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Contents

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Rand Misalignment: Evidence from Bayesian Threshold VECMs

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Abstract

This note assesses whether the rand has been misaligned relative to its economic fundamentals. Drivers of exchange rate movements also tend to be different over time. This note uses a framework that allows the relationship between the rand and its key macroeconomic fundamentals to change at specific points in time to account for this. The results show that there are relatively few occasions when the rand has deviated substantially from levels consistent with the relative fundamentals of the economy. The finding that the rand tends to move in line with economic fundamentals suggests that the rand tends to absorb a large proportion of the shocks that hit the economy, which helps shield the economy from their effects.

Introduction

The role of the exchange rate in maintaining macroeconomic stability and the possibility that it is misaligned from macroeconomic fundamentals are areas of intense debate amongst academics, policymakers and financial market commentators. If the exchange rate deviates from levels considered to be consistent with its 'fair value' according to a framework of how the exchange rate is determined, it impacts the relative attractiveness of domestic assets and the relative prices of South African goods and services and therefore the economy's external competitiveness. In this way, exchange rate deviations from fundamentals might affect the pace and composition of economic growth.

Exchange rates are jointly determined with domestic and international economic variables, in the sense that they react to, but also affect developments in other financial and macroeconomic variables. The key drivers of exchange rate movements also tend to change at different points in time. This note assesses whether the rand (ZAR) has been misaligned relative to economic fundamentals using a modelling framework that accounts for these features of exchange rate determination. The approach used models both the long term relationships between South Africa's relative macroeconomic fundamentals and the currency, and short term deviations from those relationships, while simultaneously allowing for the dynamics of the ZAR to differ at over time.

Theoretical approach

This note replicates the approach of Huber and Zörner (2019) that allows a relatively large number of variables to affect and react to the dynamics of the ZAR at any given point in time. The variables used as the fundamental determinants of the ZAR against five key cross-rates are those implied by the Taylor rule (which describes interest rate setting behaviour by central banks) and long-run monetary models (which emphasize the impact of monetary factors on currencies).

The dataset includes the following endogenous variables z_t for the ZAR relative to each of the US dollar (USD), pound (GBP), yen (JPY), euro (EUR) and Canadian dollar (CAD), measured monthly:

$$z_t = (e_t, i_t, i_t^*, p_t, p_t^*, y_t, y_t^*, m_t, m_t^*) \tag{1}$$

where e_t is the natural logarithm of the nominal exchange rate in terms of the number of rands per unit of each foreign currency, i_t denotes South Africa's short-term interest rate (proxied using three month money market rates), p_t is consumer price inflation, y_t is industrial production, m_t is the M3 money supply and $*$ denotes foreign counterparts of each domestic variable. The sample is 1994M1 to 2018M6.

Empirical approach

Huber and Zörner (2019) provide a framework for estimating three-regime Threshold Vector Error Correction models (TVECMs). The appeal of their approach is that models with multiple long-term cointegration relationships and a large number of endogenous variables can be estimated. This is made possible using a 'shrinkage' approach (that they propose) that allows a model with a very large number of parameters to be estimated in spite of a relatively short time series sample.[1] Their approach also has an important advantage in the context of exchange rate valuation. The use of a three-regime TVECM model allows periods of under/over-valuation of the ZAR to be identified. Specifically, the size of the deviations in ZAR from the value consistent with fundamentals is what determines the speed of adjustment back to equilibrium and therefore which regime the ZAR is in. This is consistent with financial market participants entering the market when exchange rates deviate substantially from their equilibrium value, helping to eliminate large deviations. Large deviations from fundamentals will imply that the cross rate is either under- or over-valued relative to the ZAR.[2]

Estimates of ZAR misalignment

Figure 11 plots the probability that each currency is under/over-valued relative to the ZAR at a specific point in time. Periods of misalignment are characterized by large deviations of the ZAR from the *long-run* value implied by the model.[3] The upper regime represents periods where the ZAR was under-valued relative to a specific currency, while the lower regime represents periods of ZAR over-valuation. The estimates suggest that the ZAR has been fairly valued for the majority of the sample against all the currencies considered. This suggests that for most of the sample there were only small deviations in the ZAR from the model implied long-run equilibrium level. Against the USD, for example, the ZAR is estimated to only have been over-valued between 2010 and 2012, and under-valued in late 2001 to early 2003, and following the global financial crisis. During the depreciation in late 2015 to early 2016, the ZAR is only estimated to have been under-valued relative to the GBP. Recently, the ZAR is estimated to have been over-valued compared to the EUR and CAD in the first half of 2018, as well as several bouts from 2010 onwards.

Figure 18 provides estimates of the deviation of the nominal ZAR relative to each of the currencies from the level that can be explained by the model. Deviations from the 'explainable level' of the exchange are calculated as the percentage deviation in the ZAR from the fitted value from the model (depending on which regime each currency is in at each point). These estimates can be interpreted as the deviation in the nominal exchange rate from the level that can be explained by relative fundamentals at a given point in time. Note that this definition is different from the exchange rate misalignment definition used in most of the SARB's other exchange rate equilibrium models, which focus on the deviation in the real effective exchange rate from a trend level determined using different theoretical frameworks.[4] The framework suggests that the ZAR has generally fluctuated within a 5 percent range around the level that can be explained by the model. Periods of major deviations correspond to periods of significant depreciation in the late 1990s, late 2001 and the global financial crisis.

[1] The model is estimated using Bayesian methods. In the absence of an empirical literature on appropriate shrinkage priors in a South African context, the priors of Huber and Zörner (2019) for the US are imposed, and this was sufficient to ensure that the cointegration relationships were identified. Raising the values of the prior hyper-parameters that govern the extent of the shrinkage applied (i.e. lowering shrinkage from 0.01 to 0.005), did not dramatically change the results. After a burn-in of 15000 draws, the next 15000 draws from the conditional posterior distributions were used to calculate the properties of the parameters. For more details on the specification of the set of prior distributions and the derivation of the conditional posterior distributions, the alogorithm and sampler used see Huber and Zörner (2019). The cointegration rank (i.e. number of cointegration relationships) in each three-regime TVECM model was determined using Deviance Information Criterion comparisons across different model specifications. A rank of 1 is selected for all currencies. The specification used is based on 2 lags in the autoregressions.

[2] This implies that the regime shifts are the same across all equations in the TVECM. The model also assumes that the regime cointegration coefficients are constant over time.

[3] The ZAR is over(under)-valued if the posterior distribution (containing information from the priors imposed as well as from the data) of the threshold variable is below(above) the lower(upper) threshold.

[4] The SARB uses several frameworks to form a judgment about whether the ZAR is misaligned. As part of its forecasting activities, the SARB maintains a suite of statistical and structural (i.e. theoretical) models that are used to estimate South Africa's 'real effective exchange rate gap'. This is the difference between the equilibrium exchange rate (i.e. the level consistent with the fundamental determinants of the exchange rate) and the current level of the trade-weighted real ZAR. The exchange rate gap is then used to model the dynamics of inflation and growth. In addition, models like the semi-structural model of Botha et al. (2019) are used for constructing narratives about the factors contributing to the exchange rate gap and inflation outcomes.

Figure 1: Probability of misalignment

USD

Figure 2: Lower regime

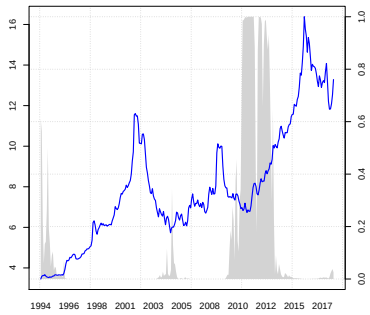


Figure 3: Middle regime

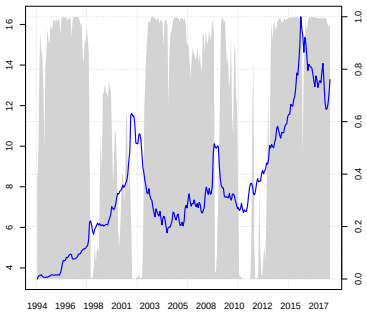
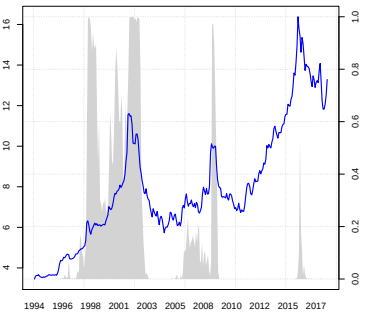


Figure 4: Upper regime



GBP

Figure 5: Lower regime

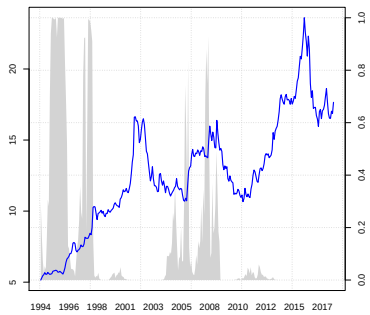


Figure 6: Middle regime

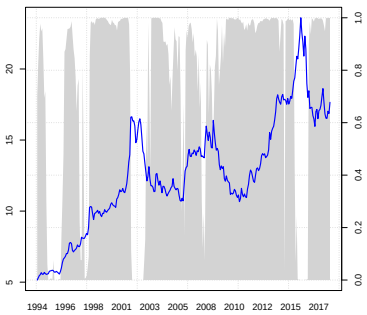
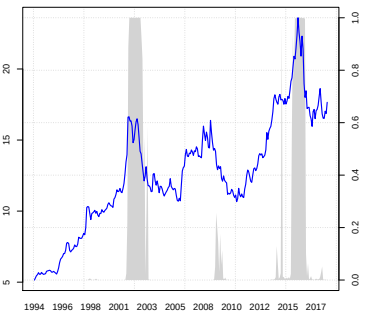


Figure 7: Upper regime



EUR

Figure 8: Lower regime

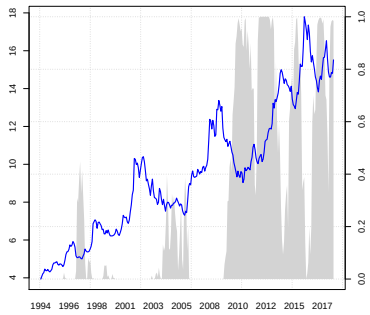


Figure 9: Middle regime

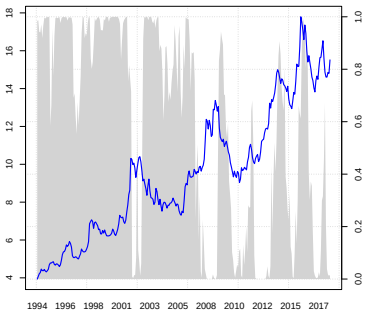
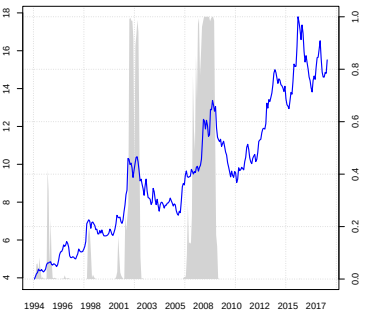


Figure 10: Upper regime

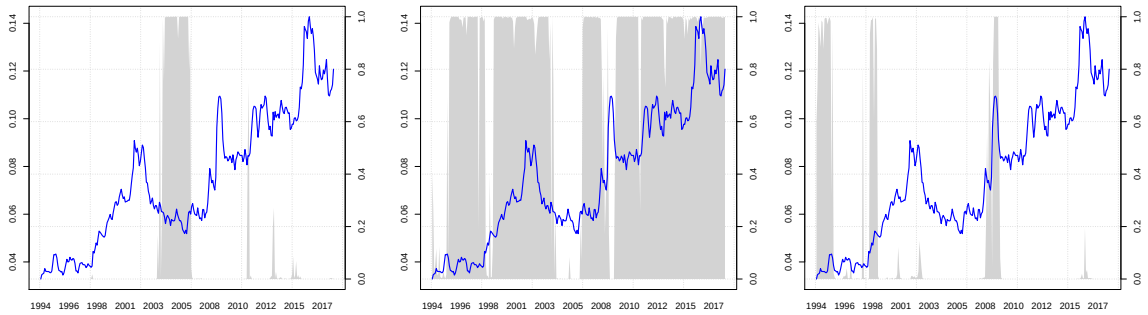


Note: Shaded areas are the posterior mean of regime probabilities. The blue line is the logged observed exchange rate.

Figure 11: Probability of misalignment

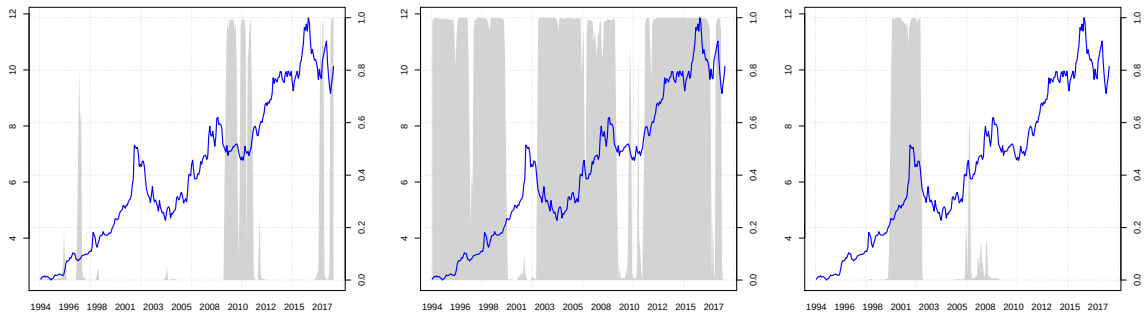
JPY

Figure 12: Lower regime **Figure 13: Middle regime** **Figure 14: Upper regime**



CAD

Figure 15: Lower regime **Figure 16: Middle regime** **Figure 17: Upper regime**



Note: Shaded areas are the posterior mean of regime probabilities. The blue line is the logged observed exchange rate.

Conclusion

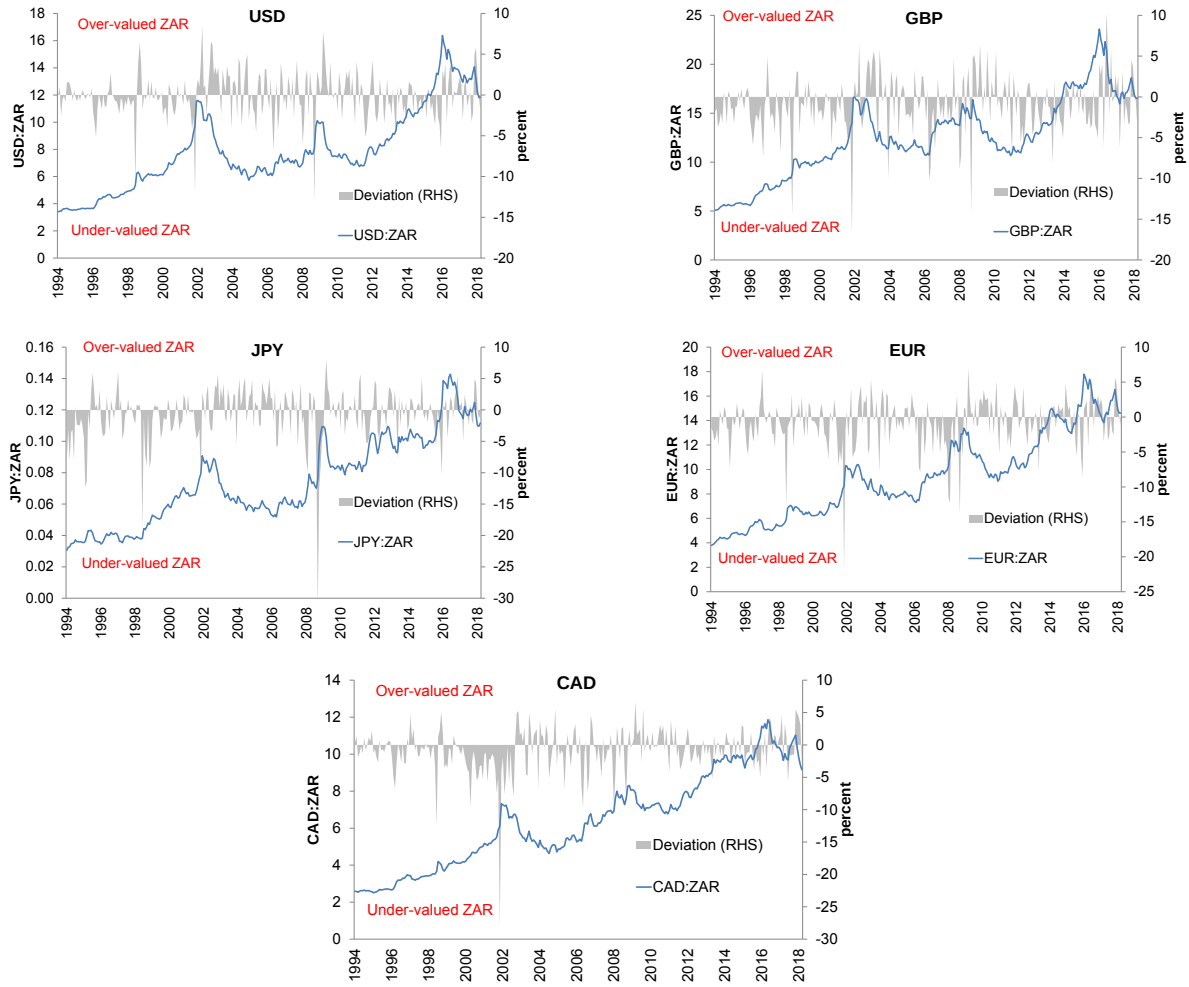
If the exchange rate absorbs shocks from domestic and foreign fundamentals, it can help shield the economy from their effects. For example, if the rand depreciates in response to a lower international gold price, it would tend to offset some of the impact on South African gold exports by smoothing the rand price of such exports. But even if the currency is predominantly a shock absorber, monetary policymakers may still be concerned about exchange rate fluctuations if there are asset market distortions that prevent efficient resource allocation or exacerbate the build-up of external imbalances.[5]

This note identifies periods of ZAR misalignment using a model that allows the relationship between the ZAR and key macroeconomic fundamentals to change at specific points in time. Even though only a couple of macroeconomic variables are included in the models, these estimates suggest that the ZAR has experienced relatively few substantial deviations from levels consistent with the relative fundamentals of the South African economy. This suggests that the ZAR tends to move in line with economic fundamentals. The implication is that the rand tends to provide a buffering role to the economy, as opposed to being a major source of macroeconomic instability itself.[6] However, this analysis cannot be used to assess whether exchange rate misalignments materially contribute to macroeconomic volatility in South Africa, and whether there is a role for monetary policy in reducing such deviations. These questions are left for future research.

[5] These include imperfect international risk sharing, imperfect exchange rate pass-through into import prices, home bias or terms of trade externalities (see, for example, Devereux and Engel 2003, De Pauli 2009, Justiniano and Preston 2010 or Corsetti et al. 2018).

[6] This finding is consistent with the FAVAR model of Soobyah and Steenkamp (2019) which suggests that ZAR deviations from fundamentals are generally not large when accounting for a large number of variables that affect ZAR dynamics. To assess the usefulness of alternative models of the equilibrium exchange rate, future work could provide in-sample fit and out-of-sample forecast comparisons of different models.

Figure 18: Deviation from explainable level (percent)



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