Rangan Gupta (South Africa), Charl Jooste (South Africa)

Is the South African Reserve Bank influenced by exchange rates when setting interest rates?

Abstract

This paper analyzes the extent to which the South African Reserve Bank (SARB) uses the repo rate in response to exchange rate depreciations. We use a vector autoregression to model the simultaneous linkage between the real effective exchange rate and the policy rate. A combination of short-run and sign restrictions are used to identify the model. The authors' results show that currency depreciation is important in monetary policy interest rate setting. The exchange rate also reacts significantly to changes in the repo rate.

Keywords: exchange rate, monetary policy, sign restricted VAR.
JEL Classification: E4, E580, C3.

Introduction

The debate regarding the appropriate response of monetary policy to exchange rate movements have been well studied. Unfortunately there is no clear consensus on how much weight monetary policy should place on influencing exchange rates or what the appropriate tools are for doing so. As a consequence streams of papers have tried to identify the monetary policy interest rate response when the exchange rate depreciates. With the assumption that shocks are correctly identified, many studies find that exchange rates do not have a small weight in the interest setting environment, even for inflation targeting countries.

The persistent South African exchange rate depreciation over 2011 to 2014 provides a reason to empirically analyze the South African Reserve Bank (SARB) interest rate response. Another motivation for this study is the use of a different identification scheme in specifying a model and comparing this to previous work. Abstracting from the use of reserves in influencing currency movements, we are mainly interested in analyzing whether, and by how much, the SARB weighs the exchange rate in setting interest rates.

There are justifiable reasons why inflation targeting central banks responds to exchange rate movements. Garcia et al. (2011) argue that interest rates should respond to exchange rates when it influences inflation expectations. However, if one were to measure inflation expectations correctly then the additional information provided by the exchange rate by explicitly accounting for it in a Taylor rule should be close to zero.

Ostry et al. (2012) show that, on average, a 10 percent exchange rate appreciation is accompanied by a 0.29 percentage points decrease in the policy rate. Ostry et al. (2012), however, argue that the central bank should only intervene by using reserves when the currency deviates from equilibrium, while the policy rate should mainly be used for inflation targeting.

Devereux et al. (2007) show that it is important to eliminate distortions due to price stickiness and show that monetary policy should attempt to produce an economy as though it had flexible prices. Their main argument is that sticky prices cause relative prices to be influenced by news about fundamentals that drive the exchange rate. Thus variations in the exchange rate (due to news about fundamentals) lead to inefficient price movements in the short run. Thus unexpected changes in the exchange rate (that which is not necessarily explained by fundamentals) provide justification for monetary policy intervention.

Leith et al. (2006) show that policy makers should be concerned about currency misalignment (from a welfare perspective). However, these channels are complicated and require correctly measuring sticky prices from both the tradable and non-tradable sectors. Cova et al. (2003) also evaluate the policy response to exchange rate movements from a welfare perspective using an open economy DSGE model. They show that it is optimal to respond to exchange rates when economies are small and face an elastic export demand curve. Internal price stabilization policies will lead to greater employment variability and uncertainty about marginal costs – when the central bank stabilizes prices, producers cannot respond to greater marginal cost variability by charging higher prices.

Gali et al. (2005) study the optimal monetary policy response in an open economy setup. They show that there exists a trade-off between the stabilization of exchange rates and that of inflation and output. Stabilization of both domestic prices and output induces larger volatility in real and nominal exchange rates. The converse is also true, and following an exchange rate peg induces more inflation and output volatility.

Many studies include the exchange rate in the Taylor rule. They estimate the weight that central banks place on exchange rate movements in setting interest rates. Ball (1999) estimates a Taylor rule that includes both contemporaneous and lagged exchange rate appreciation. He shows that it is optimal for monetary policy, in the long run, to relax interest rates by 2 percentage points when the exchange rate appreciates by 10 percent. Svensson (2000) estimates a similar model and shows that the central bank should decrease rates in respect to contemporaneous appreciations while increasing rates to past appreciations – where the cut is completely offset. The cut in interest rates negates the negative output effects due to the appreciation, while the offset is there to mitigate the effects on inflation given the initial cut in interest rates – the appreciation is temporary. In Svensson's (2000) model the rule reduces inflation variability, but increases the variance in output.

Regarding South Africa, Gupta (2013) shows that inflation would have been less volatile, at the expense of volatile growth, if the SARB pursued a fixed exchange rate policy. Alpanda et al. (2010) using a small open economy DSGE model, however, show that the SARB puts almost no weight on exchange rate depreciation in a Taylor rule specification. This is in contrast to the results from Ortiz et al. (2007) that estimate the weight of the exchange rate in the Taylor rule also in a DSGE framework. They show that the SARB responds to exchange rate movements, although very small. This response has also declined over time. A 1 percent appreciation leads to a 0.11 percentage points decrease in the interest rate.

Finally Ellyne et al. (2011) estimate the weight of the exchange rate in a Taylor-rule setup for South Africa using single equation regressions. They show that on average, the interest rate was reduced by 0.135 percentage points for any 1 percent appreciation in the exchange rate before inflation targeting. The interest rate responded a lot less to the exchange rate since inflation targeting (-0.03 percent decrease for a 1 per cent appreciation).

Our methodology follows Bjornland et al. (2013) by estimating the SARB's response to exchange rates using a VAR. Our hope is to shed somewhat more light on the interest rate response to exchange rates for South Africa. This approach is slightly more flexible in the sense that it does not impose an exact structure, like a Taylor-rule, but estimate the response freely.

1. Methodology

Our variables include consumer price inflation, (π_t) seasonally adjusted GDP in constant prices (γ_t), foreign short-term nominal interest rate (proxied by the fed funds rate) (i^*_t), domestic short-term nominal interest rate (either the repo rate or 31 day Treasury bill) (i_t) and the log of the real effective exchange rate (fx_t). All the data are sourced from the South African Reserve Bank and are in quarterly frequency. The data is estimated from 2000q1 until 2013q4, with the starting point corresponding to the SARB's adoption of the inflation targeting regime[1].

[1] The data is estimated in levels. All the data is I (1) according to standard tests of stationarity. We have also estimated the results over a longer sample. The results remain robust and can be obtained from the authors.

It is standard in the VAR literature to write the VAR (if the matrix polynomial is invertible) in MA form:

$$X_t = B(L)^{(-1)} e_t, \tag{1}$$

where X_t the matrix of variables and $B\ (L^{-1})$ is the matrix polynomial using the lag operator L. $B\ (L) = \sum^{p}_{i=0} Ail^i$ e_t is the forecast errors which is assumed to be normally distributed with a positive semidefinite covariance matrix $\sum_e$. Furthermore, e_t is linearly related to ε_t, which are the structural shocks - $e_t = Ae_t$.

Replacing the linearly related shocks into (2) gives us the MA representation in terms of structural shocks.

$$X_t = D(\mathrm{L})\varepsilon_t\, where\ and\ D(L) = C(L)A\ and\ \varepsilon_t \sim \\ \sim N\ (0, diag(I_i)). \tag{2}$$

Bjornland et al. (2013) identify the monetary policy shock (ε^{MP}_t) and exchange rate shock (ε^{EX}_t) by partitioning the A matrix into two blocks $A = [A'A'']$. $A' = \tilde{A}Q$ is a (5 × 3) matrix that contains the contemporaneous impact from the structural shocks that are not identified. $A'' = \tilde{A}Q'' = [a^{MP}, a^{FX}]$ is a matrix that contains the contemporaneous impact from the matrix that is identified. Q is an orthogonal matrix. MP is the monetary policy shock while FX is the exchange rate shock.

Like Bjornland et al. (2013) we place no restriction on the interest rate given an exchange rate shock. The exchange rate, however, is restricted to appreciate in the event of a contracting monetary policy shock. The sign restriction lasts for only one period, after which the exchange rate moves freely. We also place contemporaneous restrictions on the response of inflation, output and the foreign interest rate given a monetary policy shock. Also, there is one period delayed response of output and inflation given an exchange rate shock.

From a robustness perspective the sign restriction of the exchange rate response to monetary policy is relaxed and allows for the interest rate to respond immediately to the exchange rate shock. The restrictions can be written as follows:

$$defualt: \overset{MP\ FX}{\underset{n}{}}\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 1 & free \\ - & 1 \end{bmatrix}\begin{bmatrix} \pi_t \\ y_t \\ i^*_t \\ i_t \\ fx_t \end{bmatrix}, robust: \overset{MP\ FX}{\underset{n}{}}\begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 1 & + \\ free & 1 \end{bmatrix}\begin{bmatrix} \pi_t \\ y_t \\ i^*_t \\ i_t \\ fx_t \end{bmatrix}. \tag{3}$$

2. Empirical results

Figure 1 highlights the response of interest rates and exchange rates to different restrictions. The blue line (darker) is based only on the Cholesky decomposition while the green line (lighter) is the pure sign restriction. Both restrictions could be justified on theoretical grounds, but both of them yield different responses. The exchange rate appreciates under the Cholesky decomposition given a monetary policy shock while the interest rate decreases when the exchange rate depreciates. The converse is true under a pure sign restriction approach – the exchange rate appreciates when monetary policy tightens, while the central bank tightens rates when the exchange rate depreciates. The next set of results incorporates both sign and Cholesky restrictions[1].

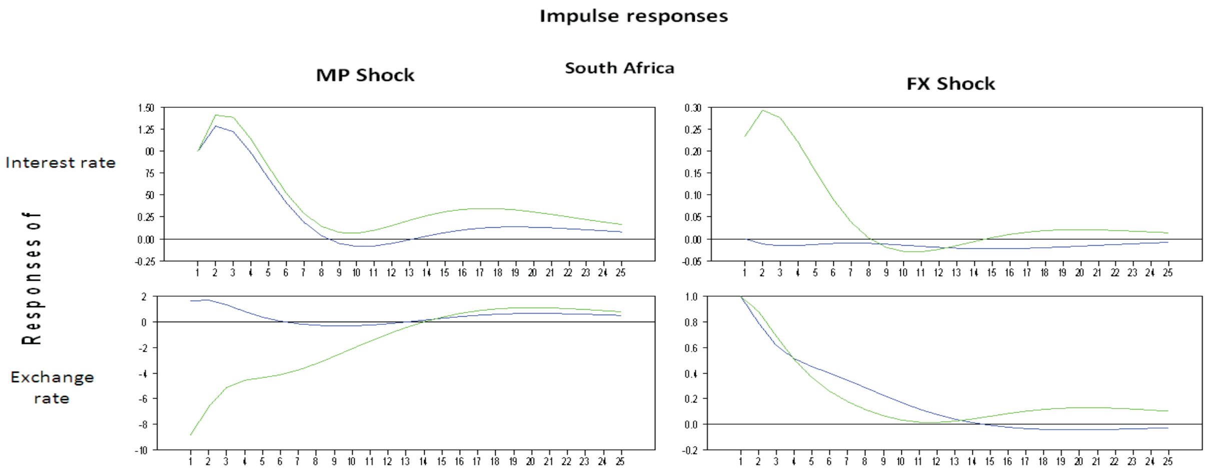

Fig. 1. Cholesky vs. sign restrictions

Figure 2 shows the response of all the variables to a monetary policy and exchange rate shock – this represents the baseline case. The exchange rate appreciates immediately given an increase in interest rates. The response of the exchange rate is small and dissipates rather quickly. This is an outcome of the sign restriction.

The central bank responds quite strongly when the exchange rate depreciates – the contemporaneous impact is a 0.2 percentage point increase in the repo rate for every 1 percent depreciation in the exchange rate. The central bank interest rate response lasts about 6 quarters. However, there seems to be some evidence of a correction – the central bank decreases interest rates after six months. This could be based on the findings of Ball (1999) that include a lagged exchange rate term in the Taylor rule to account for the second round effects of the exchange rate on inflation. The VAR also seems to create a price puzzle – inflation increases in response to an increase in interest rates. The pass-through of exchange rates to inflation reaches a maximum of about 0.3 percentage points after 3 quarters.

The results are robust given our alternative set of restrictions. The results of Figure 3 closely match that of Figure 2 (see below). The exchange rate response to an increase in interest rates is somewhat stronger, while the price puzzle falls away – inflation decreases regarding a monetary policy shock. Exchange rate pass-through to inflation is still positive albeit slightly smaller. The monetary policy response, sign and magnitude, is preserved regarding exchange rate depreciation.

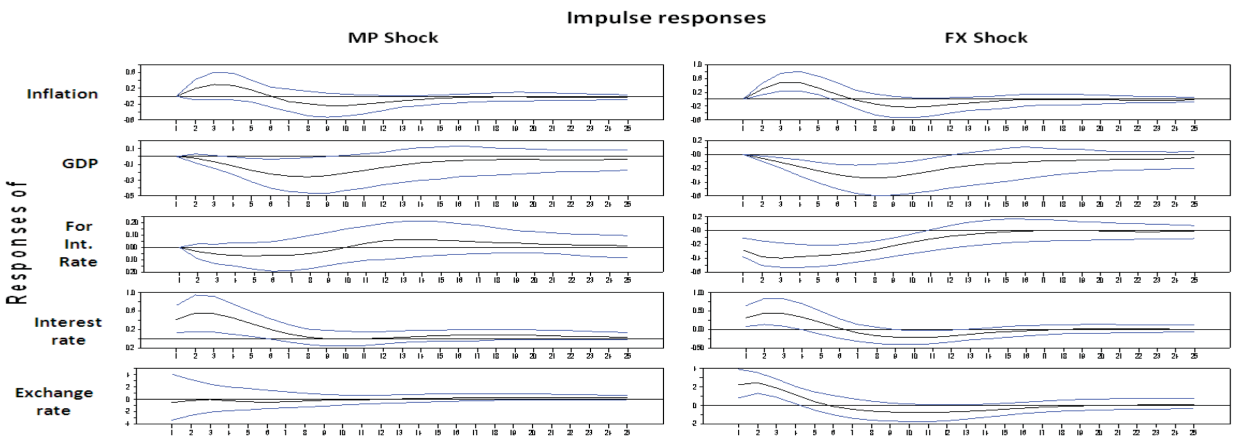

Fig. 2. Monetary policy and exchange rate shocks

[1] We use 2 lags as given by the Schwarz information criterion (see page 33).

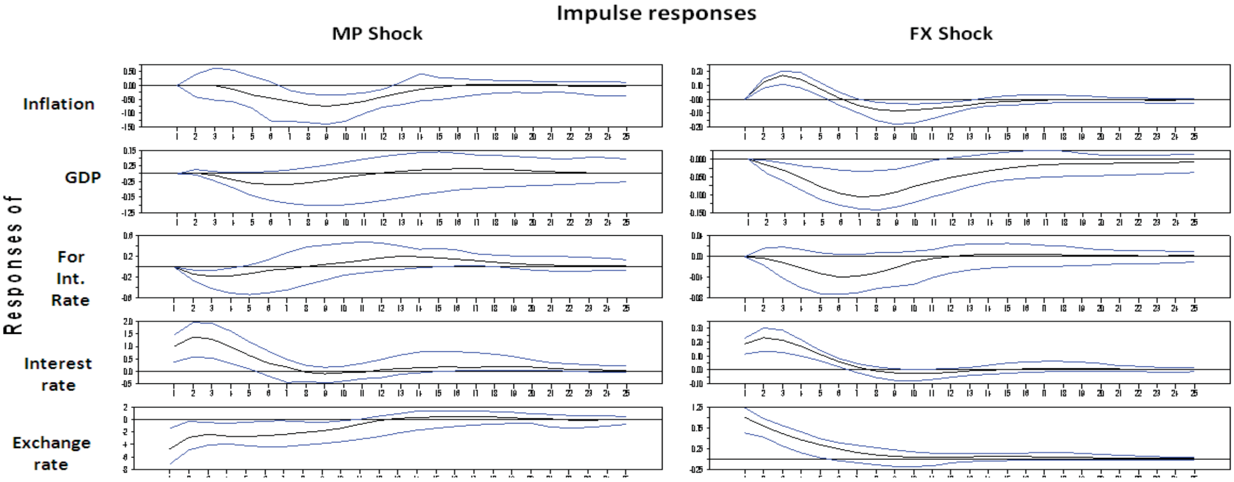

Fig. 3. Monetary policy and exchange rate shocks – robustness check

Conclusions

We use a VAR with both sign and short run restrictions to analyze monetary policy response to exchange rate movements. Our results are robust to alternative specifications. We show that monetary policy does not avoid altogether movements in the exchange rate in setting interest rates. We avoid using a Taylor rule in estimating the weight that the SARB puts on exchange rate movements, since this avoids other instruments that the SARB could use to intervene. Since our main aim is to analyze only the interest rate response to the exchange rate we avoided any restrictions on the interest rate regarding the exchange rate.

References

1. Alpanda, S., Kotze, K. and Woglom, J. (2010). Should Central Banks of Small Open Economies Respond to Exchange Rate Fluctuations? The Case of South Africa. Economic Research Southern Africa, Working Paper, p. 174.
2. Ball, L. (1999). Policy Rules for Open Economies in John B. Taylor, ed., Monetary Policy Rules. Chicago, Illinois: University of Chicago Press, pp. 127-144.
3. Cova, P. & Sondergaard, J. (2003). When should monetary policy target the exchange rate? Mimeo.
4. Devereux, Michael B. and Charles Engel. (2007). Expectations and the Misalignment of Traded Goods Prices. *International Seminar on Macroeconomics*, pp. 131-157.
5. Garcia, C., Restrepo, J. and Scott, R. (2011). How much should inflation targeters care about the exchange rate? *Journal of international money and finance*. Vol. 30 (7), pp. 1590-1617.
6. Gupta, R. (2013). Should the South African Reserve Bank respond to exchange rate fluctuations? Evidence from the Cosine-Squared Ceptstrum, *Actual Problems in Economics*, Vol. 2 (140), pp. 198-206.
7. Leith, C. and Wren-Lewis, S. (2006). The optimal monetary policy response to exchange rate misalignments, CDMA Conference Paper series 0605, Centre for Dynamic Macroeconomic Analysis.
8. Ortiz, A. and Sturzenegger, F. (2007). Estimating SARB's policy reaction rule, S*outh African Journal of Economics*, Vol. 75, pp. 659-680.
9. Ostry, J., Ghosh, A.R. and Chamon, M. (2012). Two targets, two instruments: Monetary and exchange rate policies in emerging market economies. International Monetary Fund. IMF SDN/12/01.
10. Svensson, L.E.O. (2000). Open-Economy Inflation Targeting, *Journal of International Economics*, Vol. 50 (1), pp. 155-183.
11. Uhlig, H. (2005). What are the Effects of Monetary Policy on Output? Results from an Agnostic Identification Procedure, *Journal of Monetary Economics*, Vol. 52, pp. 381-419.