 1992. It has gained popularity in both industrial countries and emerging economies. To date the number of countries following this monetary policy is more than twenty.

Svensson (2007) argues that a successful IT policy is characterized by, (1) an announcement of the numerical inflation target, (2) an implementation of monetary policy that gives a major role to an inflation forecast, (3) an adoption of short-term interest rates as the only monetary policy instrument, and (4) a high degree of transparency and accountability. Proponents of inflation targeting policy (Bernanke et al., 1999; Nadal De Simone, 2001; Corbo, Landerretche, and Schmidt-Hebbel, 2002; Neumann von Hagen, 2002; Hyvonen, 2004; IMF, 2005; Vega and Winkerlied, 2005; Mishkin and Schmidt-Hebbel, 2007) demonstrate empirically that inflation targeting is associated with an improvement in overall economic performance. According to these authors the rationale behind this success is that by targeting directly price, inflation target plays a role of explicit and a strong nominal anchor.

The application of the IT policy necessitates that the monetary authority announces the numerical target (point or interval). The central bank should also set out the period within which inflation will reach the target level. Whenever the inflation is outside the target, the central bank uses the short-term interest rates to bring it back within the target range. Such an explicit mandate requires independence of monetary authority, which in turn is accountable for missing the objective. The issue of accountability leads to improved communication or transparency with the public through the published inflation reports, minutes of monetary policy committee meetings and inflation forecasts of central bank econometric models. Without accountability and transparency, it is difficult to establish credibility, and hence anchor inflation expectation.

The results of different studies suggest that inflation levels, persistence, and volatility are lower in inflation-targeting countries than in 'nontargeters'. Furthermore, output volatility has improved during the post-targeting period. Finally, exchange rate pass-through effects have been reduced after the adoption of IT. Besides the improvement of economic performance, Johnson (2002, 2003) provides strong evidence of an immediate fall in inflation expectations after the adoption of IT. Likewise, Gürkaynak, Levin, and Swanson (2007); Levin, Natalucci, and Piger (2004); Castelnuovo, Nicoletti-Altimari, and Palenzuela (2003) argue eloquently that inflation expectations are more anchored for targeters than nontargeters, particularly at longer horizons. Consequently, supporters of this view claim strongly that monetary policy has become more efficient under inflation-targeting.

On the other hand, Ball and Sheridan (2005), Roger and Stone (2005), Epstein and Yeldan (2007) state that the earlier victory proclaimed by the proponents of IT is still to be tested. Their analysis shows that industrialized 'nontargeters', like targeters, have experienced low inflation and high output growth during the same period. Similarly, for the same period their volatility of inflation and output growth declined. Hence, one cannot attribute a recent disinflation and increase in output growth solely to the success of the IT policy. As Ball and Sheridan (2005) clearly put it, the economic environment has been fairly tranquil during the inflation-targeting era, and central banks have not been tested severely. Likewise, Rogoff (2007) assigns these benefits to the forces of globalization. To support the effectiveness and success of IT, it should be tested during the hostile periods of high inflation, such as the current rise in global food and oil prices.

3. Inflation Targeting in South Africa

Like many emerging market economies, in the aftermath of the Asian crisis, the South African Reserve Bank (SARB) adopted inflation rate targeting as its monetary policy in early 2000. Inflation becomes the primary and sole mandate of SARB, with a freely floating exchange rate. Similar to many targeters, the adherence to this new monetary policy framework reinforced the SARB independence. SARB ascribes to 3-6% target range to be achieved within the two years after its adoption.

The subsequent characteristics of IT, as explained above, became reality in the South African context. To achieve its credibility the SARB should bring inflation rate within the target range by increasing or decreasing its monetary instrument, the repo rate. The repo rate, which represents the cost of holding money, is the rate that the SARB charges commercial banks. By using the repo rates the SARB controls directly liquidity in the market. For example, if the central bank feels that there is excess liquidity in the market, it increases the repo rate to create shortage. The commercial banks will react to this contractionary monetary policy by increasing their lending rates. This will result in the decrease in the money demand and consequently the total demand. As the total demand decreases, the price level will tend to fall.

Figure 1 shows that inflation rate first reached the target band in August 2001. However, this success was short lived, in that the terrorist attack in the US on September 11, combined with massive depreciation of South African Rand put high pressure on inflation rate reaching a pick of 10.5% in October 2002. The SARB reacted by increasing the repo rate (see Figure 2) from December 2001 to September 2002 where the repo rate increased from 9.5% to 13.5%, respectively. The central bank action combined with the investigation committee, initiated by the government to investigate possibility of speculative attacks against the Rand, helped reduced inflation. Inflation was reduced gradually to below 6% in June 2003. The decline in inflation was followed by monetary easing up to 8% in December 2003. As depicted in Figure 1, inflation was back in up trend in March 2005 crossing the 6% limit in June 2007. From June 2006, onward the SARB has followed a contractionary policy increasing the repo rate from 7% to 11% in December 2007; that is, an increase of 4%. In the same time inflation, has increased from 3.9 to 8.6% for the same period. During the period 2007 to 2009, inflation has increased, reaching the 12% level in 2008. This shows the influence of the global financial crisis or external shocks on the South African inflation rate. Figure 2 overlays the headline inflation rate and the repo rate, the SARB's policy rate. The aim is to see whether the increase in the policy rate was successful in decreasing the inflation rate. It is difficult to tell from to conclude from the graphical representation on the comovement of the two variables as they seem to depict procyclicality in a number of periods. Also, it is difficult to detect clearly any lag effect, which is necessary in the reaction between the two variables. thus, this can only be a matter of empirical analysis.

Figure 1. Inflation (CPIX)

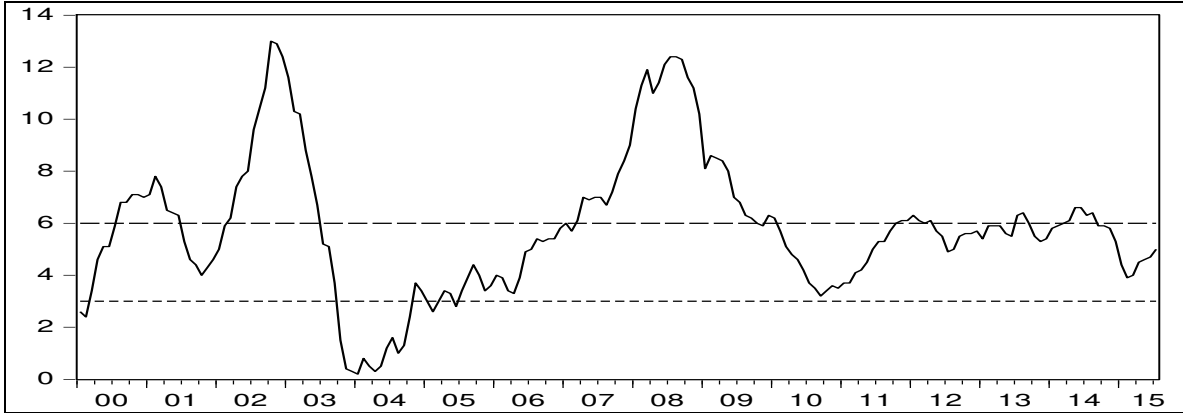
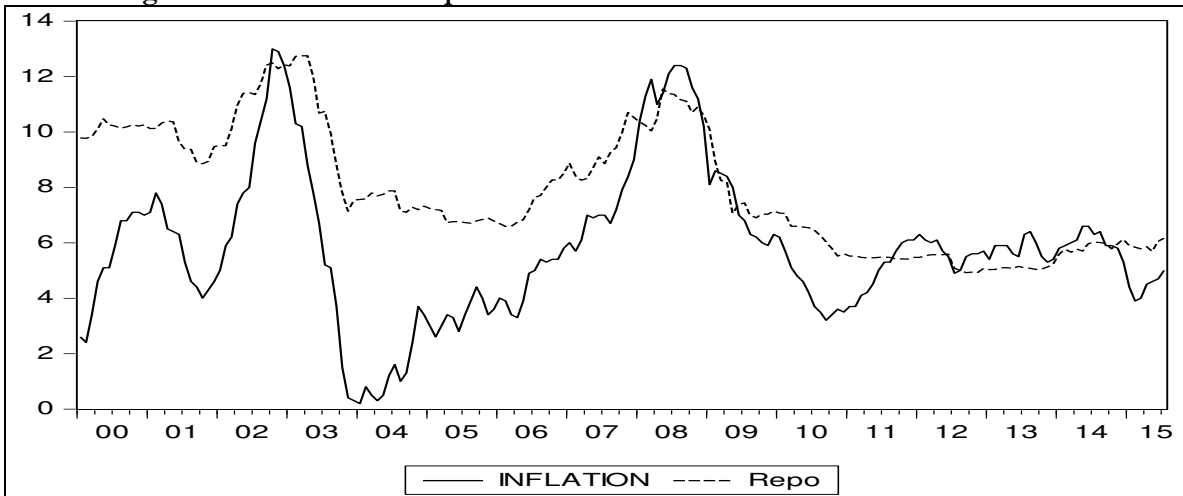


Figure 2. Inflation and Repo rates



4. Methodology of the SVEC model

In assessing how monetary policy instrument affects inflation in South Africa this paper uses the SVEC model to characterise the dynamics of inflation rate to monetary policy instrument shocks. The modelling of dynamic behaviour of economic variables, through the impulse response function (IRF) analysis, is extensively used in a vector autoregressive (VAR) framework. Nonetheless the VAR model is “a-theoretic” and therefore there is little economic content in the results provided from the IRF analysis. Like structural vector autoregressive (SVAR) models, the SVEC models provide a framework where the results that are obtained from the IRF have an economic meaning. Contrary to SVAR models, SVEC models are suitable for identifying economic shocks when cointegration relationship exists between variables in the model. SVEC analysis starts from a reduced form standard VEC model

$$\Delta y_t = \alpha \beta' y_{t-1} + \Gamma_1 \Delta y_{t-1} + \dots + \Gamma_{p-1} \Delta y_{t-p+1} + \mu_t \quad (1)$$

Where y_t is a $K \times 1$ vector of time series, $\Gamma_1 \dots \Gamma_{p-1}$ are $K \times K$ coefficient matrices. The reduced form disturbance μ_t is a $K \times 1$ unobservable zero mean white noise process with covariance matrix $\Sigma\mu$. From Johansen's (1995) version of the Granger's representation theorem it follows that the VEC model has the following moving average representation

$$y_t = \Xi \sum_{i=1}^t \mu_i + \Xi^*(L)\mu_t + y_0^* \quad (2)$$

where $\Xi = \beta_{\perp} (\alpha'_{\perp} (IK - \sum_{i=1}^{p-1} \Gamma_i) \beta_{\perp})^{-1} \alpha'_{\perp}$ and represents the long-run effects of forecast error

impulse response. $\Xi^*(L) = \sum_{j=0}^{\infty} \Xi_j^* L^j$ is an infinite-order polynomial in the lag operator with

coefficient matrices Ξ_j^* that tend to zero as $j \rightarrow \infty$. It contains transitory effects. The term y_0^* contains all initial values of the vector time series (). The forecast error impulse responses based on Ξ and the $\Xi(L)$ are without economic meaning as they are obtained from the reduced form disturbance (see Equation 2). Structural shocks need to be identified for a meaningful impulse response analysis. The relationship between the reduced-form disturbances and the underlying structural shocks is written as follows:

$$\mu_t = A\varepsilon_t \quad (3)$$

Where $K \times I$ vector ε_t contains the unobservable structural shocks, and has a covariance of $\Sigma\varepsilon$. Substituting Equation (3) in Equation (2) yield a structural IRF given by ΞA . The long-run effects of ε_t shocks will therefore be given by ΞA . This matrix has a rank $K - r$, where r is the cointegrating rank of the system. In particular, if the system has r cointegrating relations, $k = (K - r)$ shocks have permanent effects, while at most r shocks have transitory effects. To exactly identify permanent shocks $k(k - 1)/2$ additional restrictions (elements of the matrix ΞA set to zero) are needed. Similarly, $r(r - 1)/2$ additional contemporaneous restrictions are needed to identify the transitory shocks. Together, these are a total of $K(K - 1)/2$ restrictions necessary to just identify matrix A .

5. Data and Empirical Analysis

This study employs seasonally adjusted monthly data for South Africa for the period from February 2000 to August 2016. February 2000 corresponds with the official starting of inflation targeting policy. In the benchmark specification, the SVEC model includes the following variables:

- The natural logarithm of credit extension (CREDIT)
- The natural logarithm of manufacturing production used as a proxy for real gross domestic product (MANU). Figure A1 shows that the two series present a common trend and may be used of a proxy of each other.
- the prime rate as a proxy for repo rate (INTEREST). Figure A1 shows that the trend of the prime rate corresponds to the repo rate.

- The headline inflation rate¹ (INFLA)
- The international commodity price (COM) as an exogenous variable in the SVEC model to control for price puzzle

The series are sourced from the South African Reserve Bank (SARB) database. Table A1 in the Appendix presents the unit root test of all the endogenous variables. All the endogenous variables are integrated of order one, I (1). This was tested with the Augmented Dickey Fuller (ADF) test whereby a trend was included in the test for the series CREDIT and MANU and only constant was included for INTEREST and INFLA.

As the SVECM analysis necessitates that variables be cointegrated and that the number of cointegrating relationship be known for the identification of shocks, Table A2 presents the trace test statistics. For the testing procedure, the Johansen trace test was used. The number of autoregressive lags in the system chosen according to the Akaike Information Criteria is two. Table A2 indicates that there is existence of two cointegrating relationships in the system.

The vector of structural shocks in this study is given as $\varepsilon_t = (\varepsilon_t^{MANU}, \varepsilon_t^{INFLA}, \varepsilon_t^{CREDIT}, \varepsilon_t^{INTERST})$. As in section 4, for a 4-variable VEC we need $K(K-1)/2=6$ linearly independent restrictions to exactly identify the structural shocks. Since we have two cointegrating relations ($r=2$), the number of shocks with permanent effects are $k=K-r=2$. A total of 2 shocks will have permanent effects, whereas $r=2$ shocks have transitory effects. In our 4-variable VEC model we assume that only shocks in CREDIT will not have permanent effects. To identify the three permanent shocks, $k(k-1)/2=1$ additional restriction is imposed in the long-run impact matrix ΞA . So we will assume in addition that productivity is only driven by technology shocks, ε^{MANU} .

The identification of the long run matrix ΞA in the 4-variable system is as follows:

$$\Xi A = \begin{pmatrix} * & 0 & 0 & 0 \\ * & 0 & * & 0 \\ * & 0 & * & 0 \\ * & 0 & * & 0 \end{pmatrix} \quad (4)$$

Unrestricted elements are indicated by asterisk. Referring to the vector of structural shock above, the interpretation of the above matrix is that shocks to PRICE have no long run effects on MANU, CREDIT or INTEREST. Also, shocks to INTEREST have no long-run effects on MANU, CREDIT and INFLA. The rationale behind the interpretations is that nominal variables such as price and interest should not influence economic activity in the long term. Another interpretation from this matrix, as discussed above, is that productivity is only driven by technology shocks, ε^{MANU} , and not any other shock.

As said earlier we need 6 linearly independent restrictions to exactly identify the structural shocks. But as it stands now the two zero columns represent $kr=4$ linearly independent restrictions and the zeros in (4) represent only five linearly independent restrictions. We then need in addition $r(r-1)/2=1$ contemporaneous restriction to unravel the effects of the two transitory shocks. The one additional

¹It is important to note that the South African Reserve Bank (SARB) was targeting CPIX-inflation from 2000 to 2008 instead of the headline CPI. In 2008 the SARB reverted back to targeting headline CPI inflation

restriction is therefore reported in the contemporaneous or short term matrix A. The choice made is that shocks to INFLA do not contemporaneously affect INTEREST. There should be a lag effect, especially in the case of South Africa. The short run matrix is therefore represented as

$$A = \begin{pmatrix} * & * & * & * \\ * & * & * & * \\ * & * & * & * \\ * & 0 & * & * \end{pmatrix}$$

It is important to note that the VECM from which our SVEC model is derived is estimated with four endogenous variables ordered as MANU, INFLA, CREDIT and INTEREST and COM as the exogenous variable. Following the steps explained above for the SVEC estimation, we obtain the results of the impulse response functions (IRF) reported in Figures 3, 4 and 5.

6. Discussion of the Results

Figures 3, 4 and 5 provide the responses of INFLA, MANU and CREDIT to monetary policy shocks, respectively. Confidence intervals for the impulse responses are bootstrapped by procedure described in Breitung, Bruggeman, and Lutkepohl (2004). Bootstrap from percentile method proposed by Hall (1992) is used to construct the 95% confidence interval.

Figure 3. Responses of inflation (INFLA) to monetary policy shocks

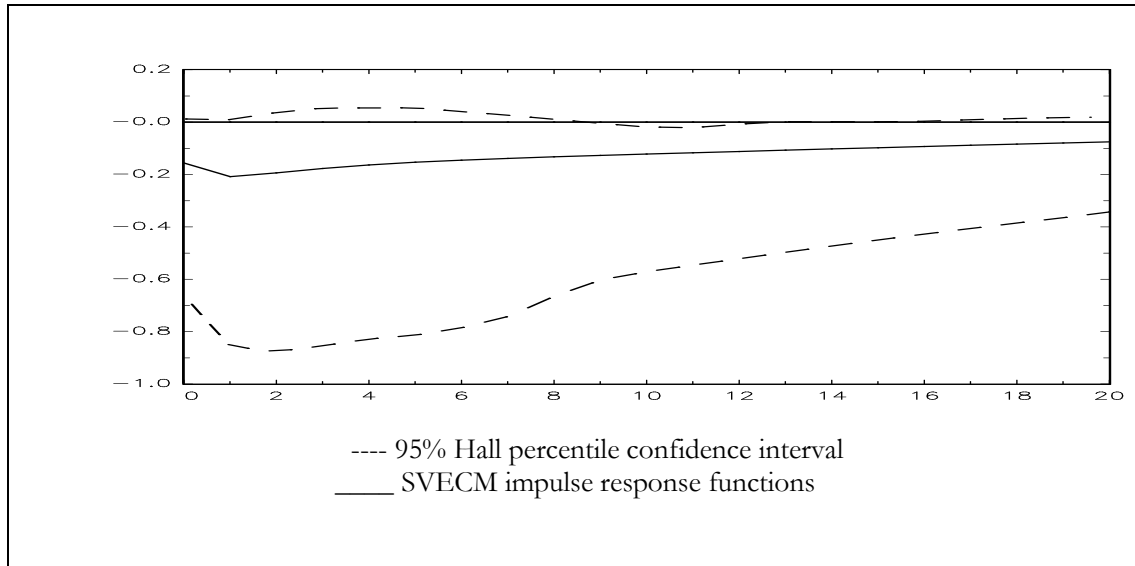


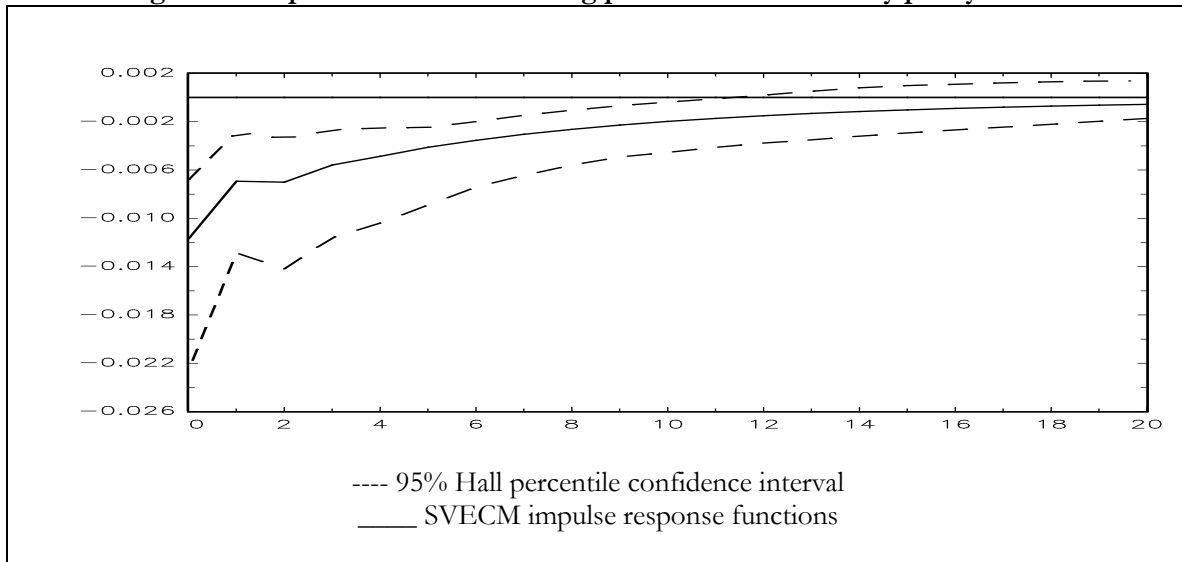
Figure 3 shows that a positive monetary policy shocks, monetary policy contraction, reduces slightly inflation but the effect is not statistically different to zero at 95% confidence level². This outcome points to the possibility that either positive monetary shocks are unable to cause a decrease in inflation or that there is substantial lag in the effect of monetary policy on inflation rate. Whichever the case may be, this indicates the ineffectiveness of monetary policy instrument in affecting inflation in South Africa. This finding is supported by a number of studies (see Bonga-Bonga and Kabundi, 2013; Gupta and Komen, 2008). The inability of the monetary policy shocks to influence the level of inflation raises a concern on the success of inflation targeting monetary policy stance. This apprehension is echoed by Jean-Claude Trichet, the former president of the European Central Bank (ECB), remarking that central banks do their best work when their threats to raise interest rate deter inflation actions³.

Figure 4 displays the reaction of the manufacturing production, proxy for GDP, to monetary policy shocks.

² Although there seems to be a statistically negative effect from periods 9 to 12, we cannot discard that the upper bound of the confidence interval is not different to zero. This was confirmed with the 95% Efron percentile confidence interval.

³ From the article titled “ECB likely to hold rates steady and enjoy the gap” published in the Sunday time newspaper of 9 March 2008.

Figure 4. Responses of manufacturing production to monetary policy shocks



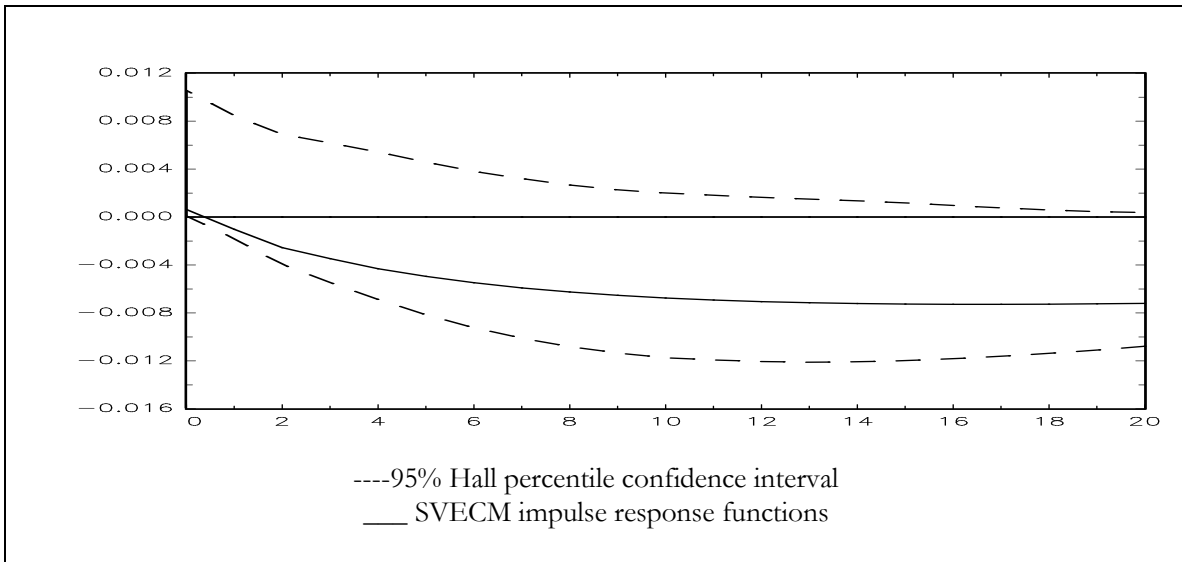
There is a clear negative effects of positive monetary policy shocks on manufacturing production in South Africa, before the effect dies out after ten months. While monetary policy shocks are not able to reverse an increasing trend in inflation, as seen in Figure 3, however, these shocks happen to depress economic growth. This outcome provides enough reason to question the effectiveness of inflation targeting in South Africa. It is important to note that a number of studies attribute the failure of the monetary policy tool to contain inflationary pressure in emerging and developing economies to the growing influence of external shocks (see Roger, 2010). It is in that context that inflation targeting policy in general evokes an escape clause to justify a temporary inability of the monetary authority to contain inflation within the target due to external shocks. However, South Africa being an open economy, there is a possibility that there will always be external shocks hitting the economy; this in fact will result in the escape clause becoming an ‘escape goat’ to justify the failure of the monetary policy tool to control inflation.

A change of monetary policy stance from a simple inflation targeting to a dual target of inflation and employment (output growth), as applied in the USA, may be an option for bolstering monetary policy in South Africa. Why should the SARB continuously increase interest rate that has a neutral effect on inflation but compromises the growth path of the country as reported in Figure 4?

Another important question is to assess the extent to which contractionary monetary policy has succeeded to curb credit demand in South Africa. We ought to believe that the successful operation of the credit channel could contribute the effectiveness of the contractionary monetary policy to control inflation in South Africa. Given that a contractionary monetary policy is assumed to increase debt service costs and impairs assets and collateral of households and firms, contractionary monetary policy shocks are expected to decrease the aggregate price level (inflation) through the decrease in aggregate demand.

Figure 5 displays the responses of the total credit extension from positive monetary policy shocks. The effects of monetary policy shocks on credits extension are neutral.

Figure 5. responses of credit extension to positive monetary policy shocks



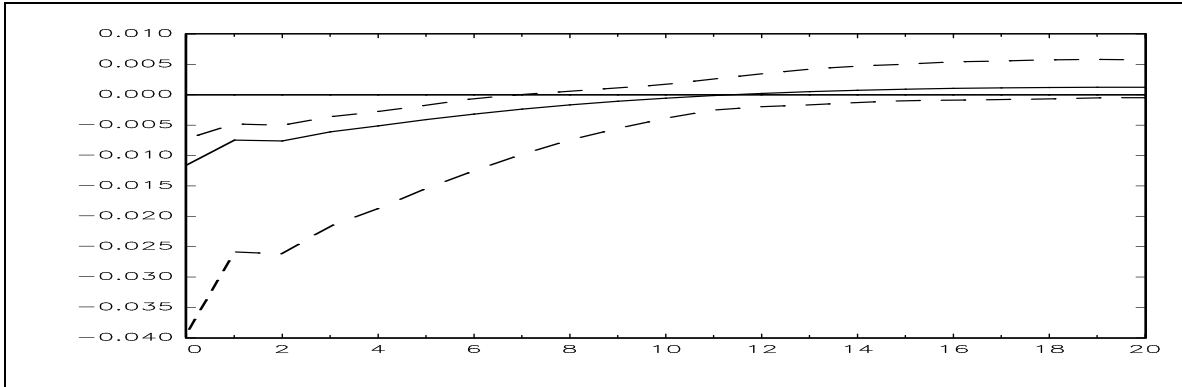
This outcome confirms the findings of a number of studies that Credit extension is insensitive to high interest rate in South Africa. For example, Bonga-Bonga (2008) alluded to the poor savings, especially household savings in South Africa, which lead to high demand for credit. The high dependence on debt by household has rendered credit extension insensitive to contractionary monetary policy. It is evident from Figure A1 that credit growth has been in an uptrend despite a continuous increase in interest rates. This outcome may suggest that, among other things, the inability of the monetary policy tool to control inflation in South Africa may be due to the insensitivity of the credit demand to contractionary monetary policy shocks.

The outcome of this paper that positive monetary policy shock failed to curb credit extension should imply that the 2005 National Credit Act (NCA), as an additional measure to regulate the credit market in South Africa, does not prove to be an enabler to curb credit extension in south Africa. This is confirmed in Figure A1 showing the upward trend of credit extension, even in the periods post 2005.

Robustness test

To test the robustness of our results, we apply different identifications, especially the zero restrictions in the short run matrix. We apply a zero-contemporaneous restriction for shocks to inflation on manufacturing production. We can observe that the results reported in Figure 6, showing the responses of monetary policy shocks to manufacturing production, are similar to those reported in Figure 4, although in Figure 6 the effects die out after 8 months rather than 10 months as in Figure 4.

Figure 5. responses of manufacturing production to positive monetary policy shocks with different identification



7 Conclusion

There is an increasing debate amongst academic, policymakers, and the public as to whether inflation rate targeting is an effective monetary policy. In South Africa, the central bank has embarked in monetary tightening for more than a year, but it has been unable to bring inflation back to the target band. This study endeavoured to assess the effectiveness of monetary policy instrument, the repo rate, in influencing inflation rate in South Africa since the adoption of inflation rate targeting. The framework used is the structural vector error correction model that facilitates the analysis of the dynamics of inflation to monetary policy instrument shocks. This study found that positive monetary policy shocks are unable to negatively affect inflation after a period of more than 20 months. This pointed to the ineffectiveness monetary policy in affecting inflation in South Africa. Similarly, monetary policy in South Africa seems less potent in curbing demand for money, though this should be an important channel through which monetary policy should affect inflation. These facts prove that economic agents in South Africa are insensitive to short-term interest rates. Credit demand by the private sector remains immune to central bank policy. However, this study shows that monetary policy does affect the real output in South Africa. A positive monetary policy shock decreases manufacturing production after six to seven months. The study concludes that inflation rate targeting as applied in South Africa does not help to curb inflation and credit demand by the private sector remains immune to central bank policy. The study then suggests that like in the USA, a dual inflation and employment (real output) target may be an option to consider for monetary policy in a developing country such as South Africa.

Appendix 1

Table A1. Unit root test at the level

Series	Adjusted t-statistics
Infla	-0.642
Credit	7.273
Interest	-2.059
Manu	-0.458

ADF is Augmented Dickey-Fuller test where the null hypothesis is of a unit root in the series. The estimated regressions include a constant and a trend.

Table A2. Johansen cointegration test

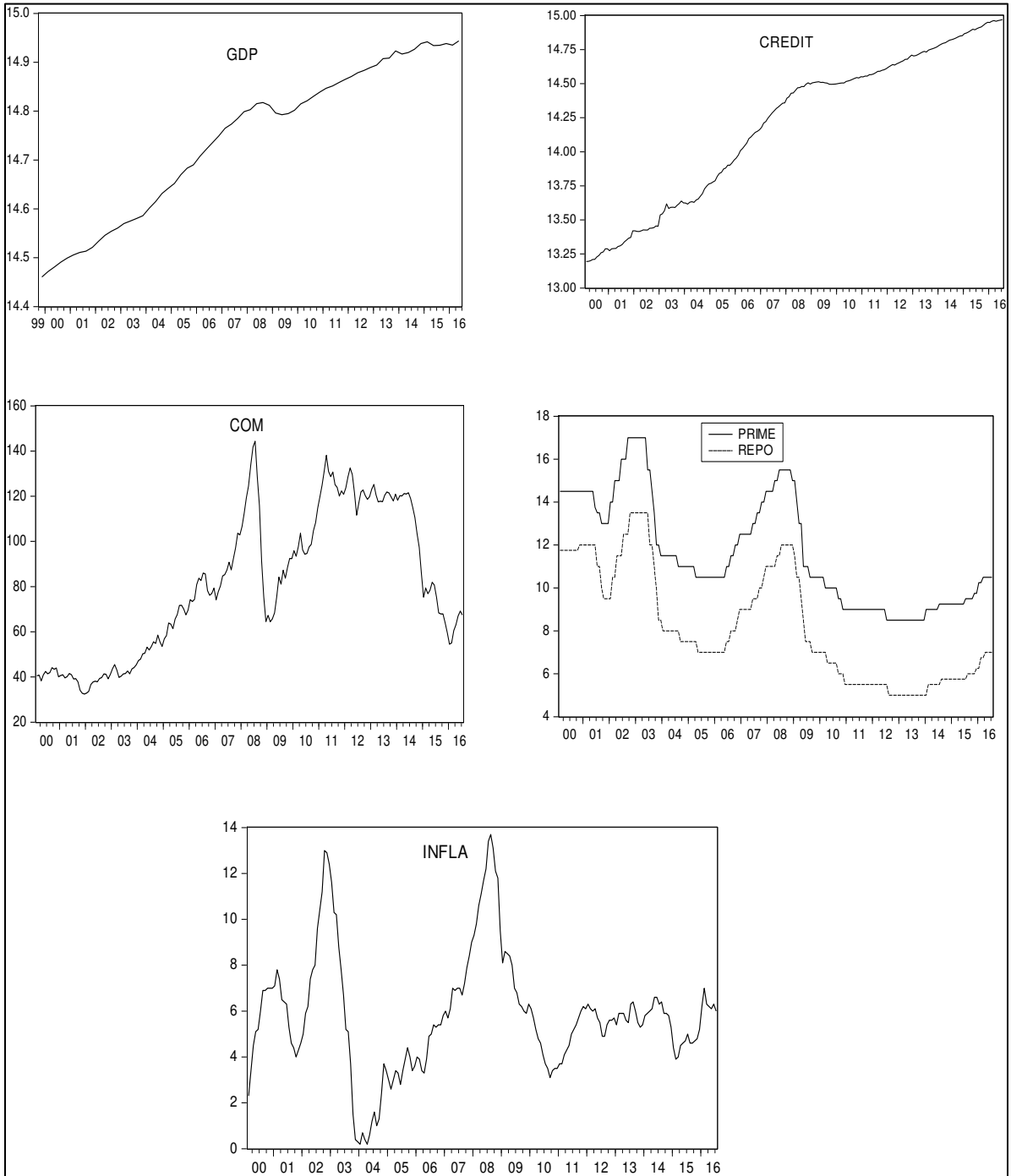
Null Hypothesis	Eigenvalue	Trace Statistics	5% Critical Value	Probability
None*	0.310	79.692	63.876	0.001
At most 1*	0.288	46.721	42.915	0.020
At most 2	0.121	16.523	25.872	0.451
At most 3	0.055	5.045	12.518	0.590

Trace test indicates 2 cointegrating eqn(s) at the 5% level

* denotes rejection of the hypothesis at the 5% level

**MacKinnon-Haug-Michelis (1999) p-values

Figure A1. Variables



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