

Gold Price Volatility and the South African Rand

by

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Abstract: We examine the relationship between South African Rand and gold price volatility using monthly data for the period 1980-2010. Our main findings is that prior to capital account liberalization the causality runs from South African Rand to gold price volatility but the causality runs the other way around for the period post-liberalization. We also provide evidence that following capital account liberalization in South Africa, capital flow composition has been tilted toward portfolio investment. Those findings are consistent with the view that global investors seeking exposure to gold price have invested short-run in South Africa, in turn leading to increased exchange rate volatility with potentially harmful impact on investment and growth.

Key words: Exchange rate; volatility; commodities; financial flows

JEL codes:

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1. Introduction

Commodity exporting countries face large terms of trade fluctuations which render their real exchange rate volatile. Increased volatility in the real exchange rate hurts the economy through its adverse consequences on private agents' consumption and investment decisions.¹ South Africa, being the second largest producer of gold, is no exception to such exposure to volatility in real exchange rate. Since the liberalization of the capital account – the financial rand was abolished in March 1995 – the South African Rand has experienced more frequent episodes of nominal and real exchange rate volatility (Ricci 2005). Interestingly, South Africa has in the past decade also received an increasing portion of capital flows in the form of portfolio investments (Arezki, Faisal and Funke, 2007; Draper, Freytag and Voll, 2011). To explain these patterns, some commentators have suggested an explanation based on the willingness of global investors to seek exposure to gold through investing in liquid South African assets. In the present paper, we examine the relationship between the volatility in gold price and real exchange rate in South Africa.

This paper aims to make two main contributions. First, it attempts to determine the direction of the causality between the volatility in both the gold price and the real exchange rate. It is important to note that we take into account both volatilities and not the joint movement of both prices. This is a novelty. Second, it explores to which extent liberalization of the capital account has changed the relationship between gold price and exchange rate volatility for South Africa. Answering these questions is not only relevant from an academic standpoint but also from a policy perspective. Indeed, given the very high level of volatility in commodity prices, it is important for resource rich countries more generally to understand better the relationship between volatility in commodity prices and the fluctuation in their exchange rate. In addition, commodity exporting countries opening up their capital account may face a very different experience than other countries. Indeed, the volatile and the potentially large source of revenue derived from commodity exports may magnify the impact of such capital account liberalization on the exchange rate.

Our main finding is that prior to capital account liberalization the causality runs from South African Rand to gold price volatility but the causality runs the other way around for the period post-liberalization. In combination with the evidence that following capital account

¹ Small firms in particular may find particularly costly to hedge using financial instruments against volatility in exchange rate. This inability to hedge against exchange rate may have important consequences on the development of export oriented sectors.

liberalization in South Africa, the capital flow composition has been tilted toward portfolio investment, the findings are consistent with the view that global investors seeking exposure to gold price tend to invest more in short-term South African assets, which in turn leads to increased exchange rate volatility with potentially harmful impact on investment and growth. The remainder of the paper is organized as follows. Section 2 discusses the basic literature and derives some hypotheses. Section 3 describes the data; Section 4 explains our estimation strategy; Section 5 discusses the main empirical results; and Section 6 concludes.

2. The Literature

This paper relates to three strands of literature. First, it connects more directly to the so-called commodity currency literature. This literature provides robust empirical evidence of the relationship between the level of the exchange rate and the level of commodity prices. The latter obviously drive the first. Frankel (2007) shows that an index of mineral prices in South Africa is one, but not the only, important determinant of the real value of the Rand. This holds particularly in times when the Rand strongly appreciates in real terms (e.g. 2003-2006); Frankel identifies a Dutch disease problem. This is confirmed by Ngandy (2005) who surveys the literature on the relation between commodity prices and the real exchange rate of commodity exporting, mostly developing, countries. Cashin, Cespedes and Sahay (2004) provide additional evidence for a large set of developing countries. The result is consistent with the analysis of Chen and Rogoff (2003) who provide evidence for a selected number of resource-rich developed economies such as Australia, Canada and New Zealand. Again, the real exchange rates of these countries (with the exception of Canada) are driven by world commodity prices.

Since we also are interested in the consequences of institutional changes on the relation between exchange rate and commodity prices, we also refer to the literature on the impact of capital account liberalization on economic growth and financial crises. While the literature mentioned above has analyzed the effect of commodity prices on the real exchange rate, Cuddington and Liang (1998) look at the effects of different exchange rate regimes on commodity price volatility. Although they only use three types of exchange rate regimes,² they show that real commodity prices are more volatile in flexible exchange rate regimes than in periods of fixed exchange rates. Dell Arrica et al. (2000) address the potential gains and

² See Levy-Yeyati and Sturzenegger (2002) for a more sophisticated differentiation of exchange rate regimes.

risks of open capital markets by first looking at what classical economic theory suggests about the benefits of capital mobility and then examine the counterarguments arising from problems of incomplete information and other distortions. They show that the risks of removing international capital controls are similar to those associated with removing controls on domestic financial institutions. Henry (2007) reviews the evidence between capital account liberalization and economic growth. He finds that, contrary to what is often argued in the literature, capital account liberalization has effects consistent with the neoclassical theory in that it raises transitorily economic growth rather than permanently.

Finally, this paper also relates to the literature on macroeconomic volatility. This of course is a vast literature and it makes sense to restrict oneself to the effects of commodity price volatility on macroeconomic trends. Drawing on several of their earlier papers, Aghion and Banerjee (2005) explore the various causal connections between the trend growth of output and the volatility of output around the trend, concluding from empirical cross-country evidence that volatility hurts growth. Along similar lines, Ramey and Ramey (1995) provide evidence that volatility in economic growth diminishes average growth in a sample of 92 countries as well as in a sample of OECD countries. Aghion, Bachheta, Ranciere and Rogoff (2009) offer empirical evidence that real exchange rate volatility can have a significant impact on the long-term rate of productivity growth, but the effect depends on a country's level of financial development. Finally, it is also worth mentioning the effect of exchange rate volatility on trade and commodity prices (e.g. Bui and Pippenger 1990, Smith 1999, and Gilbert 1989). Especially Gilbert's analysis is interesting, since he shows that commodity exporting countries can be hurt by US-dollar appreciations.

We contribute to this literature by focusing not on the first moment of the relationship between commodity price and real exchange rate but on the second moment namely their volatility, using South Africa as a case study. The literature theoretical predictions for our analysis are twofold:

First, one should expect that there is also a correlation between the volatility of commodity prices and the volatility of the South African Rand's real exchange rate.

Second, this relation should be subject to change when the institutional setting (e.g. capital controls) significantly changes, as has been the case in South Africa following the end of Apartheid in 1994.

3. Data

Since we deal with changes, we cannot use simple prices and their changes, but have to construct first a measure of the international gold price volatility covering the years 1970-2007 and taken from UNCTAD Commodity Statistics. Our measure of volatility is the twelve month rolling window of the standard deviation of our international gold price index.

We also construct a measure of real exchange rate volatility based on the real effective exchange rate using monthly CPI data from International Finance Statistics and the monthly nominal exchange rate.

Tables 1 provide a description of the source of variables used in our empirical analysis.

4. Estimation Strategy

When analyzing the statistical properties of the series, we find no unit root and no cointegration between REER and gold price volatility when taking the whole period from 1970 until 2008. This changes when splitting the sample in two in the year 1995 and we cannot reject that the series are unit root over the two sub-samples. The split is motivated by major institutional changes in the South African policy towards capital flows and exchange controls.

According to Farrell and Todani (2004), the so-called financial Rand system was abolished in 1995 and exchange controls were also relaxed. It may well be argued that the institutional changes were not finished in 1995, but we assume that this year provides the most important positive shock for the South African economy with respect to its international relations.³

The two time series appear to be cointegrated in both pre and post liberalization sub-samples. Indeed, tables 2 and 3 provide evidence based on the Johansen cointegration test that we cannot reject the existence of a cointegration relationship between gold price and real exchange rate volatility. These results motivate the use of Vector Error Correction Model rather than Vector Autoregression (VAR). Ignoring the cointegration relationship and using variables in difference in a VAR framework would lead to bias estimates.⁴

³ We do robustness tests using 1997 as the split year, which does not change the results substantially.

⁴ See West and Cho (1989) for a principal analysis of different estimation models of exchange rate volatility

After having tested for the existence of cointegration between the series, we now estimate those cointegration relationships using a VECM framework. In turn this approach allows us to isolate short and long run relationship between volatility in gold price and real exchange rate.

5. Main Results

Tables 4 and 5 summarize our estimation results of VECM linking the volatility in gold price and real exchange rate volatility.

First, we take a look at the short run. As can be seen in Table 5, before 1995, the real effective exchange rate (REER) and the gold price volatility are affected by their own dynamics but do not affect each others. This restriction is also observed after the capital account liberalization. After 1995, the REER and the gold price volatility are both affected by their own dynamics (See Table 5).

Next, we now consider the long run. In the pre-1995 period, the cointegration vector indicates a long-run relationship between REER and gold price volatility (See Table 4). The VECM estimation results indicate that there is a long run effect of REER volatility on gold price volatility but not the other way around. To complement this finding, we further perform exogeneity tests. Those tests reveal that we cannot reject the null of exogeneity for REER but we can for gold price volatility (not shown in tables). This implies that gold price volatility in the long term is driven by REER. This is in contrast with the main results offered in the literature (see section 2 and e.g. Chen and Rogoff 2003). After 1995, the cointegration vector indicates a long-run relationship between REER and gold price volatility going from gold price volatility to REER volatility (see Table 5). There is thus evidence that gold price volatility in the long term causes REER volatility. The weak exogeneity test confirms this finding. It reveals that we have to reject the null of exogeneity for both REER and gold price volatility but more so for REER volatility (not shown in tables).

We do a number of robustness checks, which confirm the results. First, we use different break dates, since it is by no means clear that the financial reforms in South Africa had their effects on capital markets immediately. Thus, we simulate the break (1) with the end of the apartheid regime and (2) with different years after 1995. The results do not change substantially.

Secondly, we link the data with capital flows, mainly portfolio flows to control for other influences on the REER. This is particularly necessary as the South African economy attracted high capital flows, wherein we observed a major shift in favor of portfolio flows, as opposed to FDI.. Again, the results do not change significantly.

Extension: Gold price volatility and sovereign bond spread in South Africa.

- We use EMBI index data available only from end 1990s
- Series are found to be unit root
- Cointegration goes both ways but we find that gold price affect RER volatility more (results not shown in tables)

6. Conclusion

The study of the correlation between Rand-REER volatility and gold price volatility has been analyzed. Our preliminary results indicate that the gold price volatility is less dominant for the Rand after the liberalization than before in South Africa. This is an important result since increased REER volatility may have consequence on investment. The dependence of the South African economy on gold and its price developments seems to become smaller, in particular under open capital markets.

Nevertheless, exchange rate volatility in South Africa is not trivial. It seems to be a self-enhancing process. We cannot fully exclude that the commodity price development is affecting this process. Thus, the result adds to a long list of challenges for commodity exporting countries.

- It is still important to find policy strategies to reduce this volatility or to adapt better to it.
- Frankel (2007) has made a proposal of pegging the exchange rate to commodity price to reduce procyclical government policies by smoothing government revenue in domestic currency. Our research suggests that the volatility may be rather increased radically should a country implement such proposal. Therefore, we have to reject this proposal.
- Our evidence of the consequences of commodity price volatility on cost of borrowing complicates the conduct of fiscal policy.

In contrast to the literature surveyed in this paper, we use the second moment of both price developments, namely the volatility. Our paper is contradicting the generally obtained view that commodity prices determine the exchange rate. In order to derive a clear and crisp policy conclusion, we need, however, more evidence.

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Table 1. Description of Variables

Variable	Description	Source
Real exchange rate volatility	volatility is the twelve month rolling window of the standard deviation of RER	IMF (2010)
Gold price volatility	volatility is the twelve month rolling window of the standard deviation of our international gold price index	UNCTAD Commodity Statistics
Sovereign bond spreads	Bond spreads are measured against a comparable US government bond and are period averages for the whole year.	Emerging Markets Bond Index Global (EMBI Global)

Table 4 VECM Results for Pre-Capital Account Liberalization Sample

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
-----+-----						
D_rvolat						
_ce1						
L1.	-.0050327	.0036588	-1.38	0.169	-.0122038	.0021384
rvolat						
LD.	.8688737	.0724027	12.00	0.000	.7269671	1.01078
L2D.	-.2367546	.0726527	-3.26	0.001	-.3791513	-.0943578
gvolat						
LD.	-.0287745	.7820951	-0.04	0.971	-1.561653	1.504104
L2D.	.1328164	.5739969	0.23	0.817	-.9921969	1.25783
-----+-----						
D_gvolat						
_ce1						
L1.	.00154	.000314	4.90	0.000	.0009246	.0021554
rvolat						
LD.	-.0051353	.0062133	-0.83	0.409	-.0173131	.0070425
L2D.	.0025122	.0062347	0.40	0.687	-.0097076	.0147321
gvolat						
LD.	.8199428	.0671159	12.22	0.000	.688398	.9514876
L2D.	-.2571044	.0492579	-5.22	0.000	-.3536481	-.1605608

Table 5 Post-Capital Account Liberalization VECM Results

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
-----+-----						
D_rvolat						
_ce1						
L1.	-.0364155	.0105168	-3.46	0.001	-.0570281	-.0158029
rvolat						
LD.	.720195	.0513738	14.02	0.000	.6195041	.8208859
gvolat						
LD.	.1703216	.9045278	0.19	0.851	-1.60252	1.943163
-----+-----						
D_gvolat						
_ce1						
L1.	.0010088	.0006207	1.63	0.104	-.0002078	.0022255
rvolat						
LD.	-.0011253	.0030322	-0.37	0.711	-.0070684	.0048178
gvolat						
LD.	.7220485	.053388	13.52	0.000	.6174099	.8266871
-----+-----						