Inflating our troubles: South Africa’s economic performance and the exchange rate

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South Africa’s export performance has been disappointing, and this is likely related to weak growth outcomes. We investigate the effect of the exchange rate on these outcomes, through two possible channels: its level and its volatility. We find little evidence in the literature or in our own tests to suggest volatility has been an important factor. The level of the currency appears to be more important, with currency undervaluation apparently favouring growth and exports. This may justify a policy of asymmetric reserve accumulation. An inflation target closer to that of our competitors and trading partners would also help maintain a competitive real exchange rate.

Introduction

South Africa’s export performance has been extremely disappointing. It compares badly with peer countries and has deteriorated since 2008, even though the pre-crisis record was also poor (Figure 1). In stark contrast to many other developing economies, South Africa’s share of world trade has declined over the past three decades (Figure 2). Economic growth over this period has been similarly underwhelming, and the two are likely connected.

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Although there are several real economy explanations for this underperformance, including recessions in traditional trade partners as well as electricity and labour disruptions, the exchange rate might also have contributed to weak exports and low growth. There are two possible mechanisms. First, the level of the exchange rate could have been problematic; for instance, an appreciated currency might have rendered the tradeable sector uncompetitive. Second, the volatility of the rand may have affected export growth. Have these aspects of the exchange rate damaged exports and growth? Our basic answers are as follows:

The literature on currency volatility does not yield a clear verdict on its consequences for growth. Our fresh attempt to evaluate its effects on South Africa fails to show it has been damaging. This is not proof of its harmlessness, and it is indeed very difficult to prove this point one way or another with existing data and techniques. The right responses would be to gather better data and – best of all – graduate from statistical methods to experiments, specifically by subsidising hedging products for smaller firms to mimic exchange rate stability. This would provide much better information about the effects of volatility on its most plausible victims: small and medium enterprises.

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3 The cost of the hedge would not exist if the exchange rate was fixed. To offset that cost to small firms, the product can be subsidised as part of the ‘experiment.’
Regarding the level of the currency, we find that an undervalued real rand has favoured net exports over the entire sample period considered. However periods of undervaluation only appear correlated with stronger aggregate output after 2004. This may be because the impact of real depreciation on net exports and aggregate output has been quite small. We interpret these findings as grounds for exploring strategies to improve competitiveness – although we do not expect these to transform South Africa’s growth performance.

There are several policy options for achieving a more competitive real exchange rate. We discuss the basic techniques for intervening in foreign currency markets and their pros and cons below. Whilst these market interventions often carry high costs, there is a case for a policy of asymmetric reserve accumulation, aimed at leaning against appreciations but not depreciations. However, the literature shows this is unlikely to succeed for long if it is funded with sterilised purchases of foreign assets. Unsterilised purchases would be more effective, but pose other serious risks, particularly to inflation. The most effective option would be reserve accumulation financed by savings, for instance through fiscal surpluses.

A complementary, perhaps more promising approach would be moderating the growth of the domestic price level, to a pace closer to that of trading partners and competitors. Over the past two decades, the real effective exchange rate has fluctuated but around a level that has remained quite stable. This is because domestic inflation has mostly undone the depreciation in the real rate achieved through trend nominal depreciation. This should be a key focus area for policy. A persistently lower inflation rate – more in line with our peers – would encourage a sustainable improvement in export competitiveness over time.

**Exchange rate volatility**

The rand is an unusually volatile currency. To demonstrate this point, we compare it to a number of emerging market peers as well as a cross section of the fourteen emerging markets for which the BIS provides effective exchange rate data. We use two techniques to calculate volatility: standard deviations for the broadly comparative chart (Figure 3) and a GARCH
model for the individual country comparisons (Figure A1). Both yield the same verdict. There is little question that the rand is a volatile currency; the puzzle is whether or not this matters for exports and ultimately, growth.

Figure 3: Rand volatility compared to 14 emerging market currencies

![Graph showing rand volatility compared to 14 emerging market currencies.]

Economic effects of volatility

In theory, currency volatility is damaging because firms cannot be sure of their export profits and therefore reduce or avoid exports. But this logic is perhaps more problematic than it first appears. Consider Table 1. If a currency’s movements over time take the form of a random walk, favourable and unfavourable changes in value should be about equally probable and firms would therefore faces comparable gains or losses. Following a stripped-down theory of choice, like Expected Value Theory, economic agents will then be indifferent between a volatile and a stable currency.

Generalised Autoregressive Conditional Heteroskedasticity (GARCH) models are used to construct conditional volatility measures. GARCH (1,1) specification – assuming that the log difference of the exchange rates follows a random walk with drift – was used to construct conditional variances reported in Figure A1. The order of GARCH is supported by the significance of the estimated coefficients. ARCH tests were conducted prior to the actual estimation and the estimated regressions ensure that the time-varying variance processes are stable and that the GARCH terms are covariance stationary.

5 The main themes of uncertainty and risk aversion are spelt out by M.A. Akhtar & R. Spence Hilton, “Effects of Exchange Rate Uncertainty on German and U.S. Trade” Federal Reserve Bank of New York Quarterly Review, Spring 1984, p. 10

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4 Generalised Autoregressive Conditional Heteroskedasticity (GARCH) models are used to construct conditional volatility measures. GARCH (1,1) specification – assuming that the log difference of the exchange rates follows a random walk with drift – was used to construct conditional variances reported in Figure A1. The order of GARCH is supported by the significance of the estimated coefficients. ARCH tests were conducted prior to the actual estimation and the estimated regressions ensure that the time-varying variance processes are stable and that the GARCH terms are covariance stationary.
Table 1: The Indifference of Rational Actors to Volatility under Expected Value Theory

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Stable Currency</th>
<th>Volatile Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td>100% chance of 100</td>
<td>½ chance of 110 = 36.67</td>
</tr>
<tr>
<td>Scenario 2</td>
<td></td>
<td>½ chance of 100 = 33.33</td>
</tr>
<tr>
<td>Scenario 3</td>
<td></td>
<td>½ chance of 90 = 30</td>
</tr>
<tr>
<td>Payoff</td>
<td>= 100</td>
<td>= 100</td>
</tr>
</tbody>
</table>

Defenders of the view that volatility hurts might object that the currency does not take the form of a random walk. In South Africa, the currency does indeed drift, and this is how we have treated it in our GARCH modeling exercise. However the currency drifts downwards in a trend depreciation.\(^6\) Furthermore, periods of major exchange rate surprises have chiefly taken the form of sudden depreciations, as in 1998, 2001 and (to a lesser extent) 2013. This means that alongside trend depreciation, major volatility has tended to deliver surprise profits for exporters, hardly a disincentive to trade.\(^7\) The counter-argument would need to show that surprise appreciations and profit losses – smaller and against trend – are more damaging to export growth.

An additional problem is that price uncertainty may even be better for exporters. Table 1 makes the case for indifference to volatility, because profits are symmetrical around the stable outcome. But, as Paul de Grauwe has pointed out, volatility may even be preferable:

Exporting can be seen as an *option*. When the exchange rate becomes very favourable the firm exercises its option to export. With an unfavourable exchange rate the firm does not exercise this option. It is well known from option theory that the value of the option increases when the variability of the underlying asset increases. Thus, the firm that has the option to export is better off when the exchange rate becomes more variable.\(^8\)

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\(^6\) The estimated coefficient for the drift term is -0.49 and is statistically significant at the 0.01 significance level.

\(^7\) In practice, much of South Africa's commodities and related exports are invoiced in USD or Euro. But because many costs are rand-denominated, producers are not unaffected by the exchange rate.

\(^8\) Paul De Grauwe, *The Economics of Monetary Integration*, Oxford: Oxford University Press, 1994, pp. 64-65
This does not prove volatility is harmless. It may be that exporting requires economies of scale and sunk costs (for instance in marketing infrastructure) that make opportunistic exporting difficult. It may also be that firms’ behavior follows prospect theory, meaning they are more wary of potential losses than they are attracted to gains. These conjectures are plausible but by no means indubitable. Consequently, volatility cannot be adjudged harmful on purely theoretical grounds.

The view from the literature

What about the empirical evidence? The literature on exchange rate volatility is rich, deep and frustratingly inconclusive. Agatha Côté’s 1994 survey identified a strong popular consensus that volatility harmed trade. But there is no such agreement in the scholarly literature, where the effects were generally described as ambiguous and – when clearer – quite small. Ilhan Ozturk revisited the literature for a 2006 survey which identified forty two published studies on the subject between 1982 and 2005. “The overall evidence is best characterized as mixed,” he reported, with a plurality of authors finding a negative effect from volatility but a significant number finding no connection, or even a positive link.

More recent research has done little to alter this view. In 2006, Silvana Tenreyro investigated the problem using new methods and identified no effect of volatility on trade, a finding she suggested could stem from volatility’s potential to deliver profits as well as losses, and might also have to do with the availability of hedging options. Christian Broda and John Romalis noticed that trade could itself suppress volatility, a fact they demonstrated by showing a correlation between country proximity and volatility (in which causation could not run the other way) and argued that this endogeneity problem explained part of whatever link seemed

visible between trade and volatility. Once this was accounted for volatility had a visible but small and uneven effect on trade.\textsuperscript{12} Kenneth Rogoff et al. tried a different approach, linking volatility to long-run productivity growth, and discovered a much stronger connection. It disappeared, however, when they controlled for development of the financial sector, suggesting that the harmful consequences of volatility could be solved through financial engineering.\textsuperscript{13}

Even if cross-country studies fail to show a clear link, one might think the evidence for South Africa – a volatility outlier – would be clearer. Indeed, Rogoff and his co-authors picked out South Africa as a country where policymakers were under particular pressure to limit the currency’s volatility. Yet once again, the literature is not conclusive. A 2003 paper by Michael Samson opened with the claim that “The foreign exchange rate and its volatility exert a substantial impact on export competitiveness…” but backtracked on the volatility claim within two paragraphs, conceding that “there is little evidence that rand volatility (independent of the level of the currency) exerts a negative effect on export production.”\textsuperscript{14} In 2005, Todani and Munyama investigated the impact on exports of short term fluctuations in the rand for the period 1984 to 2004 and found no relationship (or, where one was visible, a perversely positive connection), with their results very sensitive to alternative specifications of different variables.\textsuperscript{15} Bah and Amusa, by contrast, examined exports to the United States alone and reported a significant and negative effect from volatility.\textsuperscript{16} Ekanayake et al., however, looked at trade with the European Union and concluded that although there were short-term consequences for exports, this did not apply in the long term, nor were imports harmed.\textsuperscript{17}

\textsuperscript{12} Christian Broda and John Romalis, “Identifying the Relationship Between Trade and Exchange Rate Volatility”, NBER Chapters in “Commodity Prices and Markets”, East Asia Seminar on Economics, 20: 79-110, 2010
\textsuperscript{14} Michael Samson et al., “The volatility of the rand and its impact on the manufacturing sector: the impact on exporters and investors” EPRI Research Paper #35, 1 October 2003, p. 4
\textsuperscript{17} E.M. Ekanayake, Ranjini L. Thaver & Daniel Plante, “The Effects of Exchange Rate Volatility on South Africa’s Trade with the European Union” The International Journal of Business and Finance Research, Vol. 6, No. 3, 2012
Thus, as with the international research into volatility, empirical South African studies have failed to achieve consensus.

**An empirical investigation of the consequences of volatility in South Africa**

Puzzled by this problem, we have conducted our own study and have also been unable to identify any meaningful relationship between volatility and exports. For this exercise we employed a demand model for the manufacturing sector in South Africa, which treats manufacturing gross value added (GVA) as a function of relative prices, foreign demand and exchange rate volatility.

\[
X_t = f\left(\frac{P_t}{P_t^*}, Y_t^*, \sigma_t\right)
\]  

[1]

Where \(X_t\) represents demand for exports, \(\frac{P_t}{P_t^*}\) is the ratio of domestic prices to foreign prices, \(Y_t^*\) represents foreign demand conditions and \(\sigma_t\) represents exchange rate volatility. Parameterising equation [1] yields the following:

\[
x_t = \beta_0 + \beta_1 (p_t - p_t^*) + \beta_2 y_t^* + \beta_3 \sigma_t + \epsilon_t
\]  

[2]

Where \(x_t\) is the natural logarithm of export volume, \((p_t - p_t^*)\) is the natural logarithm of the price ratio, \(y_t^*\) is the natural logarithm of foreign demand conditions and \(\sigma_t\) is exchange rate volatility. The \(\sigma_t\) variable is proxied by the conditional variance of a GARCH(1,1) model of the natural logarithm first difference of the nominal effective exchange rate for South Africa. Consistent with the export demand relationship, rising relative prices are expected to have a

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18 We use manufacturing GVA as a loose proxy for manufacturing exports, because a time series on manufacturing exports is not available for South Africa.
19 The relative price variable is constructed as a ratio of manufacturing PPI to World Bank’s manufacturing unit value index.
20 The foreign demand variable is proxied by European Union’s GDP.
21 The analysis is limited to the manufacturing sector due to data constraints.
negative effect on manufacturing production while foreign demand is expected to support manufacturing production. However, the expected sign for the $\beta_3$ parameter is ambiguous.

The results show that exchange rate volatility has few discernible effects on manufacturing production in the long run. However, there are some weak short-run effects. Figure 4 presents the cumulative responses of manufacturing GVA to shocks in volatility, foreign demand and relative prices. It is evident that foreign demand shocks have the greatest (and positive) impact on manufacturing GVA, while exchange rate volatility exerts the smallest (and negative) impact on manufacturing GVA. In addition, the magnitude of these shocks is small and all shocks dissipate after about eight quarters, implying that their effect on manufacturing production is quite short lived. The relative importance of the various shocks in explaining short-run variation in manufacturing GVA is presented in Figure 5. Most of the variation is explained by manufacturing GVA itself, followed by foreign demand. Relative prices and volatility in particular are negligible by comparison.

Figure 4: Cumulative responses of manufacturing GVA to shocks in exchange rate volatility, foreign demand and relative prices

Source: Authors’ estimates
The possibility remains that there are potential exporters who have simply avoided international markets out of fear of volatility, and who therefore do not show up in studies. As Lawrence Edwards has observed, small South African firms are relatively reluctant to export, with only 28% doing so, compared to 69% of large firms. The inference that volatility is to blame has been drawn by Edwards and Willcox (although it is not defended).

If volatility results in fewer small firms exporting than would otherwise be observed, South Africa might be able to improve its export performance by protecting smaller firms from volatility. One way to achieve this would be to try and stabilise the rand, but it is unlikely this policy could survive a cost-benefit analysis, even assuming it would succeed. A more targeted and cheaper option for addressing volatility, however, might be to provide hedging products for small firms directly. This would also be an interesting experiment for determining if volatility really is a problem. Significant demand for hedging facilities and a visible uptick in exports would be the best evidence yet that volatility has hampered South Africa’s trade performance.

The exchange rate level

Unlike volatility, the literature generally endorses the view that the level of a currency matters for exports and growth.\textsuperscript{24} Whilst the whole body of empirical research on the subject is too extensive to be reviewed here, four points are especially important for our inquiry. First, an \textit{overvalued} exchange rate appears to hinder growth, for reasons which likely include capital shortages and unsustainable current account deficits.\textsuperscript{25} Second, an \textit{undervalued} exchange rate tends to have a positive effect (although more for developing countries than developed ones).\textsuperscript{26} A number of explanations have been offered for this pattern. One plausible contender is that currency undervaluation reallocates resources towards the tradable sector, where learning-by-doing externalities and technological spillovers lead to dynamic gains in the form of higher economic growth. Another is that it raises investment and lowers real wages. A third is that it prevents financial crises by discouraging excessive consumption financed through current account deficits.\textsuperscript{27} For reasons such as these, the literature is more sympathetic to policymakers intervening to weaken a currency than to support it.

The third salient point in the literature is that the relevant exchange rate is the \textit{real} exchange rate, not the nominal one:\textsuperscript{28} a nominal depreciation that translates into higher prices does not

\textsuperscript{26} Dani Rodrik, “The Real Exchange Rate and Economic Growth “\textit{Brookings Papers on Economic Activity}, Vol. 39, Issue 2, Fall 2008. Indeed, currency undervaluation seems to have been a winning strategy for a very long time period: Surjit Bhalla’s 2012 study of the subject goes back 150 years and finds a connection between undervaluation and growth throughout. Surjit S. Bhalla, \textit{Devaluing to Prosperity: Misaligned Currencies and their Growth Consequences}, Peterson Institute: Washington DC, August 2012
\textsuperscript{28} In measuring the effects of currency valuations, we use nominal and real effective exchange rates calculated by the Bank for International Settlements (BIS). To clarify, an effective exchange rate is the weighted average of exchange rates, with weights determined by trade. The \textit{nominal} effective exchange rate (NEER) is the weighted average of bilateral exchange rates. The BIS data treats the euro area as a single unit, which then takes the largest weighting for South Africa, at 29.1%, followed by China at 16%, the United States at 12.4%, Japan at 9.6% and the United Kingdom at 6.2%, so South Africa’s NEER is then made up of those proportions of the exchange rate for the rand/euro, rand/renminbi, rand/dollar, rand/yen, rand/pound and so forth. The \textit{real} effective exchange rate (REER) is the NEER multiplied by relative price levels. The BIS uses consumer price indices to measure price
make local goods and services any cheaper. In South Africa, for example, nominal depreciation has been near-consistent in the past twenty years, although high inflation has persistently prevented similar real gains. Fourth, it is important not to treat exchange rate policy as the Holy Grail of growth. As Barry Eichengreen reminds us,

> Development experience … shows that keeping the real exchange rate at competitive levels can be critical for jump-starting growth… This is not the same as saying that real exchange rate policy can substitute for the presence of a disciplined labor force, high savings, or a foreign investment-friendly climate.

**Does South Africa benefit from an undervalued rand?**

Since the adoption of inflation targeting, South Africa has tended to leave the value of the rand to market forces. Has this been sub-optimal? We choose to look at this using derived macroeconomic variables. We recognise the pitfalls associated with this approach and are aware of the risks in leaning too heavily on their explanatory power. However, we are primarily interested in identifying whether periods of over or undervaluation are associated with more rapid economic growth, not whether determination of the spot exchange rate says anything about macroeconomic imbalances or economic growth.

To see whether or not undervaluation of the South African REER has historically been good for growth and exports, we compare two measures of undervaluation (or currency misalignment). The first is a model-based measure devised by Shaun de Jager in his 2012 paper. It is constructed as the difference between the actual exchange rate and an equilibrium levels, although this can also be achieved with GDP deflators, producer price indices or other measures. The ultimate goal is to show the real prices of foreign goods against local goods.

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31 Berg and Miao follow a similar approach when comparing the two views on whether or not exchange rate matters for growth. First, the Washington Consensus view where exchange rate misalignments are considered as not conducive to growth because they essentially reflect disequilibria in macroeconomic fundamentals. Second, the view by Rodrik (2008) who argues that undervaluations are good for growth and that the converse is also true (i.e. overvaluations hurt economic growth).
exchange rate, the latter being determined by macroeconomic fundamentals in the medium run.\textsuperscript{33} The second measure is Dani Rodrik’s undervaluation index, based on the purchasing power parity (PPP) theory.\textsuperscript{34}

Since the equilibrium REER is an unobserved variable it may be estimated in different, non-overlapping ways. In the interests of a more robust analysis we therefore rely on both these measures of currency undervaluation. The two measures identify similar periods when the rand was undervalued, most notably the periods 1998-2002 and 2007-2009 (see Figure 6).\textsuperscript{35}

![Figure 6: Comparing model and PPP-based measures of undervaluation](source: De Jager (2012), authors’ calculations)

*Note: Green and blue shaded areas represent periods where the rand was undervalued according to the De Jager (2012) (i.e. model-based measure of undervaluation) and Rodrik (2008) (i.e. PPP-based measure of undervaluation) measures, respectively.*

\textsuperscript{33} These macroeconomic fundamentals include the real interest rate differential, productivity differential, openness, public sector borrowing requirement, the capital account and commodity prices.

\textsuperscript{34} Rodrik’s undervaluation methodology begins by regressing the log of the REER on GDP per capita to obtain a fitted REER series. The REER is defined as the ratio of the market exchange rate to the PPP conversion factor. The fitted REER essentially constitutes the REER adjusted for the Balassa-Samuelson effect. The undervaluation index is calculated as the difference between the actual and the fitted REER (hence, the REER misalignment is presented as a deviation of the actual REER from some ‘equilibrium’ REER). Values greater than 1 indicate periods where the rand was undervalued (i.e. where the exchange rate made domestically-produced goods relatively cheap). Data is obtained from Penn World Tables 7.1 – this data is annual and only available up to 2010. Market exchange rate (EXRAT), PPP conversion factor (PPP) and real GDP per capita (RGDPPC) series are used in estimation with the resulting equation for the period 1950-2010 given by: $\log(\text{EXRAT}/\text{PPP}) = 2.40 - 0.24*\log(\text{RGDPPC})$. Both coefficients are statistically significant at the 1 percent significance level.

\textsuperscript{35} Note that due to availability of data, Rodrik’s measure of undervaluation only extends to 2010.
Figure 7 presents the quarterly export and GDP growth rates against the two undervaluation measures (in shaded areas).\textsuperscript{36} There seems to be some indication that the dips in the export and GDP growth rates are associated with the periods where the rand was overvalued. Table 2 presents the correlation analysis between the model-based undervaluation measure and the export and GDP growth.\textsuperscript{37} The correlations are calculated for the entire sample (1995Q1-2012Q4) and for the two subsamples (1995Q1-2003Q4 and 2004Q1-2012Q4) due to a possible presence of a structural break in the first quarter of 2004.\textsuperscript{38}

**Figure 7: Undervaluation and export and GDP growth**

![Graph showing undervaluation and export and GDP growth](source: De Jager (2012), authors’ calculations)

*Note: Green and blue shaded areas represent periods where the rand was undervalued according to the model-based and PPP-based measures, respectively.*

\textsuperscript{36} Specifically, we use the growth in export volumes and growth in GDP per capita series. Raw data was obtained from SARB.

\textsuperscript{37} PPP-based measure of undervaluation is not used because it is not available in quarterly frequency.

\textsuperscript{38} We applied statistical tests for the presence of a structural break in the relationship between the undervaluation measure and both GDP per capita growth and export volume growth. The results indicate the presence of structural break in the first quarter of 2004.
Table 2: Correlation coefficients between the model-based undervaluation index and GDP and export volume growth rates

<table>
<thead>
<tr>
<th></th>
<th>Total sample</th>
<th>1995Q1-2003Q4</th>
<th>2004Q1-2012Q4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GDP</td>
<td>Export volume</td>
<td>GDP</td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.28</td>
<td>0.33</td>
<td>-0.14</td>
</tr>
<tr>
<td>p-value</td>
<td>0.05</td>
<td>0.01</td>
<td>0.31</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations.

Note: In the correlation calculations above, the undervaluation measure has been lagged by 4 quarters to allow for the effects of undervaluations/overvaluations to feed into GDP and export volume growth. Figures in bold indicate statistically significant results.

Table 2 shows relatively weak but statistically significant correlations for the total sample period considered. However, correlations for the two subsamples indicate a significant improvement in the correlation between the undervaluation measure and GDP growth during the 2004Q1-2012Q4 period and a marginal improvement in the correlation between the undervaluation measure and export growth. However, the latter correlation is consistent and significant across the total sample and the two subsamples suggesting that an undervalued real rand has been good for growth in export volumes.

Next, we follow the work by Couharde and Sallenave\textsuperscript{39} to investigate the relationship between the model-based measure of undervaluation and growth in South Africa. We test the relationship between the model-based undervaluation measure (i.e. measure of REER misalignment) and economic growth using a smooth transition regression (STR) model. The STR model assumes that a transition variable can be used to distinguish between different regimes in the data. Specifically, for some threshold (or thresholds) of a transition variable, economic growth would display different behaviour before the threshold is reached and after the threshold has been surpassed. There are two possible hypotheses here: first, a single threshold exists differentiating between two regimes, one where the transition variable is high

and the other when the transition variable is low; second, two thresholds exist implying that growth behaves similarly at the very low and very high values of the transition variable, but differently between the two thresholds (i.e. in the middle).

Treating misalignment as the transition variable and growth as the dependent variable, the first hypothesis holds that growth behaves differently at high values of misalignment relative to low values of misalignment. Under the same assumptions, the second hypothesis implies that there is some middle range of misalignment that results in a different growth outcome relative to very low and very high values of misalignment.

We test the threshold for exchange rate misalignment using aggregate growth data as well as growth in the mining and manufacturing sectors, to see whether sectoral results differ from the aggregate result. We find that the first hypothesis holds in the South African case – economic growth is slightly positive in periods of undervaluation, and slightly negative in periods of overvaluation. The effect of undervaluation is not significant for the mining and manufacturing sectors, although overvaluation has a significant negative impact on growth in these sectors. Thus our evidence suggests that once currency misalignment passes some threshold, there is an impact on economic growth, implying that a more competitive exchange rate level may positively impact aggregate growth.

**Policy options for an uncompetitive exchange rate**

Much of the literature makes the case that on balance countries can improve economic outcomes – better net exports and aggregate growth – if they avoid persistent and large real exchange rate appreciation. This seems especially true for economies that are operating some distance from the production possibilities frontier, and which can gain by making domestic factors of production more competitive in the production of a feasible set of products or services demanded in international markets. For South Africa, our results suggest that there could be some minor gains to growth from achieving a more consistently competitive real exchange rate. These would presumably be stronger where relative and comparative depreciation in factor costs would matter to economic incentives and outcomes, and, very
importantly, in conditions of reasonable world economic growth. As we have seen in recent years, real depreciation has little clear impact when global growth is weak.

Industries that are highly dependent for their production on imported inputs or costs set in global markets, would not benefit greatly judging by our sector results. Moreover, as domestic prices and costs react to the relative price change, the benefit of any change decreases. Stronger outcomes would require efforts that slow (second-round) price rises and be complementary to the initial relative price change.

A difficulty with real depreciation as an answer to exports and growth is that the correlation between the degree of undervaluation measure we use and GDP growth is not strong. Part of this is simply that undervaluation counts little for net export growth (demand is a much larger impact), and net exports in turn contribute relatively little to overall GDP growth. Another part of the explanation for this is that the undervaluation measures are themselves relative – they show undervaluation at times when the currency has been strong, but not as strong as the fundamentals of the economy suggest they should be. For instance, when commodity prices are rising and the currency lags the movement in commodity prices, the measure shows undervaluation. This is undervaluation relative to the contemporaneous movement of a fundamental but not necessarily relative to t-1.

Given the large impact of global growth on South Africa’s export performance, it should therefore not be surprising that the South African economy has tended to grow faster and create more jobs when the exchange rate seems appreciated in nominal terms. This may be because world GDP growth is stronger at those times, raising the rand’s asset value. Or it may be because a strengthening of South Africa’s terms of trade, due to higher commodity prices, provides a positive demand shock and bids up the value of the currency.

Assume for the moment that policy makers want to achieve real depreciation. What might they do? There are two options for directly lowering the price of a currency: interrupt the market by way of regulations to reduce capital inflows, or intervene in the market via reserve
accumulation to offset the effects of rand purchases. Neither is a sure remedy, and both come with extensive warning labels.\textsuperscript{40}

We start with foreign exchange accumulation. A number of central banks have accumulated large reserves, presumably to gain or maintain competitive advantage since the levels appear to be well beyond the amounts needed to satisfy other reserve goals.\textsuperscript{41}

It is not clear, however, that reserve accumulation is necessarily effective in leaning against an exchange rate trend. Where purchases are sterilised, the policy has been seen to work in the short run. The long-run effects, however, have been very hard to identify – a point that has achieved consensus in the literature.\textsuperscript{42}

Unsterilised intervention is likely to be more effective, but entails considerable risks. Switzerland, for instance, succeeded for a time in capping appreciation of the Swiss franc, but in the process accumulated foreign exchange reserves worth an extraordinary three-quarters of GDP. Given the prevailing deflationary conditions in Switzerland, the SNB’s non-sterilised approach was akin to quantitative easing. However, most emerging market central banks would have to worry about the inflationary consequences of such vast money creation. Furthermore, there is the problem of creating asset bubbles through ultra-loose monetary policy, and in fact the SNB had to impose counter-cyclical capital buffers to address bubbly house prices.\textsuperscript{43}

\textsuperscript{40} On South Africa’s failures to intervene in foreign exchange markets effectively, see Willem H. Boshoff, “Rethinking ASGISA and the rand exchange rate” \textit{South African Journal of Economic and Management Sciences}, Vol. 11, No. 1, 2008


The difficulties and hazards of leaning against the wind suggest it may be better to have macroeconomic policies consistent with the change in the exchange rate that one wants to achieve. For instance, China had conditions of depreciation – productivity growth higher than the cost of its labour and capital, and financial repression – which generated earnings via investment and exports that could be used to lean against the wind and sustain those conditions. For South Africa, policy could depreciate in real terms by achieving over time a fiscal surplus (and lower inflation rate) and using the fiscal surplus to lean against the wind to prevent nominal appreciation.44

The second option for changing the price of the currency is restricting inflows.45 South Africa typically benefits from inflows, which help compensate for a low national saving rate and fund the investment needed for growth. Policy has therefore prioritised attracting, not deterring, foreign capital. However, it might be possible to address excessive rand strength with limited policy interventions. Some countries, such as Brazil, have attempted to discriminate between ‘good’ and ‘bad’ inflows, with ‘serious’ or long term investment welcome but short term, potentially speculative investment penalised. These policies have attracted lively scholarly interest, but the verdict on their success remains elusive.46 There is, however, reason to suspect that restrictions would be ineffective in South Africa, particularly because the bulk of rand trading is down offshore. According to the most recent BIS survey of global foreign exchange markets, foreign exchange trading in South Africa was worth about

44 The sorts of assets currently held as foreign exchange reserves are ultra-safe government bonds, mostly US Treasuries, which offer very low yields. Because South African interest rates are significantly higher, the SARB incurs a loss when it borrows foreign exchange through debentures (at around 5%) to buy foreign assets. Holding reserves is therefore costly: the return on reserves was -1.37% for the latest financial year. This loss can be misleading because the reserves become more valuable, in rand terms, when the currency depreciates. Counting in these gains shows the SARB to have made large profits on its reserves, although the accounting methods used ignore these. However, it should be noted that these profits may go unrealized, unless reserves are sold in periods of rand weakness.


$21 billion a day, or 0.3% of global exchange trading, whereas total rand trades amounted to $60 billion or 1.1% of world trade. The gap between those figures - $39 billion or 65% of the total – shows offshore rand trading.\textsuperscript{47}

**Figure 8: South Africa’s nominal and real effective exchange rate levels**

A different option for achieving a more competitive real exchange rate is to seek a lower domestic price level.\textsuperscript{48} In nominal terms, the rand has depreciated against the currencies of South Africa’s major trading partners since 1994. That depreciation has not been monotonic, with periods of rand strength evident in our Figure 8, but the long-term trend is clearly downwards. However, because of the pass-through from nominal depreciation to inflation, this approach has not resulted in a sustained competitively valued real effective exchange rate. The South African price level has risen faster than that of SA’s main export markets, producing a near-unchanged REER over the past decade. This effect is visible in the CPI but is even more evident in unit labour costs and the GDP deflator, as Figures 9 and 10 testify.


The flexible rand has reduced South Africa’s competitiveness problem but it has not eliminated it.\(^49\)

**Figures 9 & 10: SA cost measures of inflation; Comparative manufacturing unit labour costs**

South Africa has quite high inflation when compared both to emerging markets in general and to its peer group of inflation targeters (amongst which only Brazil has seen a steeper rise in prices over the past decade; Figure 11). This sort of medium-term inflation divergence cannot be attributed simply to exogenous shocks, but rather the anchoring of inflation expectations around different numbers. (After all, the countries portrayed in Figure 11 were also exposed to supply shocks such as elevated oil and food prices.) By choosing a higher number, South Africa locked in an uncompetitive price level, a problem that gets worse with each passing year. To regain competitiveness, monetary policy could seek to at least match the inflation performance of peer countries.

Conclusion

South Africa’s export performance has been disappointing. We consider the contributions of currency volatility and the level of the exchange rate and offer some broad policy direction. Frequent public claims that volatility is responsible for poor export and growth outcomes are surprisingly difficult to corroborate. Part of the problem is assessing the counter-factual, so we would argue for an experimental approach of providing hedging instruments to small firms to see if currency volatility is an important constraint on their growth.

The literature largely agrees that an appreciated real exchange rate level is bad for economic growth. And we find that foreign demand has a large impact on exports, much larger than relative prices. Clearly the best case for South Africa is one where global demand for SA exports remains robust. This equally clearly will not be a consistent condition. The policy set for achieving a depreciated real exchange rate is however small. Larger scale reserve accumulation at appropriate times might work if scaled up and would certainly be more effective if financed by fiscal surpluses (or windfall gains of some kind from the terms of trade). Given the scale and location of South African rand trade, this does not seem a consistently viable option. More realistically, there is scope for improving competitiveness by

Figure 11: Comparative price levels

Source: IMF, World Economic Outlook Indicators

Note: Turkey is excluded because very high inflation early in the decade distorts the average and scale of the graph.
keeping inflation low and increasing productivity through a range of structural reforms. South Africa could aim at an inflation rate closer to that of its peer countries to reliably and permanently bolster its competitiveness.

Appendix

Figure A1: GARCH volatility estimate comparisons
The smooth transition regression (STR) model

The specification of the model to be estimated is given by the following:\(^5\)

\[ y_t = \phi'z_t + \theta'z_tG(\gamma, c, s_t) + u_t \quad [3] \]

\[ u_t \sim iid(0, \sigma^2) \quad [4] \]

\[ G(\gamma, c, s_t) = \left(1 + \exp\{-\gamma \prod_{k=1}^{K}(s_t - c_k)\}\right)^{-1}, \gamma > 0 \quad [5] \]

\[ z_t = (w_t', x_t') \quad [6] \]

\[ w_t' = (1, y_{t-1}, \ldots, y_{t-p})' \quad [7] \]

\[ x_t' = (x_{1t}, \ldots, x_{kt})' \quad [8] \]

Vector \( z_t \) has \( (m + 1) \times 1 \) dimension and consists of explanatory and exogenous variables contained in \( w_t' \) and \( x_t' \), respectively. Parameters \( \phi \) and \( \theta \) represent the linear and the nonlinear parts of equation [1]. The transition function \( G \) is dependent on the transition variable \( s_t \), the slope parameter for the transition function \( \gamma \) and the vector of location parameters (or thresholds) \( c \). The transition function is also continuous and bounded between 0 and 1. An identifying restriction for equation [5] is that \( \gamma > 0 \) (\( \gamma \) is the parameter that determines the smoothness of the transition from one regime to the other). The most common choices for \( K \) are \( K = 1, 2 \) (i.e. generally, at most two thresholds are assumed):

- \( K = 1 \): the parameters \( \phi + \theta G(\gamma, c, s_t) \) change monotonically as a function of \( s_t \) from \( \phi \) to \( \phi + \theta \). This model describes processes whose dynamic processes are different between two regimes and where transition from one extreme to another is smooth. The two regimes are distinguished by the threshold parameter \( c \).

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• $K = 2$: the parameters $\varphi + \theta G(\gamma, c, s_t)$ change symmetrically around the midpoint $(c_1 + c_2)/2$, where this logistic function also attains its minimum. This model describes situations where the local dynamic behaviour of the process is similar at both large and small values of $s_t$ and different in the middle. The middle part is between the two threshold parameters $c_1$ and $c_2$.

We estimate equation [3] over the sample period 1982Q2 to 2013Q2, using growth as a dependent variable.$^{51}$ The following are considered as possible explanatory variables: the misalignment measure, inflation rate, terms of trade, openness and investment.$^{52}$ These variables are selected because they are generally identified as important explanatory variables for growth by exogenous growth theories.$^{53}$ We test for the appropriateness of a non-linear model and use the grid search method to find the threshold parameters.

In order to see whether the results change markedly when sector-specific data is used, we estimate the model given in [3]-[7] using the data for mining and manufacturing sectors.$^{54}$ Specifically, we replace the dependent variable (i.e. aggregate growth) by growth in gross value added for the mining and manufacturing sectors. All of the explanatory variables are the same as in the aggregate model with the exception of investment, where we use sector-specific investment data.$^{55}$

Our tests indicate non-linearity with $K = 1$ (i.e. presence of a single threshold) and with misalignment measure and inflation as the possible transition variables.$^{56}$ We report the STR model with the misalignment measure as the transition variable in Table A1.

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$^{51}$ We also experimented with export growth (value not volumes) as a dependent variable, but this exercise did not produce any significant results.
$^{52}$ All of the data are from SARB. Codes for raw data are KBP6006D, KBP6009D, KBP5036L, KBP6013D and KBP6014D. With the exception of openness measure (i.e. ratio of exports and imports to GDP), all of the variables have been converted into growth rates. Shaun de Jager provided the misalignment data.
$^{53}$ We also include the volatility measure as an explanatory variable to control for the effects of exchange rate volatility on growth, however small.
$^{54}$ These two sectors are chosen on the basis of availability of disaggregated data.
$^{55}$ Once again, all of the data are from SARB. The codes for raw data are 6032L, 6034L, 6081L and 6082L.
$^{56}$ Hence, growth outcomes in South Africa are potentially different under high misalignment and low misalignment periods, as well as for high inflation and low inflation periods.
### Table A1: STR regression results

<table>
<thead>
<tr>
<th>Dependent variable: Growth</th>
<th>Estimated coefficients</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient on inflation</td>
<td>-0.002</td>
<td>-4.41</td>
</tr>
<tr>
<td>Coefficient on volatility</td>
<td>-0.004</td>
<td>-3.77</td>
</tr>
<tr>
<td>Coefficient on misalignment above the threshold</td>
<td>0.001</td>
<td>2.22</td>
</tr>
<tr>
<td>Coefficient on misalignment below the threshold</td>
<td>-0.003</td>
<td>-2.89</td>
</tr>
<tr>
<td>$\gamma$ (smoothing parameter)</td>
<td>7.41</td>
<td></td>
</tr>
<tr>
<td>$c$ (threshold)</td>
<td>-0.02</td>
<td></td>
</tr>
</tbody>
</table>

Note: *This table reports the statistically significant results for the 0.1 level of significance.*

The results show that economic growth is slightly positive for undervaluations and similarly negative for overvaluations. This result is contradicted somewhat by sectoral estimates. Table A2 reports the results for sector data. For both the mining and manufacturing sectors, currency overvaluations have a significant effect on gross value added, while the coefficients for currency undervaluation are statistically insignificant. This is some evidence of negative association between sector level growth and currency overvaluations and is stronger than the aggregate results. However, the thresholds for the mining and manufacturing sectors, at -0.13 and -0.12 respectively, are also considerably higher.
Table A2: STR regression results for mining and manufacturing sectors

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Mining sector</th>
<th>Manufacturing sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>Estimated coefficients</td>
<td>t-statistics</td>
</tr>
<tr>
<td>Coefficient on investment</td>
<td>0.029</td>
<td>4.69</td>
</tr>
<tr>
<td>Coefficient on misalignment below the threshold</td>
<td>-0.033</td>
<td>-1.98</td>
</tr>
<tr>
<td>$\gamma$ (smoothing parameter)</td>
<td>10.20</td>
<td></td>
</tr>
<tr>
<td>$c$ (threshold)</td>
<td>-0.13</td>
<td></td>
</tr>
</tbody>
</table>

Note: This table reports the statistically significant results for the 0.1 level of significance.