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Mineral Prices and the Exchange Rate: What Does the Literature Say?

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Executive Summary

This report reviews the literature in an attempt to find whether there exists evidence of an empirical relationship between commodity prices and the exchange rate and whether the presence of such a link has any implications on the level of labour intensive manufacturing employment. More importantly it supposed to provide a platform from which further research is going to be carried out. The main concern with respect to the latter is the extent to which capital-intensive mineral exports have an impact on the exchange rate much to the detriment of labour intensive export manufacturing. In other words can commodity prices drive the exchange rate to levels that reduce the competitiveness of export manufacturing leading to adverse consequences on employment in this sector? The subsequent volatility in the exchange rate from fluctuating mineral prices has a direct impact on the level of competitiveness and hence the potential de-industrialization of the manufacturing sector. The review finds evidence that in South Africa mineral prices are a significant determinant of the real exchange rate. It also finds evidence that alludes to the existence of co-movements between the exchange rate and mineral prices. Furthermore, there is evidence that point to the conclusion that the exchange rate has an impact on manufacturing output and employment as suggested by the Dutch disease literature. The report also finds evidence that shows a link between the exchange rate and export performance, with appreciations negatively impacting on the latter. Finally, the review then looks at studies that have focused on the exchange rate and manufacturing employment as a way of assessing the nature of the relationship, it finds that and more importantly for future research considerations, that there exists a gap in the literature with respect to the treatment of the aforementioned relationship. There are very few studies on developing countries that specifically look at the impact of exchange rate movements on the manufacturing sectors output, employment and profitability at both the national level and the industry level. The existing studies have concentrated on the United States and Japan. Those on developing countries have restricted they attention to the relationship between the exchange rate and export performance in general without explicitly animating its impact on employment.

1. Introduction

The rand has experience a 50% appreciation since early 2002 to December 2004, with a 17% appreciation in 2004. Both the mining and manufacturing export sectors have been hurt. According to the Chamber of Mines (2003) there was a decline of 9% in the average price of platinum in 2003 relative to 2002. The gold sector incurred a total unit production cost of R88 907 per kg in the second quarter of 2003, against a gold price of R83 345 per kg. The Chamber of Mines (2003) argues that at these prices 7 out of 12 South African mines are loss making and a possible 70 000 workers are exposed on these loss making mines, together with a 37% potential loss in production. On the manufacturing side the hardest hit has been the clothing and textile industry which has also taken a heavy hit from liberalization which lowered the import tariff rate on textiles. The relatively weaker rand at the end of 2001 13.85 to the US dollar had managed to ease the impact of liberalization, but its rise in recent years is starting to have its toll on the sector. There are wide spread fears that the imminent job losses in the export sector will compromise the ability of government to create jobs.

This paper reviews the literature in an attempt to find whether there exists evidence, of an empirical relationship between commodity prices and the exchange rate and whether the presence of such a link has any implications on the level of labour intensive manufacturing employment. The main concern with respect to the latter is the extent to which capital-intensive mineral exports have an impact on the exchange rate much to the detriment of labour intensive export manufacturing. In other words are commodity prices driving the exchange rate to levels that reduce the competitiveness of export manufacturing leading to adverse consequences on employment in this sector? Do booms appreciate the exchange rate and to what extent do such appreciates affect manufacturing? How significant is the contribution of mineral prices in the determination of South Africa's real exchange rate? In other words to what extent is there a correlation between the exchange rate and mineral export prices? Since commodity prices are subject to alternate periods of boom and slump, the subsequent volatility in the exchange rate from fluctuating mineral prices, has a direct impact on the level of competitiveness and de-industrialization1 of the manufacturing sector.

In trying to find a relationship between mineral prices and the exchange rate one would expect mineral prices to be a significant determinant of the real exchange rate, the link probably being transmitted via the terms of trade. We also expect to find evidence that point to the existence of co-movements between the exchange rate and mineral prices. Furthermore, we expect to find evidence that point to the conclusion that exchange rate movements induced by commodity prices have an impact on manufacturing output and employment, as suggested by the Dutch disease literature.

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1 This can be defined as the fall in employment and output in the manufacturing sector.

There should also be evidence that shows a link between the exchange rate and export performance, with appreciations negatively impacting on the latter.

This paper will proceed as follows: section 2 will look at the determinants of the real exchange rate with an emphasis on South Africa. Section 3 will look at literature that analyzes the relationship between commodity prices and the terms of trade and section 4 will look at commodity prices and the real exchange rate. The link between the manufacturing sector and the exchange rate will be look at in section 5, by looking at the Dutch disease literature and finding out what it says about the link between a commodity induced appreciation and the deindustrialization of export manufacturing. Section 6 will then look at the relationship between exports and the exchange rate and section 7 will give an overview of the cited literature.

2. Determinants of the real exchange rate

To understand the relationship between mineral prices and the exchange rate a good starting point would be to look at the determinants of South Africa's exchange rate. We need to find out what the empirical literature says about the role and significance of mineral exports as a determinant of the exchange rate in the South African case.

The equilibrium real exchange rate (ERER) is the relative price of tradables to non-tradables that, given sustainable (equilibrium) values of other relevant variables – such as taxes, international prices, and technology – results in the simultaneous attainment of internal and external equilibrium (Edwards, 1991). This means that any changes in the variables that affect a country's internal and external equilibrium, will lead to changes in the equilibrium real exchange rate. Therefore the real exchange rate (RER) required to attain equilibrium will not, for example, be the same at a very low world price of the country's main export as it is at a very high price of that good (Edwards, 1991). According to theory, the equilibrium exchange rate is determined by terms of trade shocks; changes in the tax system - import tariffs, export taxes; real interest rates; capital flows and technological progress. These determinants of the real exchange rate are referred to as the real exchange rate fundamentals and the equilibrium real exchange rate will tend to be affected by both their current levels and their expected future evolution.

We expect those goods that are significant in a countries trade to influence the ERER through their impact on the terms of trade. Since minerals are an important export for SA one would expect them to have a strong influence on the exchange rate. In these countries the terms of trade are closely correlated to the movement in mineral prices and in turn changes in the real exchange rate will also reflect changes in the terms of trade. In cases where the contribution of a mineral to total exports is significant it might be necessary to have the mineral price variable enter into the RER equation separately (Aron *et al* 1997). Given the increase in mineral prices in recent years, it is interesting to see if there have been corresponding movements in the real exchange rates of mineral exporting countries.

From an employment policy perspective any improvements in the terms of trade that lead to an appreciation of the exchange rate are important. The appreciating currency might have an impact on the country's export competitiveness, which might threaten employment in export manufacturing. This line of reasoning is highly reminiscent of the 'Dutch disease' phenomena. The Dutch disease is defined as, the de-industrialization of a nation's economy that occurs when the discovery of a natural resource raises the value of that nation's currency. This makes manufactured goods less competitive with other nations, increasing imports and decreasing exports.

The term originated in Holland after the discovery of North Sea gas in the 1960s. During the 1970s, the guilder appreciated relative to most currencies. The textiles and clothing industries almost vanished; there was a decline in metal manufacturing, mechanical engineering, vehicles, ships, and even construction and building materials. It is important to stress that it is unlikely that South Africa is experiencing the Dutch disease as was the case with Holland. However, one should note that it's not just the discovery of a natural resource that can raise a nation's currency and induce Dutch

disease type effects, significant increases in mineral prices can also have a similar effect. These variations in mineral prices on the exchange rate might affect the country's export competitiveness, which might have an impact on employment in the manufacturing sector – more so if the increase in mineral prices is sustained over a long period of time.

2.1   Empirical evidence on the determinants of the RER

There have been a number of studies (see Maeso-Fernandz, *et al*, 2002; Lee and Tang, 2003; MacDonald, 2002 and Feyzioglu, 1997) on the determinants of the RER, most of which have focused on developed countries. Most of these studies have emphasized sectoral productivity differentials between a given country and its trading partners, government spending, current account imbalances, capital flows and interest rate differentials as important fundamental variables that determine the RER. According to Cashin, *et al* (2003), in contrast to the abundant empirical literature on the behaviour of real exchange rates in developed countries, evidence on the behaviour of developing countries real exchange rates is scarce. Most of the studies focus on Latin America and concentrate on the terms of trade as a determinant of the real exchange rate (see Mkenda, 2001; Drine and Rault 2003). The reason for the emphasis on the terms of trade emanates from the fact that in developing countries' exports tend to be dominated by primary commodities, which have a strong influence on the terms of trade and enhance the real exchange rate (Cashin et al 2003).

2.2   The case of South Africa

It is important to emphasize that any attempt to single out the determinants of South Africa's exchange rate, is complicated by the political and economic developments that took place over the past two decades. For instance, there has been significant terms of trade shocks due to major gold price changes and the political crises prior to democracy, which resulted in capital outflows and trade sanctions. It is however not the task of this paper to give a detailed explanation of how each of these variables determines South Africa's exchange rate. The paper seeks to give a review on the extent to which the relationship between mineral prices and the exchange rate has been dealt with in the literature and it tries to animate a plausible link to employment.

Aron *et al* (1997) conducted one of the most comprehensive studies on the determination of the real exchange rate in South Africa. They underscore the important role of fiscal, monetary and exchange rate policies and the effect of terms of trade shocks (especially in the gold sector) together with the massive shifts in capital flows in South Africa as some of the main influences on the exchange rate. They use a quarterly model covering the period 1970:1 to 1995:1. Co-integration methodology and single equation error correction models are used to investigate both the short-run and long-run determinants. They estimate a model where the real effective exchange rate is a function of the following variables:

$$\text{REER} = f(\overset{+}{\text{TOTXG}}, \overset{+}{\text{PGOLD}}, \overset{+}{\text{TARIFF}}, \overset{+}{\text{LRCAPFLO}}, \overset{+}{\text{RESERVES}}, \overset{+}{\text{GOVEXP}},$$

$$\overset{+}{\text{DTECHPRO}})$$

A (+) represents an appreciation and a (–) represents a depreciation.

Where REER is the real effective exchange rate from the SARB; the terms of trade variable TOT is disaggregated into the major mining commodity (gold) PGOLD and non-gold terms of trade TOTXG. Since the terms of trade give a theoretically ambiguous result depending on the relative importance of substitution and income effects, this allowed the researchers to capture the mining sector's expected income dominance more satisfactorily. A dominant income effect would mean that an improvement in TOT would tend to appreciate the exchange rate. The importance of trade policy on the REER was captured by the TARIFF variable, which was proxied by customs receipts plus surcharges, divided by imports. LRCAPFLO is the long-term capital flow variable and RESERVES are the rand gross reserves of the reserve bank. According to Aron *et al* (1997) the latter variable in SA has tended to reflect gold price changes where reserves in dollar terms reached an all-time high during the high gold price period around 1980. This was a clear reflection of the substantial intervention of the Reserve Bank to prevent excessive appreciation of the exchange rate. The high reserves also allowed for repayment of reserve-related debt accumulated during the political shock period of 1976–78. GOVEXP is total government expenditure, where government expenditure on non-tradables alone is theoretically expected to appreciate the real exchange rate. The NOMDEV variable captures the effect of a nominal devaluation on the real exchange rate. DOMCRED is the total domestic credit extended by the monetary sector and SRCAPFLO are short-run capital flows and DTECHPRO, is a comparative measure of technical productivity levels between South Africa and her trading partners. All of these variables are found to have a positive and significant effect on the REER except NOMDEV, which is negative and significant.

The variable of interest is the terms of trade, which has been disaggregated into the major mining commodity (gold) and non-gold terms of trade. Aron *et al* find that the estimated elasticity for the real price of gold is positive and highly significant. In both the short and the long run an improvement in the real price of gold will lead to a real appreciation. They conclude that this is consistent with a strong income effect reflecting the importance of the gold sector in the South African economy.

In another study of the estimation of the equilibrium real exchange rate (ERER) for South Africa, MacDonald and Ricci (2003) use a Johansen cointegration estimation methodology. They find similar results to Aron *et al*, (1997) that real commodity prices (gold, coal, iron, copper and platinum) determine the long-run behaviour of the real effective exchange rate of SA. Robustness tests were performed on the commodity prices variable by running the main specification with different measures of commodity prices. The result showed that the different measures of commodity prices give broadly similar results in all cases, which demonstrates the strong contribution of commodity prices to the SA ERER. Other variables, which were also found to explain the ERER, include the real interest rate differential, GDP per capita, trade openness, the fiscal balance, and the extent of net foreign assets. They found

that the large fluctuations in commodity prices contribute heavily to movements in the real exchange rate. An increase in real commodity prices of 1 percent is associated with an appreciation of the real effective exchange rate of around 0.5%. It is interesting to note that few studies find a significant effect of the terms of trade variable for commodity exporters. Instead many studies find commodity prices to be strongly cointegrated with the real exchange rate.

After estimating the specification for the determinants of the REER, MacDonald and Ricci go on to calculate an estimate of the equilibrium real exchange rate. They define this as the level of the real exchange rate that is consistent in the long run with the equilibrium values of the explanatory variables. They found that the actual rate appears to have been close to its estimated equilibrium level in the first half of the 1990s and it subsequently depreciated by much more than the equilibrium rate, that is, about 44 percent versus 28 percent, respectively. According to MacDonald and Ricci the decline of the equilibrium level over this period arose from a number of factors. These include, the decline in commodity prices which accounted for a depreciation of the equilibrium real exchange rate in the order of 13%, the increase in openness (15%), the improvement in the fiscal balance (12%) and the slower productivity growth relative to trading partners (1%). On the other hand, the increase in net foreign assets and in the real interest rate differential partly offset these forces by contributing to an appreciation in the order of 7 and 5 percent, respectively. With respect to the speed of adjustment of the RER to its equilibrium level they found that deviations can be expected to revert to equilibrium fairly quickly, in the absence of further shocks. The study suggests that about half of the gap is normally eliminated within two-and-one-half years.

This section has looked at the determinants of the real exchange rate and has found that commodity prices and more importantly in the case of SA mineral prices do have a significant influence on the RER. The empirical literature has also shown that the impact of commodity prices enters the determination of the RER via its influence on the terms of trade. As such section 3 will go on to look at the empirical literature on the link between commodity prices and the terms of trade.

3. Commodity prices and the terms of trade

There are a number of studies that look at the commodity price - terms of trade nexus. Most of the studies that look at this relationship either concentrate on the persistence of shocks to commodity prices or the impact of changes in commodity prices on the terms of trade (Cashin *et al*, 1999; Bidarkota and Crucini, 2000). If the effect of the terms of trade shock due to an increase in mineral prices is permanent it will have significant implications on the performance of the country long after the increase in the countries mineral prices. This will also have important implications in the countries ability to create employment in the sectors that are negatively impacted on. Therefore in the South African case if the rise in mineral prices had the impact of improving the terms of trade to the extent that there was a dominant income effect (which is associated with an appreciation), as was found by Aron *et al* (1997), it is possible that the macroeconomic conditions that we see in SA today with respect to the exchange rate are the direct result of previous terms of trade shocks caused by increases in world mineral prices.

Cashin and Pattillo (2000) in their study on the duration of terms of trade shocks on countries in Sub-Saharan Africa find that, on average, the persistence of terms of trade shocks varies widely for about half the sub-Saharan African countries. Such shocks are short lived (that is, half of the effect of the initial shock typically dissipates in less than four years) and for one-third of the countries such shocks are long lived (that is, permanent). South Africa is one of the countries that was found in the study to have long lived terms of trade shocks. Thus, in the case of SA the effects of a terms of trade shock will be felt long after the initial shock on the terms of trade. They go on to say a characteristic common to the commodity-exporting developing countries of sub-Saharan Africa is that; movement in their terms of trade is a key determinant of macroeconomic performance and has an important impact on real national incomes. Citing the example of Ethiopia with its dominant export of arabica coffee, they reiterate that, the slump in world coffee prices in 1986-87, caused largely by world production in excess of consumption, resulted in a 40 percent fall in Ethiopia's terms of trade. Since imports were about 15 percent of Ethiopia's national expenditure, this adverse movement in its terms of trade resulted in a decline of about 6 percent in Ethiopia's real income.

Bidarkota and Crucini (2000) studied the relationship between the national terms of trade for developing countries and world prices of internationally traded primary commodities. They found that variation in the world prices of three or fewer key exported commodities account for 50% or more, of the annual variation in the terms of trade of a typical developing country. This result has strong policy implications for developing countries that are predominantly commodity exporters since it implies that variations in world commodity prices will have a significant influence on their exchange rates.

4. Commodity prices and the real exchange rate

There have been a number of studies that have looked at the relationship between commodity prices and the real exchange rate (see Spatafora and Stavrev, 2003; Cashin *et al,* 2003a; Chen and Rogoff, 2002; Cashin *et al*, 2002, Amano and van Norden, 1998; Douglas *et al*, 1997; Edwards, 1985a; Edwards, 1985b). Most of these studies find a significant relationship for both developing and developed countries and more so for the former whose exports tend to be dominated by commodities. According to Cashin *et al,* (2003a) commodity prices are one of the most important variables in explaining the real exchange rate for commodity exporting countries, most of which are developing countries. They go on to say, while terms of trade fluctuations have been considered a key determinant of real exchange rates, it is surprising that there has been no comprehensive empirical work done to assess the mechanisms through which changes in real commodity prices affect the real exchange rate.

Cashin *et al,* (2003a) analyse the extent to which the real exchange rates of commodity-exporting countries and the real prices of their commodity exports move together over time. Specifically the key objective of their paper was to determine how many commodity-exporting countries have 'commodity currencies', in that movements in real commodity prices can explain fluctuations in their real exchange rates. They use IMF data on the world prices of 44 commodities and national commodity export shares. They found evidence of a long run relationship between national real exchange rates and real commodity prices for about one third of the commodity-exporting countries. Cashin *et al* also found that unlike purchasing power parity-based models the long-run real exchange rate of these 'commodity currencies' is not constant but is time varying, being dependent on movements in the real price of commodity exports.

For commodity exporting countries like Columbia and Zambia where a large percentage of total exports are dominated by one commodity, 88% in the case of Zambia (copper), the influence on the exchange rate of these countries is even more striking. The same is also true for OECD countries like Australia, New Zealand and Canada, whose exports contain a significant share of commodities. In fact, in the case of Australia, Chen and Rogoff (2002) said researchers at the Reserve Bank of Australia noted that one could have earned a substantial excess profit in trading on the Australian dollar by incorporating forecastable terms of trade movements into exchange rate forecasts.

Figure 1 – SA real effective exchange rate and US dollar gold price
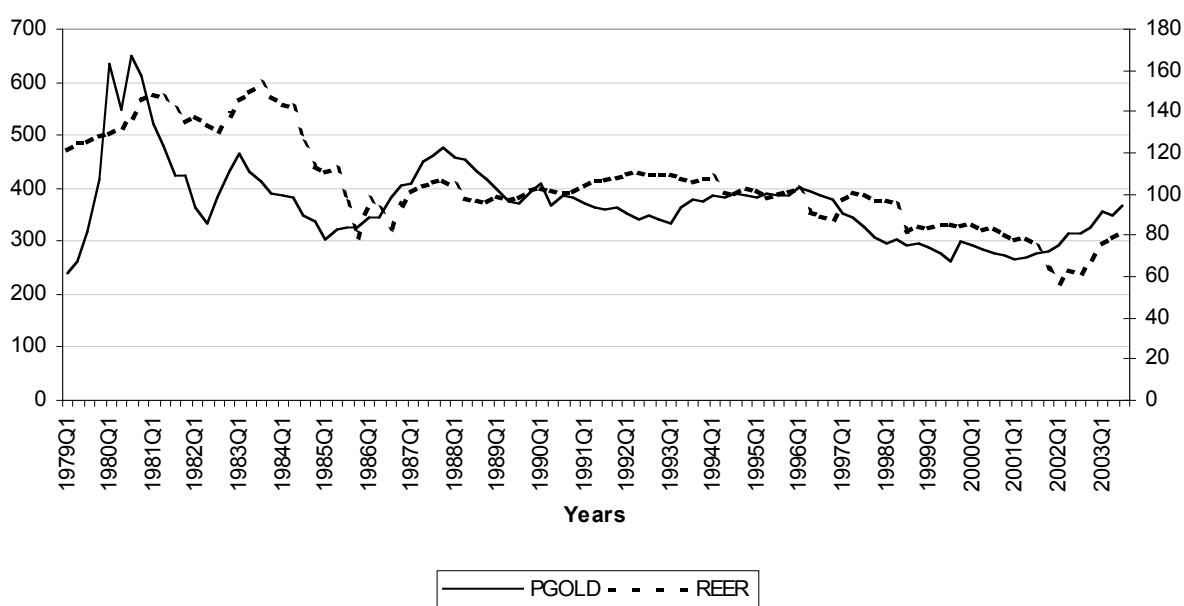
[Source: IFS]

The above diagram plots the US dollar price of gold along side South Africa's real effective exchange rate (an increase in the REER represents an appreciation). It can be seen that the gold price and the exchange rate exhibit visual correlation. The series appear to mirror each other in movement and it also seems as if the magnitude of their swings are almost similar. As gold prices start rising in the third quarter of 2001 the REER also starts appreciating early 2002. There is a need to estimate the extent to which metal prices influence the rand exchange rate, this kind of analysis will require the construction of commodity price indices covering metals. These indices could be aggregated according to South Africa's major metals, for example gold and platinum. A regression could then be run with the log of the metal prices being regressed against the log of the real exchange rate, this will allow us to interpret the metals price coefficient as an elasticity. After finding the estimates of the metals price elasticity of the real exchange rate, causality tests can then be carried out to determine the direction of causality (Cashin *et al,* 2003b and Chen and Rogoff, 2002).

5. Resource endowments, economic growth and the real exchange rate

According to Sachs (1999) one of the most important puzzles of economic development in the post-war era is the striking difference between Latin America's economic growth and that of East Asia (EA). Simply put EA has out performed Latin America to the extent that even with the crisis it is unlikely to reverse the long term difference in growth since the 1960s. In trying to explain this difference Sachs points to the fact that part of the explanation has to do we the differing economic polices in the two regions especially policies to do with international trade. However, the other half of the story as highlighted in his paper has to do with the role economic structure played in the growth performance of the two regions. According to Sachs the structure of the economic is determined by the resource endowment of the country. Latin American countries tend to be more resource endowed than the there resource scare counter parts in the East. Though the former benefited from export-led growth of these natural resources in the early nineteenth century, countries such as Argentina experience rapid capital inflows from advanced countries to build railways. However, in the past few decades it has been exports of labour intensive manufactures that has played a key role in spurring growth. He underscores the fact that economic structure and economic policy has affected the capacity of Latin American countries to achieve high growth in the past 30 years.

Sachs shows evidence that broadly speaking trade patterns tend to match the resource endowments of a country. The labour intensive export countries of Asia tend to export labour intensive export manufactures whilst the land and resource rich countries of Latin America and Sub Saharan Africa tend to export primary commodities. He also quotes a study by Morawetz's (1981) of Colombian where the coffee boom in the late 1970s also contributed to a real appreciation of the currency and a resulting profit squeeze in the fledgling textile and apparel export sector. To summarise the main thrust of his paper, "it seems that the Dutch disease is a disease after all, both with regard to long term growth rates and short term macroeconomic crises.

5.1 The manufacturing sector and the exchange rate (Dutch Disease reanimated?)

It should be noted that given the structure of the South African economy, it is highly unlikely that the country is experiencing a case of the Dutch Disease in the same way that Holland did. This section has been included to motivate the analysis of how resource booms can impact on the manufacturing sector and induce Dutch disease symptoms. This holds true bearing in mind that according to the seminal work by Corden and Neary (1982) a resource boom is only one of the several factors that can induce Dutch disease type effects.

There is quite an extensive literature on the Dutch Disease (see Stevens, 2003; Wunder, 2003; Kuralbayeva *et al*, 2001; Rosenberg and Saavalainen, 1998; Baek,

Seung-Gwan, 1996; Corden and Neary, 1982) with most of the recent studies focusing on the countries in transition that have an abundance of natural resources and developing countries whose exports are predominantly commodities. As such the price increases of these commodities tend to have significant impacts on their exchange rates.

The "Dutch disease" has since been used with reference to adverse structural changes that economies undergo as a result of sectoral booms associated with factors such as positive external terms of trade shocks and large capital inflows. It can also occur from any development that results in a large inflow of foreign currency, including a sharp surge in natural resource prices. As such it encompasses RER appreciation and the shrinkage of export manufacturing (tradables sector). According to Stijns (2003) there are usually symptoms of the Dutch Disease in most instances of a commodity boom but it is very difficult to disentangle the Dutch Disease effects from the domestic and international macroeconomic conditions prevailing at the time of the shock. Furthermore, in LDCs, authors struggle with disentangling manufacturing trade patterns due to Dutch Disease effects from the general failure of the development of a competitive manufacturing sector that might be policy induced.

The main focus of this paper is the impact of mineral prices on SAs exchange rate and the subsequent impact on employment in the export-manufacturing sector. In the Dutch-disease literature de-industrialisation usually refers to cases where as a result of an appreciation of the exchange rate due to a booming commodity sector there is a subsequent loss of employment from the tradable sector, which is usually export manufacturing, to the booming commodity sector. Corden and Neary (1982) present what has come to be known as the "core model" of Dutch Disease economics. They analyse the impact of a booming sector and de-industrialisation in a small open economy using a sequence of real models characterised by different degrees of intersectoral factor mobility. Their analysis is aimed at addressing the effects of a boom in a commodity sector on the functional distribution of income and on the size and profitability of the manufacturing sector. According to Corden and Neary though there are many reasons why a boom might occur the paper concentrated on the case of a once-and –for all Hicks-neutral improvement in technology and later extended the analysis to other cases. They however reiterate that the analysis can be applied to the effects of booms, which arise, from a variety of exogenous shocks in a small open economy, *including a change in world prices.* The latter being more applicable to the case of South Africa with respect to changes in mineral prices over the past few years. Their analysis introduces an important distinction between the two principal effects of a boom, namely the *resource movement effect* and the *spending effect.*

The *resource movement effect* can be explained as follows; an exogenous increase in the value of the booming sector's output raises the marginal products of the mobile factors employed in that sector. This draws resources out of other sectors, giving rise to various adjustments in the rest of the economy. One of the adjustment mechanisms is the real exchange rate. A contraction of the tradable sector will result from its reduced use of production factors. This will create excess demand of the non-tradable good which leads to an increase in its price. Since the price of tradables is exogenously determined in world markets, the rise in the prices of non-tradables is equivalent to an appreciation of the real exchange rate (Stijns, 2003).

In the case of the *spending effect* the boom, leads to increased income at home and therefore, to increased demand for all goods. The major impact of the boom and the resultant higher incomes leads to extra spending on all goods, which raises their price. With a fixed price of tradables on world markets the extra spending raises the relative price of non-tradables, resulting in a further appreciation of the real exchange rate. We end up with labour shifting from the tradables sector to the non-tradables sector resulting in a contraction of the non-booming tradables sector.

The strength of the resource movement effect, which is one of the mechanisms, that determines the extent of the de-industrialisation will depend on the relative factor intensity of each sector. If the booming sector uses more labour relative to the other sectors then one can expect the magnitude of de-industrialisation to be relatively high. However, if the booming resource sector is the capital-intensive sector, as is often the case in LDCs, the spending effect will dominate the resource movement effect leading to a low level of de-industrialisation.

The importance of the spending effect will depend on the marginal propensity to consume non-tradables. With a high propensity to consume non-tradables we can expect a relatively significant appreciation of the exchange rate, which will lead to a significant loss in the competitiveness of export manufacturing.

Corden and Neary in the simple model that they considered, assume that labour is the only mobile factor between sectors. This model shows that de-industrialisation occurs as a result of the boom in the energy sector, that is, a decline in the traded goods sector (which is manufacturing). The de-industrialisation in the manufacturing sector is characterised by a fall in output and employment, a worsening of the balance of trade in manufacturing and a fall in the real return to factors specific to the manufacturing sector. Both the *resource movement effect* and the *spending effect* imply a shift of labour away from the manufacturing sector, resulting in an unambiguous decline in manufacturing output. It was also shown that in this model the boom gives rise to a real appreciation.

In their paper Corden and Neary (1982) also make a distinction between *"direct de-industrialization"* and *"indirect de-industrialization"* the former being used to describe the movement of labour from the manufacturing sector to the booming sector. Whereas *"indirect de-industrialization"* refers to the flow of labour out of the non-tradable sector due to the spending effect. With the spending effect the increased demand for non-tradable goods, leads to an increase in their price and thus causes a further appreciation of the real exchange and the further shift of labour from the manufacturing sector to the non-tradable sector.

In an empirical analysis of the Dutch Disease hypothesis, Stijns (2003) using a gravity model approach focuses on an exogenous rise in the world price of a natural resource exported by a country as the source of the resource boom. He finds that a one percent increase in world energy prices is estimated to decrease a net energy exporter's real manufacturing exports by almost half a percent. Similarly, after instrumentation, a one percent increase in an energy exporting country's net energy exports is estimated to decrease the country's real manufacturing exports by 8 percent. Stijns also found that the corresponding confidence intervals are tight and these results are shown to be quite robust. He concluded that price-led energy booms systematically tend to hurt energy exporters' manufacturing exports. However, Stijns cautioned that one should

be careful not to over-interpret the results, since a country needs only worry about the Dutch Disease in so far as there is indeed something desirable about having a large proportion of manufacturing exports.

5.2   Dutch disease remedies

The measures that a country can take when it is experiencing Dutch Disease symptoms depend on the perceived duration of the resource boom, surge in commodity price and/or FDI inflows. According to Ebrahim-zadeh (2003) if the impact of the latter are expected to be temporary then policymakers may want to protect the vulnerable sectors possibly through foreign exchange intervention. The sale of domestic currency in exchange for foreign currency tends to keep the foreign exchange value of the domestic currency lower than it would otherwise be, helping to insulate the economy from the short-run disturbances of the Dutch disease that will soon be reversed. The country then has to make sure that the build-up of reserves does not lead to inflation and that the country's additional wealth is spent wisely and managed transparently through, for example, a central bank account or a trust fund.

In countries that expect the boom from new discoveries of a natural resource, increased aid flows, and favourable terms of trade gains to be permanent, Ebrahim-zadeh (2003) notes that, policymakers need to manage the structural changes in the economy so as to ensure economic stability. Policymakers can also take steps to boost productivity in the non-traded goods sector (possibly through privatization and restructuring) and invest in worker retraining. Export diversification to reduce dependency on the booming sector is also implied and to make exports less vulnerable to external shocks, such as a sudden drop in commodity prices.

This review of the Dutch disease literature should not be taken to mean that we are making the assumption that South Africa is experiencing symptoms of the disease. It is meant to illustrate the relationship between resource prices, the exchange rate and the subsequent de-industrialization of the tradables sector.
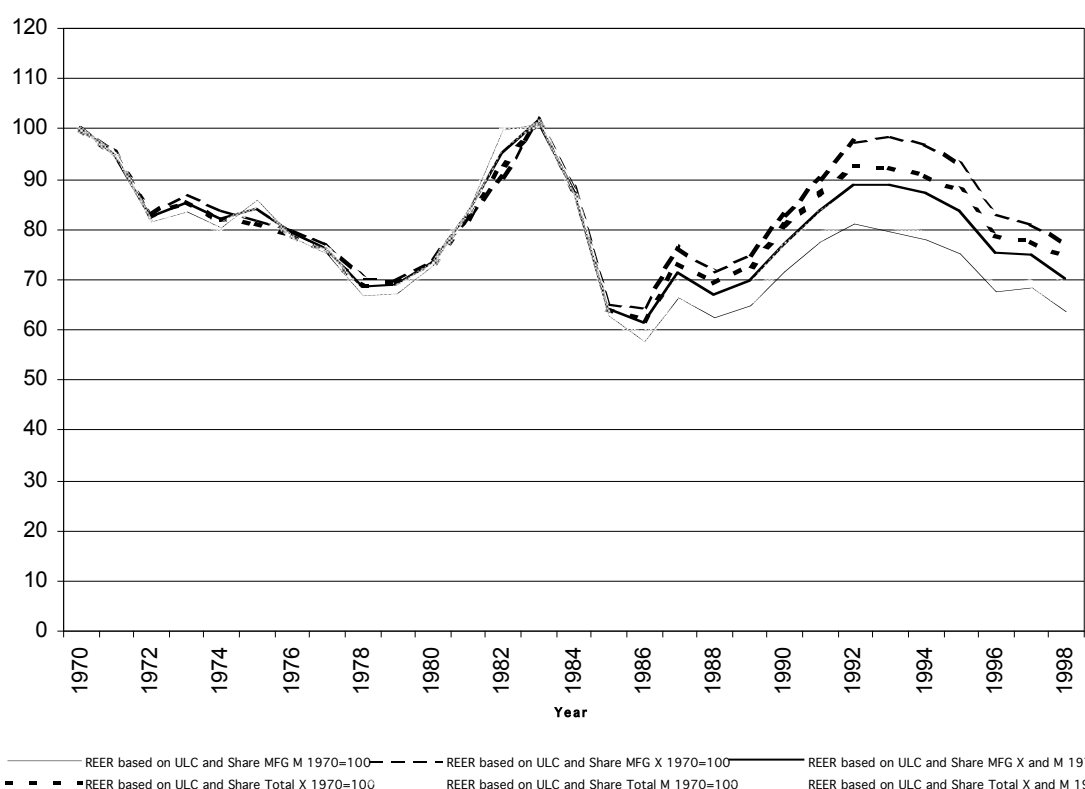
6. Exports and the real exchange rate

This section focuses on the relationship between the exchange rate and export manufacturing employment in an attempt to find out what the literature says. Since the demand for exports depends on the exchange rate one can infer that if a depreciation causes exports to fall, this might have an impact on employment in that sector. As such it is also important to look at the relationship between exports and the exchange rate more so given the scarce nature of empirical studies that look at the direct relationship between the exchange rate and employment.

In the context of this study the empirical literature on the relationship between exports and the real exchange can be classified into three categories. The *first* constitutes studies that look at the relationship between export performance, competitiveness and the real effective exchange rate (REER), the latter is one of the widely used measures of international price and cost competitiveness (see Nabli and Véganzonès-Varoudakis, 2002; Golub and Ceglowski, 2002; Cerra and Soikkeli, 2002; Söderling, 2000; and Gupta and Ray 1998). We then have the *second* group, which is composed of those studies that focus specifically on the relationship between exports and the exchange rate. These concentrate on the three factors that capture exchange rate policy and its impact on exports; these are changes in the REER, its volatility and its misalignment (see de Vitan and Abbottnn, 2004; Achy and Sekkat, 2003; Sekkat and Varoudakis, 2002; Bouoiyour and Rey, 2002; Sekkat and Varoudakis, 1998; Ogun, 1998). The *third* group is composed of studies that look at the impact of exchange rate movements on the manufacturing sectors output, employment and profitability. The empirical literature in this last group, though it is the most relevant when trying to animate the link between movements in the exchange rate and its subsequent impact on manufacturing employment, is very scarce with the few studies that have been done concentrating mainly on the United States (see Klein *et al* 2000; Clarida, 1991; Branson and Love, 1988; and Branson and Love, 1987) and with a few on developing countries Frenkel (2004) finds that an exchange appreciation has a negative impact in four Latin American countries. Burgess and Knetter (1996) find that for a group of countries from the Organisation for Economic Co-operation and Development (OECD) the results vary from country to country. Therefore from a research perspective the exact dynamic between exchange rate movements on the manufacturing sector output and employment remains a black box in the case of developing countries. Given the dominant nature of commodities in the South African terms of trade and hence the South African exchange rate, it becomes imperative to try and analyse the impact that changes in the exchange rate have on the level of employment of the South African manufacturing sector.

Golub and Ceglowski (2002) calculate South African REERs and examine the quantitative relationships between these REERs and trade in manufactured goods. They find that price and cost competitiveness has an important and statistically significant effect on both exports and imports of manufactured goods. According to their definition a rise in the REER represents a real appreciation of the domestic currency, which is associated with a loss in competitiveness. The main findings by Golub and Ceglowski indicate that for the REER series as a group, South African competitiveness worsened in the early 1980s then improved dramatically in the mid-

1980s. There was a period of real appreciation around 1992. The rest of the 1990s have witnessed a substantial real depreciation, which has been associated with an increase in the proportion of exports as a percentage of GDP.

Figure 2 – Unit labour cost-based real effective exchange rate alternative weights

[Source: Golub and Ceglowski (2002)]

The above graph taken from Golub and Ceglowski (2002) plots South African real manufactured exports divided by real GDP against the real effective exchange rate based on unit labour costs, the latter is inverted for ease of visual inspection (so that an increase in the REER index now represents a depreciation, i.e. an improvement in competitiveness). There is a strikingly close correlation between the two variables. The only apparent anomaly is that manufactured exports have grown more rapidly in the 1990s than competitiveness alone would justify. This is consistent with the ending of sanctions associated with Apartheid and the adoption of more outward oriented economic policies. The above visual correlation is further confirmed by the results of the OLS regressions, which were carried out by Golub and Ceglowski.

Sekkat and Varoudakis (2002) analyse three indicators that capture the impact of exchange rate policy in fostering manufactured exports from North Africa: changes in the real effective exchange rate (REER), its volatility, and its misalignment. They also

examine the impact of trade policy using a trade liberalisation indictor. They estimate export supply equations for three manufacturing industries; textiles, chemicals, and food. They find that trade and exchange rate polices matter for export performance, as is evidenced by the negative influence exerted independently by real exchange-rate misalignment and volatility and by the positive influence of trade liberalisation.

Exchange rate fluctuations tend to have more pronounced effects on developing countries than their developed counterparts largely because the real exchange rates have been highly unstable. A problem then arises in that if the effects of exchange rate volatility are negative and economically significant then any policy that seeks to enhance outward orientation and promote international trade should include specific measures that stabilize the real exchange rate over time (Sauer and Bohara 2001). Sauer and Bohara (2001) in their study on exchange rate volatility and exports use fixed and random effects models on a panel data sample of 91 countries to capture cross – country differences. They found that volatility has significant negative effects on exports from developing countries, especially Latin American and African, but not on exports from Asian LDCs or industrialized countries.

Branson and Love (1988) in their paper on the real exchange rate, employment and output in manufacturing in the U.S. and Japan present estimates of the effects of movements in the US dollar and Japanese yen exchange rates. Their main argument is that swings in real exchange rates have effects on employment and output in sectors producing tradable goods. They use time series data for the period 1970 to 1986 on a simple model of supply and demand to estimate the impact of swings in the effective real exchange rate of the dollar and the yen on manufacturing employment and output in the US and Japan. The data is disaggregated by industrial sectors, and by production and non-production workers in the case of the US employment. For the US, they found significant and substantial effects of the dollar appreciation on employment and output in US manufacturing. They also found that exchange rate movements have had important effects on the durable goods sectors, including primary metals, fabricated metal products, and non-electrical machinery. Other sectors that where found to suffer large employment and output losses when the dollar appreciates are stone, clay and glass products, transportation, instruments, and chemicals. They found that production workers are relatively more sensitive to the real exchange rate, especially those in the durable goods sector.

In the case of Japan they also found significant effects of movements in the yen on employment and output in the durable goods sectors, especially those producing machinery. Yen appreciation is found to cause substantial losses in employment and output in fabricated metal products, general machinery, and electrical machinery. They also found that the results for Japan are not as clear as those of the US; they attribute this to the use of annual data for Japan unlike quarterly data, which was used for the US. They however concluded that the importance of movements in the real exchange rate for employment and output in manufacturing is evident in both cases. Clarida (1991) in his paper investigates the relationship between manufacturing profits, exports, and the real exchange rate. He finds that even after taking into account output, costs, and relative prices, real exchange rate fluctuations have a sizable and statistically significant influence on real US manufacturing profits.

7. Overview of the literature and conclusion

From the literature reviewed we can see that, firstly, commodity prices are a significant determinant of the real exchange rate of commodity exporting countries like SA. Secondly, we have also seen that there is empirical evidence that points to the persistence of shocks to commodity prices and changes in commodity prices on the terms of trade. Thirdly, and more importantly in the context of this paper there is evidence of the co-movement of commodity prices and the real exchange rate. Given the scope of this paper, the graphical analysis in section 4 showed that there is a strong correlation between the South African price of gold and the REER and as such there is need to define this relationship in the case of SA. Fourthly, both the Dutch disease and the real exchange rate and export performance literature have also shown that exchange rate movements do have a significant impact on exports, with the few studies on the US showing that such movements also have an impact on the level of employment and output in manufacturing. Lack of studies that animate the latter dynamic in developing countries thus represent a gap in the empirical literature of developing countries that needs to be filled, especially if the impact of exchange rate movements on export manufacturing employment are to be quantified in developing countries, more so in the case of SA where significant fluctuations in the exchange rate are caused by changes in mineral prices.

A number of questions were asked at the begin of this report concerning the current appreciation of the rand. These questions have been answered in the report and are repeated here with some brief answers and references to the sections that looked at the issues that were raised by in the questions.

How significant is the contribution of mineral prices in the determination of South Africa's real exchange rate? Evidence in section 2 shows that mineral prices play an important role in the determination of South Africa's real exchange rate.

To what extent is there a correlation between the exchange rate and mineral export prices? Section 4 has shown that there is a significant literature that point to the conclusion that for commodity exporting countries there is a significant correlation between the exchange rate and mineral export prices

Is South Africa experiencing mild Dutch Disease symptoms? One of the most prominent symptoms of the Dutch Disease is the loss in the competitiveness of the manufacturing sector due to an appreciation of the real exchange rate. The recent appreciation of the rand has been blamed on the current poor performance of the export sector. The mechanism through which an appreciation in the RER affects the manufacturing sector has been discussed in section 5.1.

To what extent does the exchange rate determine the competitiveness of export manufacturing? In section 6 we find evidence that point to the conclusion that an appreciation in the exchange rate has a significant impact on export competitiveness.

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