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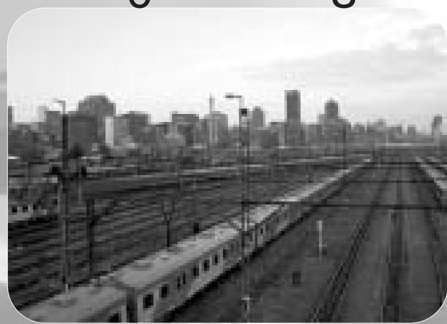

PAPERS

The Currency Premium and Local-currency Denominated Debt Costs in South Africa

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Abstract

In this paper we aim at identifying the determinants of South African currency premia in order to assess the scope of South African economic policies to narrow the spread on local-currency denominated debt. South Africa is one among very few emerging economies able to borrow long-term abroad in its own currency and one of the few that has developed its domestic bond market fairly well. However, allowing for the heightened and increasing instability in the nominal exchange rate of the rand over the last years, this fortunate specificity may fade away: local-currency denominated issues might become more expensive and less liquid overtime. Therefore, a key policy issue is how South African monetary policy may influence exchange rate determination and how it can be instrumental in stabilising expectations about the course of the rand, thus bringing down local-currency denominated debt costs. Moreover, lower debt costs are of utmost importance in boosting investment and future output growth. Using high frequency data and resorting to volatility modelling, we carry out an empirical analysis of the determinants of the 1-month and 1-year currency premia. Among these determinants, the South African Reserve Bank's Net Open Forward Book and the misalignment of the real effective exchange rate stand out. We also control for global risk aversion, the dollar price of gold, idiosyncratic and regional political shocks as well as other shifts in monetary policy, like the inflation targeting regime set up in early 2000.

The currency premium and local-currency denominated debt costs in South Africa

Contents

1) Introduction and motivation

The cost of capital, and in particular the debt cost, is an important determinant of successful economic growth, particularly so in developing countries where capital is still a scarce resource. Most emerging countries that are able to tap international capital markets currently pay a premium over a risk-free asset (typical benchmarks are US-Treasury securities) when issuing debt. One of the main components of the latter is the currency premium, which reflects the risk of a domestic currency depreciation or devaluation (normally, only relevant for domestic currency denominated issuances).

In this paper we intend to evaluate the currency premium considering the South African experience over the period 1997-2002 as a case study.

Why the currency premium?

The main reason why we study this component is that local-currency debt at reasonable cost and long maturities:

a) allows economic agents to avoid currency mismatches and, hence, disruptive balance sheet effects in case large swings in the nominal exchange rate come about;

b) allows these agents to find hedging strategies for firms confronted to exchange rate risk, and

c) fosters domestic financial market development, especially with respect to providing alternative sources of long-term project finance.

For this purpose, we will pin down the empirical determinants of the currency premium through econometric modelling in view of a policy analysis. More specifically, we will identify a group of economic, financial or political variables whose importance has been well established in the literature, in order to explain the variability in the one-month and in the one-year currency premia. Our model will not only account for the variations in the levels of these two premia but also for the fluctuations in their volatility, i.e. in the variance of the changes in these currency premia. The fact that we also look into the variance is due to the very specific nature of the currency premium observations over time. These observations are usually characterised by (a) volatility clustering, i.e. large changes in the currency premium tend to be followed by large changes of either sign and small changes tend to be followed by small changes; (b) leverage effects (bad news – i.e. higher currency premia – are associated with higher volatility); and (c) non-trading periods effects: information that accumulates when markets are closed is reflected after markets reopen, for instance a sudden increase in the currency premium after a long week-end.

Why have we selected South Africa as a case study?

Positive externalities to a poorer neighbourhood. Other African countries can draw some lessons from South Africa's experience with financial market development. Notably, we make reference to its partners in the Common Monetary Area (CMA) and Botswana (a former member of this currency union, which is closely tied to the South African economy). These countries already enjoy a potential access to the South African capital market, making available to them a long-term source of finance in rand currency, i.e. their own anchor currency (Grandes, 2003). A key policy issue here is that by reining in the currency risk and its volatility, a positive externality would occur: the lower and less volatile the currency risk, the cheaper the rand-denominated finance (e.g. for long-term investment projects) that may be potentially secured by CMA countries and Botswana through the South African capital market.

No "original sin" so far… South Africa is one among a few sovereigns that can resort to international bond markets at reasonable, relatively low spreads (between 600 and 700 basis points over the last two years). Moreover, it is one among a handful of emerging economies able to borrow abroad, long-term in its own currency (avoiding the so-called "original sin" problem (Hausmann et al. (1999) and Hausmann, Panizza and Stein (2001)). More remarkably, institutional investors and multilateral lending institutions have been issuing rand-denominated instruments, possibly as a way to hedge against or diversify their emerging market exposure or to swap risks with South African counterparts with exposures in e.g. US dollars.

…but things can turn around. Heightened volatility and increasing instability in the nominal exchange rate – partly due to the way South Africa's current flexible regime under inflation targeting is operating – might be a source of vulnerability:

i) It may fuel external liquidity pressures. The short term hard-currency denominated external debt is indeed still poorly covered by hard-currency reserves held at the central bank. Factoring in the net open forward position (that can be regarded as contingent short term debt), foreign reserves (excluding gold) hardly cover 60% of short-term external debt, a fairly low ratio by usual standards.[1] Therefore, a near meltdown of the rand would widen and worsen this short-term currency mismatch, thereby making the roll-over of short-term debt far more difficult and expensive for South African debtors.

ii) It could hamper future local currency issues, especially if monetary policy loses credibility. In an extreme case, there is a risk that South Africa becomes an "original sin" country. This would make local-currency denominated issues more expensive and less liquid. A key policy issue here is how monetary policy may influence the exchange rate determination and how it drives its long-term expectations.

Fear of floating doesn't cost much more. Compared to "credible" hard-pegs, we would expect emerging markets with floating exchange rates to bear a higher and more volatile currency premium on average. However, comparing the currency premia of a group of "floaters" with a hard-peg regime such as Hong Kong's, we find diverging results:[2] some floaters display as much volatility as Hong Kong. By contrast, they display barely higher levels. A key policy issue here concerns the ability of a hard peg regime versus a managed float to bring down both the currency risk premium level and volatility, and therefore narrow the spreads in local currency.

[1] The so-called "Guidotti rule" recommends a full coverage of short term external debt by hard-currency reserves.

[2] The case of the Argentine currency board, which collapsed in December 2001, has been well documented by Schmuckler and Serven (2002).

Charts 1-3: One-year currency premium for countries with floating exchange rates (South Africa, Mexico, Taiwan, Thailand) and a currency board country (Hong Kong). In basis points.

Chart 1: South Africa

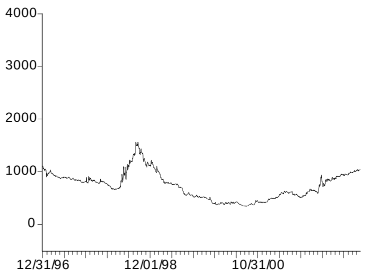


Chart 2: Hong Kong

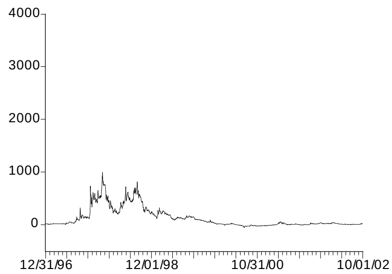
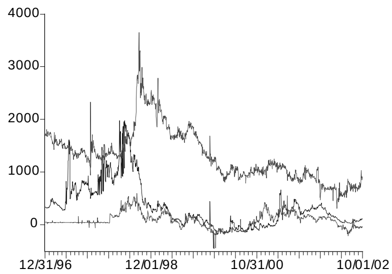
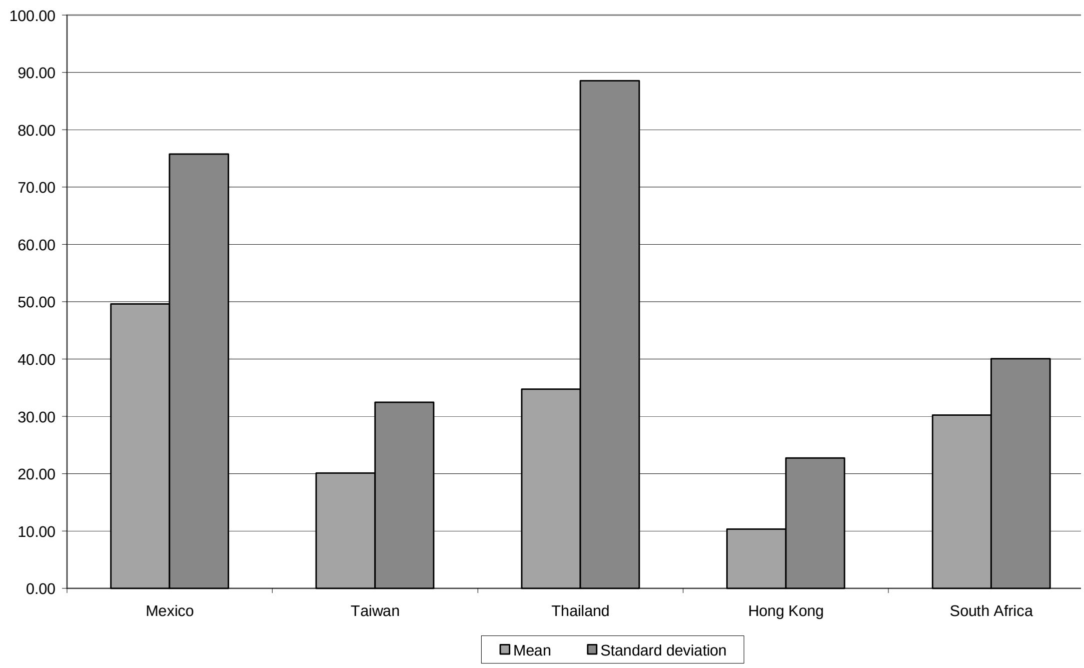


Chart 3: Taiwan, Thailand, Mexico



Source: Datastream.

Chart 4: Mean and volatility of the 1-year currency premium fluctuations[3]: a comparison between "float" and "hard peg" regimes (1/1997-8/2002).

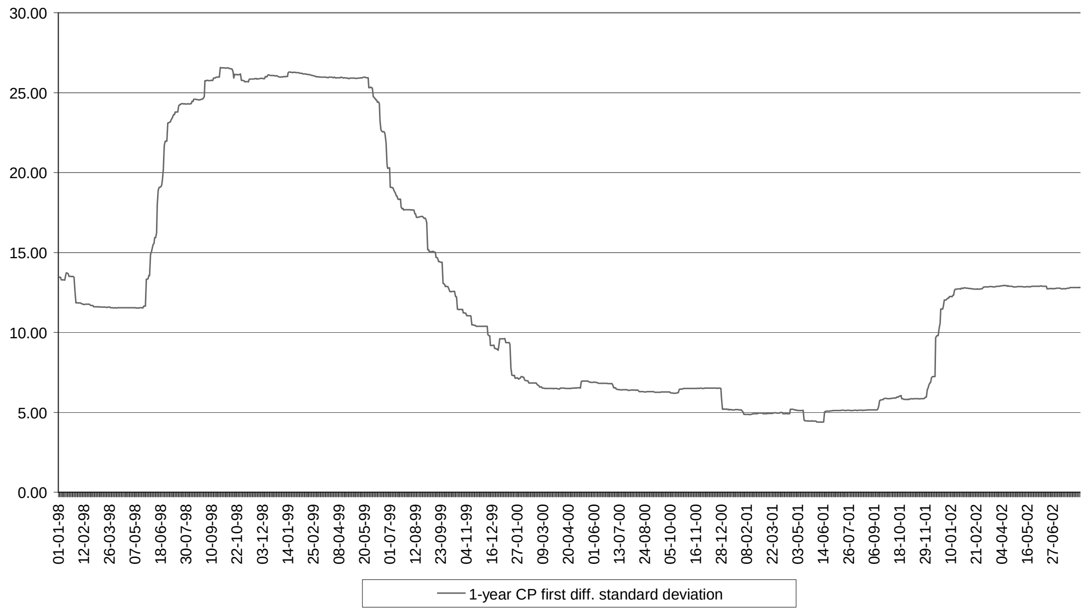


Source: Thomson Financial Datastream and own calculations

[3] The 1-year currency premium fluctuations are computed as the first differences (in absolute value) $|CP1year_t - CP1year_{t-1}|$ (basis points). Volatility refers to the standard deviation of the currency premium first differences.

For South Africa, we observe a major stylised fact: the one-year currency premium stands at around 730 bps on average while the one-month currency premium averages 860 bps over the period. The one-year premium is becoming increasingly more volatile (especially over the last two years, see Chart 5). This is relevant for local currency issuers because it raises their borrowing costs. Hence, this should be a concern for the South African monetary authorities, were they aiming at low and stable interest rates.

Chart 5: Volatility[4] of the South African currency premium (1 year)



Source: Thomson Financial Datastream and own calculations

The rest of the paper is divided into four sections. Section 2 presents the analytical framework, intended to define the currency premium as well as to identify its theoretical determinants. In section 3, we discuss the economic relevance of these determinants, how they can be measured in practice, and what signs we would expect on their coefficients in an econometric model where the currency premium is regressed against them. Then, in section 4, we introduce the econometric methodology; we report the regression output and provide some economic intuition on the results. Finally, we conclude putting forward some policy implications which come out from the paper results.

[4] The volatility is computed as the "rolling" standard deviation of the currency premium first differences (in absolute value) $|CP1year_t – CP1year_{t-1}|$ over the preceding 12-month period.

2) Analytical framework

2.1) Disentangling the currency premium from the total bond yield differential

For a local-currency denominated asset, the premium over a risk-free asset (typical benchmarks are US-Treasury securities, denominated in US dollars) can be approximately broken down as follows. First, let $R_{t,k}$ denote the annualised gross yield (i.e., one plus the interest rate) at time t on *local-currency* debt issued in the *home country* (i.e. an *onshore* issuance), by the *resident sovereign*, with k-period maturity; let $R^*_{t,k}$ denote the gross yield at time t on *foreign-currency (*denoted by the superscript '*') debt issued by the same debtor (i.e. having identical default risk) in the home country, with k-period maturity; and let ${}^{off}R^{*f}_{t,k}$ denote the gross yield on foreign-currency debt of the same maturity issued *offshore*[5] (superscript '*off*') by some benchmark *foreign debtor* (superscript '*f*'), typically a risk-free instrument issued by the US Treasury. Hence, we can write the following identity:

(1) $$\frac{R_{t,k}}{{}^{off}R^{*f}_{t,k}} \equiv \frac{R_{t,k}}{R^{*}_{t,k}} \frac{R^{*}_{t,k}}{{}^{off}R^{*f}_{t,k}}.$$

Taking logs of (1), letting $i_{t,k} = \ln(R_{t,k})$ and similarly with the other yields, we get:

(2) $$(i_{t,k} - {}^{off}i^{*f}_{t,k}) = \underbrace{(i_{t,k} - i^{*}_{t,k})}_{\text{Currency premium}} + \underbrace{(i^{*}_{t,k} - {}^{off}i^{*f}_{t,k})}_{\text{Country premium}}.$$

Furthermore, as suggested by Serven and Schmukler (2002), the country premium can be further broken down as:

(3) $$\frac{R^{*}_{t,k}}{{}^{off}R^{*f}_{t,k}} \equiv \frac{R^{*}_{t,k}}{{}^{off}R^{*}_{t,k}} \frac{{}^{off}R^{*}_{t,k}}{{}^{off}R^{*f}_{t,k}}$$

Taking logs of (3) and proceeding similarly as before, we obtain:

(3') $$(i^{*}{}_{t,k} - {}^{off}i^{*f}{}_{t,k}) = \underbrace{(i^{*}{}_{t,k} - {}^{off}i^{*}{}_{t,k})}_{\text{Onshore-offshore premium}} + \underbrace{({}^{off}i^{*}{}_{t,k} - {}^{off}i^{*f}{}_{t,k})}_{\text{Pure default premium}}$$

[5] *Offshore* (*onshore*) refers to an issue of securities in a *foreign* (*domestic*) financial centre.

Substituting (3') into (2) we finally get:

(4) $$\underbrace{(i_{t,k} - {}^{off}i^{*f}{}_{t,k})}_{\text{Total premium}} = \underbrace{(i_{t,k} - i^{*}{}_{t,k})}_{\text{Currency premium}} + \underbrace{(i^{*}{}_{t,k} - {}^{off}\ i^{*}{}_{t,k})}_{\text{Onshore-offshore}} + \underbrace{({}^{off}\ i^{*}{}_{t,k} - {}^{off}i^{*f}{}_{t,k})}_{\text{Pure default premium}}$$

Therefore, the total risk premium paid by a debtor issuing onshore a bond at time *t* with maturity *k* in local currency has three main components, namely:

1) A *currency premium* that reflects the risk of a domestic currency depreciation or devaluation (normally, only relevant for issuance of domestic currency denominated bonds). In the currency premium, we have the same issuer, the same jurisdiction, but a different currency.
2) A *"pure" default premium* that compensates for the risk that the issuer "defaults", i.e. that the issuer is unwilling or unable to service its debt (interest payments plus amortisations). This is the yield spread on a risky asset compared to a riskless asset (issued by a benchmark issuer) in the same currency and the same (offshore) market.
3) A *jurisdiction premium* that is due to the differences between domestic ("onshore") financial regulations and international ("offshore") legal standards. In this onshore-offshore premium we have the same issuer, the same currency but a different jurisdiction. International bonds are usually issued in top financial centres such as New York or London and, hence, governed by New York or British law.

2.2) How to measure the currency premium?

The strict covered interest parity and the forward premium equation

If a (efficient) forward exchange market exists, and in the absence of transaction costs and capital controls, risk-free arbitrage between securities that are identical in all respects (i.e. same maturity, same issuer, same jurisdiction, etc.) except for their currency of denomination should yield what we call the "strict" version of the covered interest parity. This condition says that the interest rate differential between comparable assets denominated in two different currencies should be equal to the forward premium or discount (see box 1).

Box 1: definition of a forward exchange rate

- A *forward exchange rate* is an exchange rate fixed today for exchanging currency at some future date. A forward exchange trade is a foreign currency purchase or sale at a given exchange rate (at a price agreed upon on the trade date) but with payment or delivery of the foreign currency at a predetermined future date. A currency trades respectively at a *forward discount*/*premium* when its forward price is lower/higher than its spot price.

- Exporters, importers, investors and dealers usually resort to forward exchange transactions for hedging purposes, that is, to be shielded from exchange rate volatility. Put it differently, forward exchange contracts are aimed at limiting currency risk for market players featuring net currency exposures. For instance, South African importers usually seek to be protected from a depreciation of the rand against foreign currencies (more precisely, against those in which their imports are denominated). Therefore, they will ask market makers in the rand to supply them, at a given date in the future (usually the date of the hard-currency payment), with hard currency against rand, at a pre-negotiated rate.

- The forward market of a currency may however be used for speculation purpose through short-selling strategies. Basically, short-selling a currency means establishing a market position by selling a futures contract. Usually used to hedge commercial or financial operations from exchange rate fluctuations, this technique may also consist of shorting[6] a currency *without* any underlying "real" transactions on domestic assets. Thereby, short-selling is aimed at pure speculation. This technique is used when an investor discounts a depreciation of the exchange rate.

More formally, the no-arbitrage condition in terms of gross yields is

$$R_{t,k} = R^*_{t,k}\left[\frac{F_{t,t+k}}{S_t}\right]^{1/k}, \tag{5}$$

where $F_{t,t+k}$ is the k-period[7] forward exchange rate at time t, and S_t is the spot rate at identical time. Taking logarithms of (5) and rearranging terms, we conclude that the currency premium can be measured by the forward premium, $fd_{t,t+k}$:

$$(i_{t,k} - i^*_{t.k}) = fd_{t,t+k}, \text{ where } \quad fd_{t,t+k} = \frac{1}{\mathrm{k}}\ln\left[\frac{F_{t,t+k}}{S_t}\right]. \tag{6}$$

[6] The shorted currency must be borrowed on the spot market, before the sale, to make "good delivery" to the buyer along the lines of the forward contract. Eventually, the currency must be bought to close out the transaction.

[7] k is expressed on an annual basis

We also know that if there were no forward currency markets, speculation by risk-neutral investors should assure that the expected returns on the two types of securities are the same:

(7)
$$R_{t,k} = R^*_{t,k}\left[\frac{E_t S_{t+k}}{S_t}\right]^{\frac{1}{k}}$$

where $E_t S_{t+k} / S_t$ denotes the expected (gross) rate of depreciation (or appreciation) of the local currency over the period k. This is the well-known uncovered interest parity condition. It states that the rates of return (yields) of the two securities should be equalised once expected exchange rate changes are taken into account.

Taking logs of (7) and rearranging terms, we obtain

(8)
$$(i_{t,k} - i^*_{t.k}) = \Delta s^e_{t,k}$$

where $\Delta s^e_{t,k} = 1/k \cdot \ln[E_t S_{t+k}/S_t]$ is the rate of expected depreciation (or appreciation) of the local currency. Condition (8) states that in a risk-neutral world, the currency premium should be equal to the expected rate of change in the exchange rate.

If, as is more likely, investors are risk-averse, they will require a compensation for the risk of (unexpected) exchange rate changes in order to make them indifferent between holding foreign currency-denominated assets (and, hence, being immune to exchange-rate fluctuations) and holding domestic currency-denominated assets that are exposed to depreciation risks.[8] This compensation will take the form of an exchange risk premium, $\rho_{t,k}$>0.[9] Hence, with risk-averse investors, the currency premium will be

(9)
$$(i_{t,k} - i^*_{t.k}) = \Delta s^e_{t,k} + \rho_{t,k}\,.$$

Lastly, substituting (6) into (9) we get:

(10)
$$\underbrace{fd_{t,t+k}}_{\text{Forward premium}} = \underbrace{\Delta s^e_{t,k}}_{\text{Expected rate of change in the exchange-rate}} + \underbrace{\rho_{t,k}}_{\text{Exchange risk premium}},$$

that is, the forward premium - our measure of the currency premium - is equal to the expected rate of depreciation (or appreciation) plus the exchange risk premium. This condition will serve us as starting point for the econometric exercise.

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[8] We assume investors' assets and liabilities to be mostly domestic-currency denominated. Therefore, from a currency mismatch perspective, the currency risk being taken by the local investor ensues from holding foreign currency-denominated liabilities.

[9] Typically, in a portfolio model (i.e. CCAPM) where rational individuals can optimally choose between consuming goods, saving for the next period or investing in local-currency denominated assets with devaluation risk, the exchange risk premium will be higher the less tolerant to risk the investor is and the more positive the covariance between the asset's returns and consumption is.

The computation of the 1-month and 1-year forward premia is straightforward since high frequency data is available through Datastream (the primary source for exchange rate data being WM/Reuters Spot rates). The next section details how we measure the right-hand side variables, namely the expected rate of depreciation and the exchange risk premium, expressed in nominal terms.

Some caveats are in order, though, before we turn our attention to the explanatory variable set. As Serven and Schmukler (2002) warn, in practice several factors can cause the strict covered interest parity condition to fail.

First, default risk may differ across instruments issued in alternative currencies, even when issued by the same borrower in the same jurisdiction. This might reflect, for example, a threat of mandatory re-denomination of foreign-currency assets into local currency assets (akin to partial confiscation in the case of devaluation), or also the fact that the government can print only local currency, so that it can redeem its local-currency obligations more easily than its foreign currency ones (or those of any debtor in need of a bailout).

A second factor that can potentially affect the strict version of covered interest parity is transaction costs. Aside from default risk, arbitrage across onshore instruments in different currencies might involve potentially large costs resulting from various market imperfections, such as the impossibility of shorting certain assets, or the presence of large bid-ask spreads mirroring some market illiquidity.

3) Explanatory variables: What are the determinants of the currency premium? What is specific to South Africa?

Recall equation (10), which made clear that the currency or forward premium (our dependent variable) is determined by the expected rate of change in the exchange rate and an exchange risk premium to allow for risk-aversion. Following Serven and Schmukler (2002), we can further decompose the expected rate of change in the exchange rate, $\Delta s^e_{t,k}$, into the *subjective probability* held at time t of a devaluation happening prior to $t+k$, that we denote by $P_{t,k}$, and the *magnitude* of the depreciation, that we denote by $(s_{t,t+k} - s_t)$. $S_{t,t+k}$ stands for the natural log of the spot exchange rate expected to prevail at time $t+k$ if a depreciation occurs between t and $t+k$. Thus, equation (10) is now expressed as:

$$fd_{t,t+k} = P_{t,k}(s_{t,t+k} - s_t) + \rho_{t,k}\,. \tag{11}$$

Our next step is to define a group of observable explanatory variables pertaining to both right-hand side terms with the purpose of preparing the ground for the econometric estimations and the subsequent policy analysis.

Misalignment in the real effective or trade-weighed exchange rate (REER)

The misalignment in the real effective or trade-weighed exchange rate (REER) is a well-documented culprit for currency depreciation and might therefore be instrumental in shaping expectations of depreciation (subjective probability of depreciation). It is also a straightforward measure of its magnitude: the higher the misalignment, the stronger the expected correction.

First, we built a REER by using daily nominal exchange rates and monthly consumer price indices and trade shares provided by the South African Reserve Bank. An increase in REER implies a depreciation. Second, using this data we calculate the geometric average version of the REER[10]. Third, and in order to find the degree of misalignment, we first compute an approximation of the equilibrium REER by filtering the Hodrik-Prescott trend, setting the proper smoothing parameters (REERHP). Finally, the deviation from this "equilibrium" trend is simply equal to (REER-REERHP)/REERHP. We name it REERGEODEV. *Persistent negative deviations (i.e. a currency overvaluation) should imply a higher expected depreciation, hence a higher currency premium. Thus, we would expect a negative sign on the REERGEODEV coefficient*.

South African Reserve Bank's monetary stance and the 'Forward Book'

From a theoretical standpoint, in a pure float regime, no foreign exchange reserves would be required because the monetary authority is not committed to sustain a given parity or band. Unless the monetary authorities seek to sterilise excessive capital inflows, the exchange rate should be the shock-absorbing mechanism. However, emerging countries floating their currencies in a context of an inflation-targeting policy do intervene in the foreign exchange market to avoid excessive volatility in the nominal (and real) exchange rate and pass-through effects into the domestic price level. This phenomenon has been dubbed "fear of floating" (Calvo and Reinhart, 2002). Paradoxically, the more open, diversified and smaller these economies are, the more they should "fear" (higher translation of exchange rate variations to prices) and so the more rational should be the adoption of a hard peg.

This is not the case in South Africa. Despite the progressive opening up to trade and capital flows, South Africa is a large economy where the non-tradable sector accounts for almost half of GDP, where the export mix is yet poorly diversified and the sources of shocks are mostly real and/or external[11]. However, a relatively sound record of macroeconomic management during the post-apartheid era has helped South Africa in building up credibility and the rand has widely played its role of store of value, i.e. liabilities have not been dollarised, a phenomenon commonly seen in other emerging economies.

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[10] The geometric version of the REER uses exponential instead of multiplicative trade weights associated to each price index of the relevant trading partners of South Africa.

[11] Notably terms of trade shocks (gold, diamonds, and oil prices), contagion from emerging market financial crises (Mexico, Asia, Russia, Argentina) or regional shocks (i.e. Zimbabwe's turmoil, civil wars in the periphery).

While not in need of a hard-peg regime, South Africa has been far from adopting a hands-off approach to the exchange rate. Instead, it has been a case-in-point of a "fear of floating" country over the last two decades. Calvo and Reinhart (2002) evidence that South Africa, following other so-called "floaters", has not been loath, over the two last decades, to intervene in order to stabilize its exchange rate, thereby displaying stronger interest rate and foreign exchange reserves volatility than 'benchmark' floaters (such as the US or Japan).

However, endowed with an inadequate level of foreign exchange reserves, the central bank was unable to support the South African currency by selling dollars against rand on the spot market. It had therefore to resort to short-selling dollars in order to make up for the low level of hard-currency reserves at its disposal. In so doing, the SARB built up a sizeable *Oversold Forward Book*, partly uncovered by foreign-currency reserves held by the central bank. The non-covered component of the oversold forward book is the net open forward position (see Box 2).

Box 2 – The Oversold Forward Book and the Net Open Forward Position

- The amount of forward sales of dollars by the SARB not covered by equivalent forward purchases of the US currency is called the "oversold forward book" (OFB).

OFB = forward purchases of USD – forward sales of USD

- Part of this "oversold forward book" may not be itself covered by hard foreign currency reserves detained by the SARB. This uncovered part of the oversold forward book is the "Net Open Forward Position" (NOFP), also called "Net Open Oversold Position".

NOFP = OFB + Net reserves (excluding gold)

Though pivotal in stabilizing the exchange rate, the NOFP exposure, if large, may prove to be a major weakness of the South African monetary stance. There are various risks involved:

i) The central bank has to buy dollars on the spot market in order to meet its dollar forward commitments so long as further rollovers are not available. Thus, it runs the risk of incurring massive losses stemming from a sharp depreciation of the rand against the US currency.

ii) In this respect, the credibility of the Bank/Treasury may be called into question as the market focuses, from time to time, on the sustained ability of the SARB to run a large, uncovered forward book.

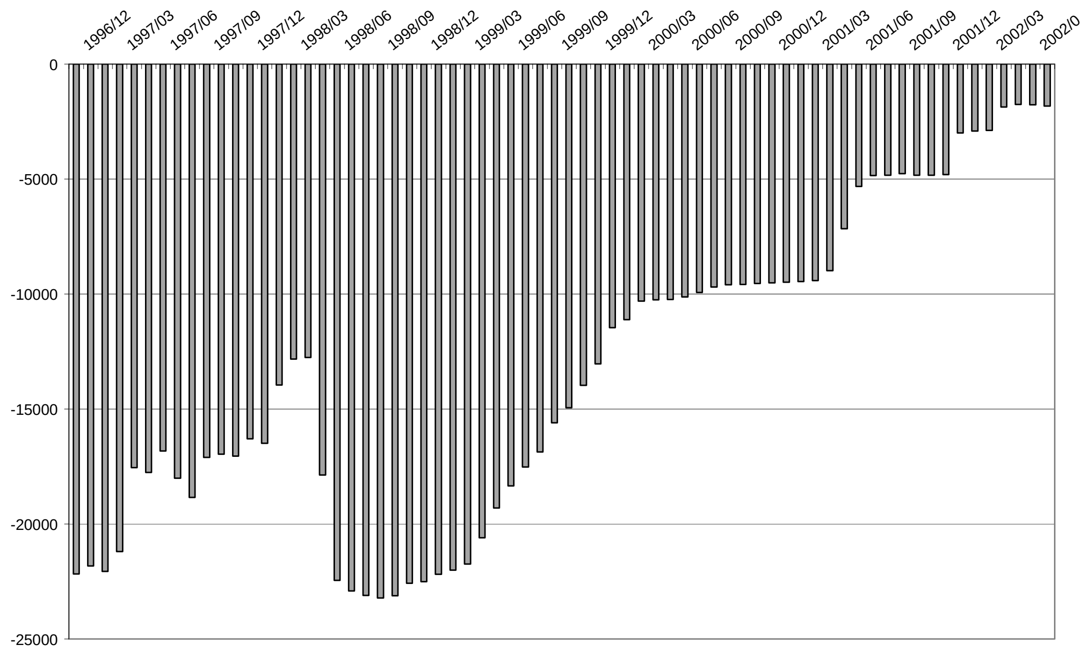
iii) Most importantly, the government incurs the losses made on the forward book. Losses and gains on the oversold forward book are listed in the state budget so that a high-flying exposure to dollar fluctuations may also put the country's budget at risk and jeopardise the substantial improvements of South African fiscal positions recorded over the last years.[12]

[12] See South African Reserve Bank Act 90 of 1989, §27.1: "Any profit or loss on any current or future forward exchange contract entered into by the Bank […] shall accrue to the Government". The SARB

iv) Because negative pressures on the exchange rate are partly absorbed by the forward book, they may not always be visible to policy makers and this could delay necessary policy adjustments.[13]

For a long time, the SARB had been urged by the IMF and rating agencies to close down its NOFP. However, in 1998, faced with strong speculative attacks on the rand, the SARB was not only compelled to raise its main interest rate to record levels, but also to increase its NOFP. Far from abating, the latter skyrocketed to an all-time high of USD23bn in September 1998 (chart 6). Until recently, this exposure had been strong and thereby a major weakness of the South African monetary stance (see Cross, 2002). However, together with the implementation of an inflation-targeting regime the monetary authorities have been able to work it down to levels near zero around mid 2002.

Chart 6: South African Reserve Bank's Net Open Forward Position (USD million)



Source: South African Reserve Bank

In this context, the key monetary policy instrument that has shaped the probability of depreciation throughout has been, in our view, the intervention of the SARB in the spot and forward exchange markets. Given its large impact on the determination of the nominal exchange rate over the sample we cover in our study (December 1996-August

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records any loss on the assets referred to in section §27.1 into a "Foreign Exchange Adjustment Account". Losses incurred by the SARB on its forward book are not registered in the fiscal deficit and do not even show up in the public sector borrowing requirement. The South African government nevertheless issues bonds aimed at financing these quasi-fiscal losses. With a time lag, the latter may thus weigh down on the South African sovereign debt.

[13] For further details, see '*The South African Reserve Bank's forward foreign exchange book*', 27 February 1998 (http://www.resbank.co.za/IBD/fwdcover.html)

2002), it is worth exploring how this policy has worked and what its consequences have been for the rand.

In sum, closing down the NOFP may, on the one hand, bring about a narrower currency premium if a perception of lower **vulnerability** (external and fiscal imbalances) prevails (negative sign). On the other hand, it could also drive the premium higher in case the **pressure** exerted by the SARB by buying spot dollars to meet its dollar forward commitments is expected to last (also driving the forward rate up, hence a positive sign). Of course that would depend on the supply source of the required foreign exchange: if the dollars are purchased through the proceeds of some privatisation or some external public debt issuance the effect should be lessened to an extent. *Therefore, the expected sign of the NOFP-coefficient in the currency premium equation is ambiguous, depending on the relative magnitude of the* ***"vulnerability perception"*** *and the* ***"demand-side pressure"*** *(related to SARB's interventions on the USD spot market) effect*.

Inflation targeting and the "inflation gap"

The South African Reserve Bank moved to an inflation-targeting system in April 2000. As a result, price stability is the primary goal of monetary policy to which other variables - not least the exchange rate - are subordinated.[14]

In this context, the fulfilment by the SARB of its inflation target may substantially impact the exchange rate. Falling short of its commitments, the SARB risks losing credibility and failing to rein in inflation expectations. Markets may question the SARB's ability and resolve to curb inflation in the future. Along the lines of the Purchasing Power Parity rule, the higher inflationary expectations are, the larger the expected depreciation will be.[15] The magnitude of the latter depends on the size of the "*inflation gap*", i.e. the difference between the actual and the targeted inflation rate for a given period. Accordingly, *the expected sign of the* inflation gap *(INFGAP) in the currency premium equation is positive*.

This argument is valid as long as the two implicit underlying instruments (rand and dollar-denominated securities) bear the same default risk, as we assume in this paper. If the two instruments were to bear different default risk despite belonging to the same issuer, the sign of the INFGAP-coefficient could turn out ambiguous. Why? Take the case of two one-year T-bills, one denominated in rand, the other denominated in US dollar, by the South African government. In the context of South Africa's inflation-targeting regime, the default risk in the rand-denominated T-bill could go up if the inflation target is met (because there is less seigniorage and inflationary finance available) while the default risk in the US-dollar denominated T-bill could go down. This positive correlation between the inflation gap and default risk on the foreign currency instrument could be due to the following mechanism: any positive deviation from the inflation target should imply a higher expected depreciation of the nominal exchange

[14] This implies that the exchange rate is no longer targeted. However, albeit not a specific target, the course of the exchange rate is not disregarded by monetary authorities: it has indeed a strong bearing upon the inflation process.

[15] The former could be collinear with our measure of real exchange rate misalignment (REERGEODEV).

rate; the higher expected depreciation would induce a higher expected debt service burden in local currency terms (owing to currency and/or maturity mismatches in the balance sheet of the government and other side effects on the expected discounted cash flows of the government) and, hence, lead to a higher default risk on this asset.[16]

Gold price

Another important variable that may drive the probability of depreciation is the dollar gold price (GOLDPRICE; daily observations from DATASTREAM). The gold price is relevant because South Africa produces and exports large quantities of this commodity, and because gold reserves are not included in the NOFP calculation. Generally, a permanent increase in the dollar gold price increases, *ceteris paribus*, the dollar value of South Africa's foreign exchange reserves and, hence, strengthens the balance of payments. This should induce an expected appreciation in both the long-term and short-term exchange rates and, as a result, a lower currency premium (negative coefficient). If the price increase is considered temporary, however, it will mostly affect (i.e. strengthen) the spot rate and, thus, lead to a higher expected future depreciation which, in turn, will increase the currency premium (especially at longer horizons, e.g. 1-year, hence a positive coefficient). *Therefore, the expected sign of the GOLDPRICE-coefficient in the currency premium equation is ambiguous, depending on to whether the change is viewed as permanent or transitory.*

Exchange Control Regulations

We identify major steps of exchange control relaxation with dummy variables (denoted *ECR_*).[17] We assign zeros to all days prior to the introduction of a given measure, and ones thereafter. We expect them to have a mixed impact on the currency premium. For instance, the loosening of exchange control regulations may induce markets to expect a strong and durable capital outflow (mostly driven by South-African residents); or it may foster the credibility of the economic policy and bolster foreign investors' confidence in the domestic economy, hence boosting capital inflows. *Therefore, we expect an ambiguous sign on the coefficients of these dummy variables.*

Exchange risk premium (risk aversion)

In order to proxy for the exchange risk premium ($\rho_{t,k}$ in equation 10) that stems from (currency) risk aversion, we follow Serven and Schmukler (2002) and use various measures that reflect market perceptions of this risk. In particular, we employ the US high-yield corporate spread index from Merrill Lynch (MLUSHY), the Lehman Brothers US$ sovereign spreads in Asia and Latin America for all maturities (SPLEHAMER and SPLEHASIA, respectively), and Moody's (MOODYS) or S&P's (SANDPS) sovereign

[16] See Vocke (2003) for some evidence on this default-risk shift.
[17] See Appendix A3 for details about the exchange control dummy variables.

foreign currency ratings. This data, at daily frequency, was collected from DATASTREAM and the respective rating agencies.[18]

If the rand were regarded as riskier than the US dollar (so that the exchange risk premium is positive), then we would expect higher risk aversion to lead to a higher exchange risk premium and, other things equal, to a larger currency premium. From this point of view, we would expect these variables to be positively related to the currency premium (positive coefficient). This characteristic may be reinforced by the strong involvement of non-residents in rand trading that is partly related to the high liquidity of the South African currency (at least when compared to other emerging market currencies). This feature of the rand market has proved a mixed blessing for South Africa. Highly liquid, traded both onshore and offshore (mostly in New York and London), easy to short since market makers have been readily offering hedging instruments to their clients, the rand might have been used as a *proxy hedge* for exposures on other and more shallow emerging currencies markets[19]. Therefore, when incurring losses on fairly illiquid forex markets of other emerging countries, investors may make up their losses through short-selling the South African currency, thus raising the currency premium.

However, other forces may be at work. Other emerging market assets and/or US high-yield corporate bonds may be perceived as substitutes rather than complements to South African assets, as we assumed. In other words, the perceived riskiness of, say, US high-yield bonds and South African bonds may move in different directions, reflecting investors' substitution among alternative assets. For example, a shift out of US high-yield assets and into emerging-market assets (like South Africa's) could result in a higher premium for the former but a lower one for the latter. In this case, a negative correlation between these risk aversion proxies and the currency premium would result (negative coefficient). *Thus, the expected sign of MLUSHY, SPLEHAMER, SPLEHASIA and MOODYS in the currency premium equation is ambiguous.*

[18] As Moody's has been more proactive than S&P with respect to South Africa, and due to the fact that the latter seems to lag behind, we use only Moody's rating. We convert the alpha numeric ratings into integer values using the following conversion scale: Ca=1, Caa3=2, Caa2=3,…, Aaa=20. verifier

[19] See *Commission of Inquiry into the rapid depreciation of the exchange rate of the rand and related matters: Final Report dated 30 June 2002*.

4) Model specification and estimation

4.1) Econometric estimation procedure

We start from a general ARDL (autoregressive distributed lag) specification of order (p,q):

$$Y_t = c + \sum_{j=1}^{k}\sum_{\tau=o}^{q} b_{j\tau} X_{j,t-\tau} + \sum_{i=1}^{p} a_i Y_{t-i} + u_t \,, \tag{12}$$

where Y_t is the currency premium (measured by the forward premium) at each t, and the X_j are the k explanatory variables as described in section 3. After some manipulations, (12) can be rewritten as:[20]

$$\Delta Y_t = \sum_{j=1}^{k} b_{j0}\Delta X_j - \sum_{j=1}^{k}\sum_{\tau=1}^{q-1} B_{j\tau}\Delta X_{j,t-\tau} - \sum_{i=1}^{p-1} A_i \Delta Y_{t-i} + \left(c + \alpha Y_{t-1} + \sum_{j=1}^{k} \beta_j X_{j,t-1} \right) + u_t \,, \tag{13}$$

where $B_{j\tau} = \sum_{\tau=2}^{q} b_{j\tau}$ for all explanatory variables j = 1,…, k and all their lags τ = 1,…q; $A_i = \sum_{i=2}^{p} a_i$ for all lags of the dependent variable i = 1,…, p; $\alpha = \left(\sum_{t=1}^{p} a_t\right) - 1$ and $\beta_j = \sum_{\tau=0}^{q} b_{j\tau}$. The term in brackets on the right-hand side of (13) captures the "steady state" (or "long-run") version of (12). Thus, the long-run impact of explanatory variable j on Y is equal to $-\left(\beta_j / \alpha\right)$.

For an ARDL(3,3) and one explanatory variable X_1 (i.e. k=1), for instance, equation (13) looks as follows:

$$\Delta Y_t = b_{10}\Delta X_t - B_{11}\Delta X_{t-1} - B_{12}\Delta X_{t-2} - A_1 \Delta Y_{t-1} - A_2 \Delta Y_{t-2} + \left(c + \alpha Y_{t-1} + \beta_1 X_{1,t-1}\right) + u_t \tag{13'}$$

where $B_{11} = b_{12} + b_{13}$ and $B_{12} = b_{13}$; $A_1 = a_2 + a_3$ and $A_2 = a_3$; $\alpha = a_1 + a_2 + a_3 - 1$ and $\beta_1 = b_0 + b_1 + b_2 + b_3$. The long-run impact of X_1 on Y is thus equal to $-\left(\beta_1/\alpha\right) = -\left(b_0 + b_1 + b_2 + b_3\right)/\left(a_1 + a_2 + a_3 - 1\right)$.

Our purpose is to estimate equation (13). In order to select the best specification of this equation, we resort to both information criteria (i.e. Akaike and Schwarz) and to the maximum likelihood function evaluated at the point estimates obtained by EVIEWS 4.1, for a comparable sample size.

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[20] For an ARDL(1,1) with k explanatory variables, these manipulations are: (1) subtracting Y_{t-1} on each side of equation (12), and (2) adding and subtracting $b_{j0}X_{t-1}$ on the right hand side of (12) for explanatory variables j = 1,…, k. For an ARDL(p,q) with p ≥ 2 or q ≥ 2, the following additional manipulations are required: (3) adding and subtracting $b_{j\tau}X_{t-1}$ on the right hand side of (12) for explanatory variables j = 1,…, k and all their lags τ = 2,…, q; and (4) adding and subtracting $a_i Y_{t-1}$ for all lags i = 2,…, p of the dependent variable.

First, it is worth noting that we work with stationary or quasi-unit root time series so that we do not have a spurious-regression problem in our exercises (see unit root tests in the Appendix A1).

Second, we start our modelling exercise with *p*=28 and *q*=7. We judge that with daily data, *p*=7 lags of the explanatory variables represent a sufficiently general dynamic setting to start with. We do not take lags of the monthly dummies (e.g. NOFP) or other discrete variables (e.g. MOODYS) because they would be highly collinear with their original variables. The dependent variable (i.e. first difference of the currency premium) is lagged up to *t*-21 or *t*-28 because it shows a large degree of persistence (not surprising with daily data) even though it is stationary.

Then, from this very general model we work our way down to find a specific function, or model, that best fits our data. As our dependent variable displays a high degree of volatility, the variance of the model is very likely to fit an autoregressive conditional heteroskedastic (ARCH) structure, making OLS estimates inefficient and usually biased. Put differently, a first OLS regression does not pass a G(ARCH) (generalised autoregressive conditional heteroskedasticity variance) Lagrange Multiplier test of order $p = 1$, $q = 0$, at any given level of significance.[21]

This comes as no surprise as financial asset returns in high frequency (e.g. yield differentials like a forward premium/discount) are characterised by well-known empirical regularities. These returns usually display: (a) thick tails or leptokurtic distributions, i.e. the tails are thicker than those of a normal distribution; (b) volatility clustering, i.e. large changes tend to be followed by large changes of either sign and small changes tend to be followed by small changes; (c) leverage effects (stock prices or yield differentials are negatively correlated with their volatility: bad news are associated with higher volatility); and (d) non-trading periods effects: information that accumulates when markets are closed is reflected after markets reopen.

In order to take these empirical regularities into account, we add a conditional variance equation to the conditional mean equation (13). We model the (conditional) variance σ_t^2 of the error-term in the (conditional) mean equation (13), u_t, as a GARCH(p,q) process. Provided the conditional variance σ_t^2 follows a stationary process, it can be expressed as:

(14)
$$\sigma_t^2 = \underbrace{\omega}_{\text{Constant, long term value}} + \underbrace{\sum_{i=1}^{q} \theta_i u_{t-i}^2}_{\text{Moving average terms (q)}} + \underbrace{\sum_{j=1}^{p} \varphi_j \sigma_{t-j}^2}_{\text{Autoregressive terms (p)}}$$

More specifically, σ_t^2 is the variance of the unexplained variability, u_t, of the variations (i.e. first differences) in the currency premium, ΔY_t. Chart 5 shows a measure

[21] Where *p* and *q* are the orders of the autoregressive and moving average terms, respectively. The raw data to perform ARCH-LM tests at each step of the estimation procedure is available upon request for any interested reader.

of the total variability in the daily changes of the 1-year currency premium for the period from January 1998 to August 2002.

Furthermore, as it is known that GARCH(p,q) models are not well suited to capture leverage effects that are likely to occur in our case (bad news – i.e. higher currency premia – are associated with increasing volatility), an alternative specification proposed by Nelson (1991) is used. This is the exponential GARCH - or EGARCH - model, where the conditional variance is taken in logs and leverage effects are included so as to account for the asymmetric impact of innovations on volatility. The leverage effects are captured by the last two terms in equation (15):

(15) $$\ln \sigma_t^2 = \omega + \sum_{j=1}^{p} \varphi_j \ln\sigma_{t-j}^2 + \sum_{i=1}^{q} \left(\gamma_i \left| \frac{u_{t-i}}{\sigma_{t-i}} \right| + \theta_i \left[\frac{u_{t-i}}{\sigma_{t-i}} \right] \right)$$

To summarise, we do not only have to find the best fit for the ARDL mean equation (13) but we also simultaneously model the variance structure of the error term as an (exponential) generalised autoregressive conditional heteroskedastic ((E)GARCH) process. In the modelling process, we start with our initial ARDL mean equation (13) and compare across different (E)GARCH specifications. We eliminate the individually and/or globally redundant variables, especially the dummies and the variables capturing the short-term effects.[22] We try to be as parsimonious as possible but we verify in each step that no residual (E)GARCH or serial correlation are left in the mean equation.[23] Equations (13) and (14) or (15) are jointly estimated by quasi-maximum likelihood estimators (see the EViews 4.1 manual for further details, or Bollerslev and Woodbridge, 1992). This method yields heteroskedasticity-consistent and efficient estimators.

Once we obtain a satisfactory output while following the criteria laid out above (i.e. maximising the value of the log-likelihood function, minimising Akaike's information criterion and verifying the estimators' properties, notably the absence of serial correlation and (E)GARCH), we proceed to test its robustness by varying two sets of convergence parameters available in EViews 4.1: (1) the coefficient starting values, and (2) the numeric derivatives method. For the starting values, we run the numerical maximisation with all available options. They are: OLS/TSLS coefficients, 0.8·OLS/TSLS, 0.5·OLS/TSLS, 0.3·OLS/TSLS, 0, and user supplied. For the numeric derivatives method, we use both options provided by EViews 4.1: the "speed" option performs fewer objective function evaluations, while the "accuracy" option uses a more sophisticated routine, favouring precision (see Appendix A2 and EViews 4.0 User's Guide, p. 652f, for further details).

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[22] This is done by performing a Wald test where the null hypothesis holds that the coefficient(s) associated with the respective variables are statistically equal to zero.

[23] Basically, we plot the squared residuals and standardised residual correlograms as well as their corresponding Q-Statistics, and we perform ARCH LM tests under the null of p ARCH-terms statistically equal to zero. Whenever possible, we retain the minimum of (p,q) terms as possible, checking its compatibility with the lack of some residual (E)GARCH.

4.2) Regression output and economic interpretation

The goal of this paper is to find the empirical determinants of both short-term (1-month horizon) and medium-term (1-year) currency premia. Hence, the estimation methodology explained before is applied to both cases in the same way. The "retained" equations in each case correspond to the specifications with the highest log-likelihood value, or the lowest Akaike value, controlling for the absence of serial correlation and (E)GARCH in the conditional variance. This means that if, for instance in the 1-year currency premium equation with OLS/TSLS starting values, the log-likelihood was equal to -99 compared to -100 with starting values equal to 0.8·OLS/TSLS, but if, at the same time, the former displayed some degree of serial correlation, then we would retain the latter estimates (i.e. those based on starting values equal to 0,8·OLS/TLS). Regression outputs obtained by applying both accuracy and speed options (Marquardt algorithm) were compared in the same way. Tables 1 and 2 show the best regression output for both currency premia (EGARCH (1,1) for the 1-year currency premium, and EGARCH (1,2) for 1-month currency premium), as well as their OLS counterparts. For reasons of space, the tables do not display the coefficients for the lagged dependent variables. We also remind that individually or globally redundant variables (controls and/or dummies) were dropped.[24]

The best results for the **1-year currency premium** (Table 1) are obtained if the variance equation (15) is modelled as an EGARCH(1,1) process, if the starting values are 0.5·OLS/TSLS, and using the "speed" option. Running the model with OLS/TSLS starting values and under the "accuracy" option, for instance, yielded a very slightly higher log-likelihood value but displayed some degree of serial correlation. The most significant and robust variables, together with the sign of their parameters, turn out to be:

- NOFP (-)
- GOLDPRICE (+)
- D(D(SPMLUSHY)) (+)
- D(SPLEHASIA(-1)) (+)
- D(SPLEHASIA(-2)) (+)
- D(REERGEODEV) (+)
- D(REERGEODEV(-1)) (+)
- D(GOLDPRICE(-5)) (-)
- MOODYS (-)
- ECR0102 (+)
- ECR0201 (+)

Note that many insignificant dummies were excluded because they cause multicollinearity problems in the equations, distorting the sign and/or the significance of other variables. The listed variables were quite robust in 9 out of 10 regressions (i.e. "accuracy" and "speed" option; five options for starting values for each, accuracy and speed, option).

[24] See footnote 20.

The best results for the **1-month currency premium** (Table 2) are obtained if the variance equation (15) is modelled as an EGARCH(1,2) process, with starting values equal to 0.8·OLS/TLS and the "accuracy" option. The most significant and robust variables turn out to be:

- NOFP (-)
- REERGEODEV (+)
- D(GOLDPRICE(-2)) (+)
- INFGAP (+)
- ECR0201 (+)

Table 1: The determinants of the 1-year currency premium

Sample(adjusted): 2/07/1997 8/01/2002				
	Dependent Variable: D(CP1Y)			
Estimation method	OLS		ML - ARCH (Marquardt)	
	Coefficient	Prob(1-F(x))	Coefficient	Prob(1-F(x))
C	24.885	0.353	5.259	0.707
CP1Y(-1)	-0.023	0.013	-0.025	0.000
D(SPMLUSHY(-1))	0.087	0.193	0.096	0.053
D(SPLEHAMER(-1))	0.062	0.324	0.035	0.204
SPLEHASIA(-1)	0.011	0.079	0.007	0.078
NOFP(-1)	-0.001	0.040	-0.001	0.000
REERGEODEV(-1)	18.682	0.760	39.820	0.263
GOLDPRICE(-1)	0.055	0.128	0.085	0.000
D(D(SPMLUSHY))	0.054	0.186	0.074	0.006
D(SPLEHASIA(-1))	0.008	0.767	0.041	0.028
D(SPLEHASIA(-2))	0.032	0.067	0.054	0.022
D(REERGEODEV)	732.743	0.000	467.018	0.000
D(REERGEODEV(-1))	649.814	0.000	228.394	0.000
D(GOLDPRICE(-5))	-0.318	0.039	-0.300	0.014
INFGAP	0.726	0.315	0.140	0.854
MOODYS	-2.050	0.091	-1.229	0.036
ECR0201	7.067	0.009	5.157	0.000
ECR0102	12.029	0.011	11.421	0.001
Variance Equation				
C			-0.004321	0.9564
|RES|/SQR[GARCH](1) or γ_1			0.368636	0
RES/SQR[GARCH](1) or θ_1			0.116694	0.0131
EGARCH(1) or $\ln\sigma^2_{t-1}$			0.948113	0
Adjusted R-squared	0.180		0.076	
Log likelihood	-6012.922		-5469.868	
Akaike info criterion	8.435		7.683	
Prob(F-statistic)	0.000		0.000	

Table 2: The determinants of the 1-month currency premium

Sample(adjusted): 2/07/1997 8/01/2002				
	Dependent Variable: D(CP1M)			
Estimation method	OLS		ML - ARCH (Marquardt)	
	Coefficient	Prob(1-F(x))	Coefficient	Prob(1-F(x))
C	-63.007	0.177	2.833	0.847
CP1MWMR(-1)	-0.026	0.107	-0.012	0.016
D(SPMLUSHY(-1))	0.264	0.199	-0.034	0.824
D(SPLEHAMER(-1))	0.023	0.908	-0.104	0.243
SPLEHASIA(-1)	0.000	0.986	0.004	0.384
NOFP(-1)	-0.002	0.152	0.00044	0.000
REERGEODEV(-1)	-186.729	0.319	245.667	0.020
GOLDPRICE(-1)	0.199	0.172	-0.018	0.764
D(REERGEODEV(-3))	215.581	0.393	230.422	0.118
D(GOLDPRICE(-2))	0.362	0.679	1.220	0.000
D(GOLDPRICE(-5))	-1.441	0.014	-0.441	0.120
INFGAP	2.086	0.366	1.222	0.009
ECR0201	20.559	0.046	5.826	0.010
Variance Equation				
C			0.120	0.034
|RES|/SQR[GARCH](1) or γ_1			-0.031	0.738
RES/SQR[GARCH](1) or θ_1			0.273	0.000
EGARCH(1) or $\ln\sigma^2_{t-1}$			0.188	0.172
EGARCH(2) or $\ln\sigma^2_{t-2}$			0.797	0.000
Adjusted R-squared	0.256		0.137662	
Log likelihood	-8182.667		-7410.928	
Akaike info criterion	11.500		10.42787	
Prob(F-statistic)	0.000		0	

The same caveat with respect to the existence of potential multicollinearity holds. As before, these variables were quite robust in 9 out of 10 regressions (i.e. "accuracy" and "speed" option; five options for starting values for each, accuracy and speed, option).

The results show that the forward premia are very monetary (or exchange) policy driven, more strongly so in the short term, contrary to what one may have expected. The reduction of the NOFP has a greater impact on the 1-month premium and bears a negative sign, what might indicate the “vulnerability perception” effect more than compensates the “demand-side pressure” effect. INFGAP, however, is only significant in the 1-month currency premium equation but has the expected positive sign. That is, when SARB has not met its inflation target this is more likely to bear upon short-term expectations indicating the prevalence of the inflation premium in short-run exchange rate expectations. The non-significance of INFGAP in the 1-year regression may be due to a high degree of collinearity of this variable with respect to MOODYS and ECR0102.[26]

[26] Why doesn't this happen in the 1-month equation? Here, Moody's had been taken out by means of “redundant variables” or Wald testing. When we include it again into the one-month equation, it turns out

The various risk aversion proxies always impacts positively on the currency premia. The impact is more important on the 1-year premium than the 1-month premium. The negative coefficient on Moody's ratings implies that a higher rating leads to a lower 1-year currency premium. The coefficient on the gold price (South Africa is somehow a price maker) has a positive and significant coefficient in the 1-year equation but a negative and insignificant one in the 1-month equation. This might reflect counteracting effects owing to, on the one hand, the decline in the currency premium brought about by the perception that the gold price has permanently increased and, on the other hand, to a higher forward premium when agents believe that increase is judged as transitory.

The only capital control dummies that are significant are the ones related to shifts in capital controls that have occurred in early 2001 and early 2002. This might mirror the destabilising impact of changes in the capital controls regime occurring while the currency has already been under pressure.[27]

Finally, let us speculate on a possible explanation for the puzzling positive and robust sign of REERGEODEV. This positive sign implies that the more the rand is undervalued in real terms (i.e. relative to its "equilibrium" real exchange rate), the more it is expected to further depreciate and, hence, the higher is the currency premium. The variability of REERGEODEV is mainly driven by nominal exchange rate changes. Furthermore, assume relative prices show very little variability at the end of the month when a variation takes place. If we have a positive deviation from the "equilibrium" level, we should expect a downward correction that is a real exchange rate appreciation back to its equilibrium level. As prices are invariant throughout the month, it is the nominal exchange rate which must do the job. That said, if you assume the nominal spot rate appreciates more than the 1-month or 1-year forward do in order to restore the equilibrium (and the vice-versa in case a negative deviation occurs), then you get the puzzling sign.[28]

that INFGAP still remains significant (though less than before, at 3% to be more accurate). In conclusion, there might be other variables that lick part of this collinearity, which are not present in the 1-year regression. Of course, one couldn’t attribute the source of this problem to any particular variable to a given extent.

[27] 2001 was a rocky period for the South African currency.

[28] An alternative explanation could be that our sample is biased in the sense that we mainly look at a period with large depreciations, which may have been anticipated and may be driving our results. In this case, the deviation from the equilibrium REER is simply not a good measure of the magnitude of the expected correction towards this equilibrium. We thank Luca Ricci for his suggestions on this point.

5) Conclusions and policy recommendations

Investigating the behaviour of the currency premium: policy relevance for South Africa

Reining in the instability of market expectations towards the course of the rand is important for the South African economy. In a nutshell, the case for stabilising the rand currency premium is based on the following arguments:

- The volatility of the rand may have a strong adverse impact on the South African economy, e.g. being an impediment to the expansion of foreign trade, making inflation targeting trickier, hindering the development of domestic capital markets and turning South Africa into an "Original Sin" country.

- As mentioned before, a lower and less volatile currency risk would help draw in foreign investors willing to buy rand-denominated securities, making it potentially easier for sovereigns and corporates throughout Southern Africa to mobilise resources. Increasing the liquidity of the South African financial markets clearly fits in with the priorities set out by the *Capital Flows Initiative* of the NEPAD[29]: "the deepening of financial markets within countries" ranks among the NEPAD guidelines aimed at bolstering private capital flows to Africa. In the specific case of South Africa, the government has conveyed that high-flying investment needs in infrastructure would require making the country a magnet for long-term private foreign investors. A prerequisite is to offer investors a business-friendly macro-economic environment, including a stable currency, thereby making South African financial markets (notably the bond market (Rand Merchant Bank, 2001)) much more attractive.

It is therefore of critical relevance to identify the determinants of the currency premium on rand-denominated assets in order to find ways of lowering local-currency debt costs and stem their volatility.

Main Findings and Policy Recommendations

In this paper we have characterised the behaviour of the rand currency premium and its volatility. Several interesting findings emerge from this paper, which may be regarded as a basis for policy recommendations. Our results suggest that monetary policy is key to understanding the behaviour of the currency premium.

First, by dramatically unwinding its Net Open Forward Position (NOFP), the South African Reserve Bank has achieved a major breakthrough in reducing the external vulnerability of the country.[30] According to our results, a large NOFP drives up the

[29] NEPAD (2001), §151.

[30] However, its timing turned out to be fairly inappropriate. It presumably fuelled the near-collapse of the rand in 2001 (*Commission of Inquiry into the rapid depreciation of the exchange rate of the rand and related matters: Final Report dated 30 June 2002*)

currency premium and makes rand-denominated financing more expensive. The low NOFP level should now enable the central bank to replenish its foreign currency reserves, thereby stabilising the rand and reducing the susceptibility of the country to contagion phenomena and spill-over effects. It should also broaden the scope for monetary authorities to support the rand when coming under speculative attacks, thus avoiding a systematic surge in interest rates.[31]

Second, the move to an inflation targeting system requires a strong commitment of monetary authorities to meet their target. If actual inflation exceeds the target, our results point to the risk of an increased currency premium. This might trigger a vicious circle: a large "inflation gap" pushes up the currency premium (at least in the shorter term), that might in turn boost inflation expectations and put the fulfillment of the inflation target in jeopardy.[32]

Third, the South African risk, including the currency risk, is still far from being idiosyncratic. In this paper we find that the currency premium is driven up by global risk aversion. The rand remains a highly volatile currency, strongly susceptible to news affecting the global economy, not least other emerging economies. This characteristic partly ensues from the high liquidity of the South African currency. As Cross (2002, 148) notes, "this is of course not to say that poor-functioning, illiquid markets are to be preferred." But here again, the high volatility should give the South African authorities an incentive to build up large enough foreign currency reserves and to strive to improve ratings. In this paper we find that rating upgrades have a benign impact on the currency premium by reducing its level. It might also make the South African currency risk more idiosyncratic, i.e. less vulnerable to global risk aversion.

Fourth, we evidence in this paper that shifts in capital controls regime may have a mixed impact on market expectations towards the course of the exchange rate. Most of the steps taken by the South African Treasury to modify capital controls regime have had no impact on the currency premium between 1997 and 2000. However, decisions made in early 2001 and early 2002 with respect to the exchange controls regime gave a boost to the currency premium.[33]

Our guess is that the process of foreign exchange liberalization, *alongside* stiff speculative attacks and a dramatic depreciation, may have added to the downward pressures on and the instability of the rand. Lifting capital controls is a tricky process given the substantial capital flows moving to and out of the South African economy, the high number of players in the forex market and the wide range of financial instruments used. Accordingly, shifts in the capital controls regime must be handled very carefully and in a timely**.**

[31] In the second half of 2001, faced with a drop in the value of the rand, the SARB had little choice but to resort to a hike of interest rates. The SARB had indeed too low a level of hard currency reserves to support the rand and was loath to reverse its strategy of downsizing the forward book.

[32] Therefore, there might be a dynamic, endogenous relationship between the inflation gap and the currency premium to be dealt with (suggested as a future research work).

[33] Whatever their direction, these measures seem to have had an upward impact on the currency premium: in early 2001, the Treasury relaxed this controls, while in early 2002, expired capital controls dispensations have not been renewed.

In this paper, we have shed light on the determinants of the currency premium in South Africa and provided guidelines as to the way of reining in its level as well as stemming its volatility. These guidelines converge towards the necessity for South Africa to carry on with a cautious monetary policy designed to strengthen its external liquidity position. South Africa should also be cautious to avoid a strong currency mismatch and liability dollarisation so as to cushion the impact of the rand volatility.

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Econometric Appendix

A1) Unit Root Tests: Perron-Philips and ADF Tests (adjusted sample method)

Perron Philips equation: $\Delta Y_t = \alpha + \gamma Y_{t-1} + \varepsilon_t$

ADF equation: $\Delta Y_t = \alpha + \gamma Y_{t-1} + \sum_{j=1}^{p} \Delta Y_{t-j} + \varepsilon_t$

H0: $\gamma = 0$

While the ADF test corrects for higher order serial correlation by adding lagged differenced terms on the right-hand side, the PP test makes a correction to the t-statistic of the γ coefficient from the AR(1) regression to account for the serial correlation in ε_t. The correction is nonparametric since an estimate of the spectrum of ε_t at frequency zero is used that is robust to heteroskedasticity and autocorrelation of unknown form.

Table A1: Perron-Philips Test (default options)

Variable	H_0: $\gamma = 0$; τ value	Critical Value 5%
CP1M	-40.57912	-2.863292
CP1Y	-1.414246	-2.863292
D(CP1M)	-366.2574	-2.863293
D(CP1Y)	-39.52937	-2.863293
D(SPMLUSHY)	-41.58365	-2.863293
D(SPLEHAMER)	-36.43035	-2.863293
SPLEHASIA	-2.332095	-2.863292
REERGEODEV	-10.44898	-3.412899
GOLDPRICE	-3.216139	-2.863292

Table A2: ADF Test (intercept, no linear deterministic trend)

Variable	Optimal lags (max 21) SC	H_0: $\gamma = 0$; τ value	Critical Value 5%
CP1M	9	-4.053034	-2.863304
CP1Y	0	-1.477897	-2.863292
D(CP1M)	10	-19.66504	-2.863307
D(CP1Y)	0	-39.43642	-2.863293
D(SPMLUSHY)	4	-13.65479	-2.863299
D(SPLEHAMER)	0	-36.44606	-2.863293
SPLEHASIA	0	-2.312563	-2.863292
REERGEODEV	4	-9.952772	-3.412908
GOLDPRICE	0	-3.130050	-2.863292

A2) Estimation Settings in EViews 4.1 versus EViews 3.1

The result of an (E)GARCH estimation may be influenced by several factors. These factors include different versions of the supporting software, different convergence criteria (e.g. Marquardt), different ways to compute the derivative (for version 4.1: accurate or speed), different starting values for the parameters (OLS/TSLS[34] values, 0.8·OLS, 0.5·OLS,….,0 or user supplied) and, most importantly, the convexity of the objective function in question.

There was a significant change in EViews version 4.1 compared to version 3.1. The two version differ with respect to how the derivatives of the quasi-maximum likelihood function are taken and with respect to the convergence criteria (to jointly estimate equations 13 and 14, or 13 and 15). As a result of these changes, the two versions might not yield the same results. However, when the objective function is well behaved (i.e. convex), these changes do not influence the outcome.

One way to test whether the problem is well-behaved or not is to start the estimation with different starting parameters. If one obtained the same result with different starting values then the problem is well-behaved. Regarding our equations (in Eviews 4.1), we obtain a rather satisfactory convergence to a single maximum (ML). Otherwise, the opposite would indicate that the objective function is rather flat and there might be many local maxima.

Generally, when we use fast derivatives ("speed" option in EViews 4.1), EViews 4.1's results come much closer to those obtained by EViews 3.1. Playing with the starting value (OLS, 0.8·OLS, etc.), or starting the estimation with previous' estimated values and using fast derivatives, one should be able to obtain a better likelihood using EViews 4.1.

A3) Exchange control regulations (ECR) dummy variables

ECR0397: March 1st, 1997

- Income earned abroad and capital introduced into the Republic on or after July 1, 1997, by private individual residents in South Africa may be retransferred abroad.
- Institutions that qualify for asset swaps of their South African portfolio for foreign securities will be broadened to include regulated fund managers registered with the Financial Services Board. Qualifying institutional investors may acquire foreign portfolio investments by way of asset swaps for up to 10% of their total South African assets.
- In addition to the 3% foreign currency transfers already authorized[35], also apply to the Control to avail of foreign currency transfers in 1997 of up to 2% of the net inflow of funds during the 1996 calendar year, to be invested on registered stock exchanges in any SADC member country.

[34] TSLS = Two-stage least squares

[35] In 1996, South African institutional investors were permitted to transfer abroad 3% of their net inflow of funds generated during the 1995 calendar year within the overall limit of 10% of total assets.

- As far as South African corporates investing abroad are concerned the amount that could be remitted from South Africa was increased from R 20 million to R 30 million per new investment and to R 50 million in respect of new investments in SADC countries.

ECR0697: June 1st, 1997

- Permission was granted to private individuals resident in South Africa to invest up to R200,000 abroad.

ECR0398: March 1st, 1998

- The overall limit of 10% was increased to 15% and the 3% pertaining to the currency transfers was increased to 5% based on the net inflow of funds during the 1997 calendar year.
- Simultaneously the 2% pertaining to SADC countries was increased to 10%.
- Foreign investment by natural persons in South Africa was increased from R 200,000 to R 400,000.
- Direct investment by corporations in countries outside the CMA was raised from R 30 million to R 50 million and into SADC, an amount of up to R 250 million (set against R 50 million beforehand) is allowed. Any higher amount has to be financed abroad.

ECR0299: February 23th, 1999

- Foreign investment by natural persons resident in RSA was further increased from R400,000 to R500,000.

ECR0200: February 1st, 2000

- Foreign investment by natural persons resident in RSA was further increased from R400,000 to R500,000.
- Unit trusts through unit trust management companies may acquire portfolio investments up to 20% of their total assets under management whilst the limits of 15% of total assets for long term issuers and pension funds and 15% of total assets under management for fund managers were retained.

ECR0201: February 21st, 2001

- Direct investment by corporations in countries outside the CMA were raised from R50 million to R500 million and into SADC, an amount of up to R 750 million is allowed.

ECR0102: January 1st, 2002

- The cash flow dispensation to institutional investors in terms of which foreign exchange could be transferred from South Africa to acquire foreign portfolio investments, based as a percentage of net inflow of funds during the previous calendar year, subject to the overall limits on institutional foreign assets holdings of 15% and 20% respectively, expired at the end of 2001 and has not been renewed.