


Macroeconomy, Economic Bias & Employment

The Impact of Exchange Rate Movements on Employment: The Economy-wide Effect of a Rand Appreciation

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Abstract

There has been some debate on the impact of exchange rate volatility and levels in South Africa. This is a particular concern as South Africa needs to dramatically expand sustainable employment, and at the same time, raise value-added in its goods and services production. These are not necessarily complementary objectives in the context of a minerals exporting economy. Surprisingly little has been written about the relationship between exchange rates and employment. This paper is one of eight being produced as part of an HSRC project to review this relationship in depth. In this paper, we analyse the possible impact of an appreciation of the rand on employment.

The intention is to identify the impact on both aggregate employment as well as sector shifts. This is done by using a computable general equilibrium model, with the appreciation induced by a commodity price boom. A rise in the world price of mineral exports improves South Africa's terms of trade and leads to an appreciation. This partially counteracts the benefits of the price boom. It also impacts negatively on both exporting and import-substituting industries, largely manufacturing sectors that have to compete internationally. At the same time, relative price changes benefit more domestic oriented activities, largely services.

Unlike the standard small open economy model, this paper does not assume full employment. The expanding sectors thus not only absorb some of the labour displaced from declining sectors, but also create jobs for previously unemployed labour. This expansion is sufficient to offset the decline in manufacturing output, so that GDP experiences a slight increase, as does employment. However, profits fall in manufacturing, raising questions about what the position of the economy will be when the commodity price boom is over. Will manufacturing sectors that have shrunk or remained stagnant during the boom be able to recover sufficiently to replace the earnings lost when commodity prices fall?

JEL Codes: C68, D58, F31

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1. Introduction

The rand experienced a brief appreciation in the early 1980s, followed by a sharp depreciation that ended in the last quarter of 1985. From then on it experienced a significant real depreciation which accelerated in 2001. However, after reaching a low in December 2001, it appreciated significantly over the next four years, rising by about 75 per cent against the US dollar. This was in stark contrast to its previous history. In 2005 the nominal effective exchange rate experienced notable fluctuations, declining slightly, by 2 per cent, over the year. Having depreciated by 9 per cent during the first half of 2005 it went on to recover all the lost ground during the second half of the year and from December 2005 to 28 February 2006 it appreciated by a further 2.1 per cent. The overall appreciation over the past few years has been attributed to a number of different forces. These include increased capital inflows (primarily portfolio rather than FDI); the weakness of the US dollar against a range of currencies between September 2002 and the beginning of May 2004; sharp increases in commodity prices on international markets; improved international perceptions of the strength of South Africa's economic fundamentals; and the positive nominal interest rate differential between South Africa and rest of the world (SARB, 2004; SARB, 2006).

Concerns have been raised that the appreciation and sustained strength of the Rand has restricted growth and employment, particularly in the manufacturing export and import-substitution industries. The improvements in exports in the 1990s can be attributed to a structural shift from primary commodities towards manufactures, the end of Apartheid which saw the lifting of sanctions and the adoption of more liberal economic policies.

This paper uses a computable general equilibrium model to investigate the impact of a commodity-induced appreciation of the rand on employment in different sectors of the South African economy. The paper is organised as follows. Section 2 will look at the literature, first, on the relationship between trade and the exchange rate and then the relationship between the exchange rate and employment. Section 3 will briefly look at the methodology used, section 4 will then look at the simulations and give an interpretation of the results and section 5 will conclude.

2. The relationship between exchange rates and employment

This review will first look at those studies that analyze the relationship between exchange rate volatility and trade. The rationale for the latter is that, since labour demand in most cases is a derived demand any changes that affect the relative prices of imports and exports and their output will also have an impact on a given sectors demand of the factors it uses. It should also be noted that the exchange rate volatility question is presumably separable in theory from the exchange rate level question, though since changes in exchange rate constitute a form of volatility, they may be looked at together.

2.1 Exchange rate volatility and trade

Côté (1994) conducted an extensive survey of the literature on exchange rate volatility on trade. Contrary to the view that an increase in volatility reduces the level of trade, his review shows that the impact is actually ambiguous. He also found that though a number of studies find exchange rate volatility to reduce the level of trade, when the effect is measured, it is relatively small. Clark et al. (2004) emphasises the point that whether one finds volatility to have an impact on trade, it will depend on the assumptions made. In the theoretical literature, differences in assumptions have meant that there is considerable ambiguity in the theoretical predictions made by various models more so in a general equilibrium setting where other variables are changing as the exchange rate changes. It is this theoretical ambiguity that necessitates empirical investigation.

A number of empirical studies find that the economic effects of exchange rate fluctuations differ across industries and within industries (Fouquin et al*.,* 2001; Mckenzie, 1999). There is also evidence to show that the impact of exchange rate volatility varies both in the short-run and in the long run. De Vita and Abbott (2004) found that United Kingdom (UK) exports to countries in the European Union (EU) are largely unaffected by short-term exchange rate volatility both at the aggregate and sectoral level. Re-estimation of the model using a long-term measure of volatility, however, showed evidence supporting the hypothesis that exchange rate uncertainty has a negative and significant influence on UK exports to EU countries.

The relationship between the exchange rate and export competitiveness has also been analyzed for South Africa. Bah & Amusa (2003) investigate the impact of the real exchange rate volatility on South Africa's exports to its largest, trading partner the US. The results indicate that volatility of the Rand's real exchange rate exerts a significant and negative effect on exports in both the long run and short run while a decline in the real exchange rate has a positive impact on exports. The overall policy recommendation of the study is that a stable competitive exchange rate and sound

macroeconomic fundamentals that enhance international competitiveness are necessary to ensure greater market penetration of South Africa's exports.

2.2 Exchange rate movements and employment

A number of studies have looked at macroeconomic impacts of the exchange rate on aggregate employment (Frenkel, 2004). Others have concentrated on sector responses of employment to the exchange rate (Branson & Love, 1987; Burgess & Knetter, 1996; Koren; 2004). However, most of these have tended to use partial equilibrium approaches. Most of these studies have also concentrated on industrialised nations with a few looking at developing countries. One of the overall conclusions from this body of work is similar to the one made above for exchange rate volatility. The overall impact of exchange rate movements on employment also tends to be sector specific.

Exchange rate movements tend to have an impact on labour demand through two main channels; a depreciation increases the competitiveness of the countries exports and hence the demand for labour. On the other hand, a depreciation increases the cost of intermediate inputs which might offset the first effect. The net effect is going to depend on the exposure of local firms to the exchange rate. These cost considerations have also been analyzed in the literature.

Filiztekin (2004) examined the impact of exchange rate fluctuations on Turkish manufacturing employment and wages using data for a panel of manufacturing industries over the period 1981 – 1999. He finds different conclusions from most of the studies that look at this relationship; a depreciation has a net negative effect on both employment and wages, with more pronounced effects on wages. The high dependency of Turkish manufacturing industries on foreign inputs outweighs the positive effect a depreciation has on competitiveness. There is however considerable variation across industries. The industry most hurt by devaluations is clothing, the industry that generated the most employment growth throughout the 1980s. In the case of Hungary Koren (2001) finds that the relative importance of the demand and cost effect tends to be industry specific and that only the Machinery and Food industry has a significant positive demand side exchange rate elasticity, a 10% real depreciation causes labour demand to rise by 0.36% in Food Industry. The overall effect of the exchange rate on labour demand remains ambiguous. He also finds that export share doesn't affect exchange rate exposure. Nucci and Pozzolo (2004) use firm level panel data drawn from two sources to examine the relationship between exchange rate fluctuations and labour inputs for Italy. They find that exchange rate fluctuations have a significant effect on employment and hours worked. The effect of the real exchange rate on labour inputs is stronger for firms with low price – cost margins than firms with a high mark up. They also find that an exchange rate depreciation causes an expansion in the number of hours worked in the subsequent year through the revenue side and a contraction through the cost side.

The sensitivity of employment to the exchange rate is also going to be affected by market structure and labour regulations. In a perfectly competitive market one would expect any change that affects the price of the firm to be reflected in changes in the firms profitability. On the other hand in an imperfect market setting this relationship

breaks down and the firm as a price setter now responds by changing mark-ups instead of output. Labour regulation tends to influence the hiring and firing of workers. In tightly regulated labour markets firms respond to changes in the exchange rates by price adjustment instead of output and employment. Burgess and Knetter (1996) evaluate the response of employment to exchange rate shocks at the industry level for G-7 countries. They argue that both the elasticity of employment to exchange rates and the speed of adjustment to exchange rate shocks is likely to depend on market structure and the regulation of international trade and the labour market. Using non – linear least squares they find that exchange rates do influence industry employment in the expected manner; a real appreciation of a nation's currency leads to a decline in manufacturing employment. Country comparisons show that UK industry employment is more sensitive to exchange rate changes than United States (US) employment, which in turn is more sensitive than German or Japanese industry employment. The US and UK labour markets are more responsive to exchange rate induced changes in relative costs than are labour markets in either Germany or Japan. They conclude that this confirms the conventional wisdom that the US and UK are generally viewed as more "laissez faire" than Germany and Japan, both in terms of international trade and labour market regulation.

There have been several studies that that have focused on the impact of exchange rate movements on employment on the US (Golberg & Tracy, 1999; Branson and Love, 1988; Branson & Love, 1987; Golberg & Tracy, 1999; Kandil & Mirzaie, 2003). The overall conclusion from these studies is that the impact is sector specific and it seems to indicate that dollar appreciation seems to have an overall negative impact on employment. For example, Branson & Love (1987) find that for the country as a whole, movements in the real exchange rate led to the loss of about 1 million manufacturing jobs. Whereas Golberg & Tracy (1999) find that exchange rates have statistically significant wage and employment implications in local labour markets. With the importance and size of dollar induced effects varying considerably across industries and being more pronounced in some US regions. On balance dollar appreciations (depreciations) are associated with employment declines (increase) for high and low profit margin industry groups. As industries increased their export orientation the adverse consequences of appreciations for employment is also increased. With some of these adverse effects being counteracted as industries increase their reliance on imported inputs.

Of the studies done on developing countries Frenkel (2004) looked at the relationship between the real exchange rate and employment for 4 Latin American countries. Using ordinary least squares he finds that GDP is negatively related to unemployment, a 10% increase in GDP is associated with a 14.9% decrease in the unemployment rate, the real exchange rate is negatively related to unemployment, a 10% appreciation of the real exchange rate is associated with a 5.6% increase in the unemployment rate with a 2-year lag, a significant time coefficient indicates that there is a 6% per annum autonomous upward trend in the unemployment rate (not explained by GDP and the real exchange rate). His overall conclusion is that preserving a stable and competitive real exchange rate is the best contribution macro policies can make to the improvement of employment and growth performances.

2.3 Commodity prices and 'Dutch Disease' type effects

In trying to understand how an increase in commodity prices plays through the economy we will look at the Dutch Disease literature. The name Dutch Disease was coined following the experience of the Netherlands in its discovery of natural gas in the 1960s. The major outcome of this discovery was an appreciation in the real exchange rate which had a negative impact on the export manufacturing sector. In more recent times the term has become a generic descriptor of the adverse structural changes that economies undergo as a result of sectoral booms associated with a number of factors which range from capital inflows to commodity booms induced by increases in world commodity prices.

Corden & Neary (1982) developed what has come to be known as the core Dutch Disease model, which highlights two fundamental effects of a sectoral boom, the spending effect and the resource movement effect. The resource movement effect occurs when resources can be drawn from the non-booming sectors of the economy to the booming sector. As the boom raises the marginal products of the mobile factors they become expensive for use in the non-booming sectors. This movement of resources leads to adjustments in the rest of the economy and one mechanism of adjustment is the real exchange rate. The spending effect on the other hand occurs when resources cannot be easily drawn out of other sectors of the economy due to the enclave nature of the booming sector. In such a case the resource movement effect is insignificant and the major impact of the boom comes through increased spending on services and other non-traded commodities. One measurement of a country's real exchange rate is the ratio of demand for non-tradable versus tradable goods. Increased demand for non-tradable goods increases their price and as such causes a real appreciation of the exchange rate which in the context of the Dutch Disease is associated with the subsequent shrinkage of the manufacturing sector.

In the context of this study it will be interesting to see whether South Africa exhibits such a sharp sectoral contrast in the face of a commodity induced appreciation of the exchange rate.

3. Methodology

Although the findings are mixed, one conclusion is that the full impact of exchange rate fluctuations on employment is sector specific and as such should be analyzed with a framework that takes into consideration intersectoral linkages. Failure to do so might lead to incorrect estimation of the impact. Sector responses depend on their specific characteristics. For example, those that are net importers of inputs are likely to benefit in the face of an appreciation, while those that export a large proportion of their output are bound to be negatively affected. While a partial equilibrium framework can give some insights into the impact of an appreciation on a particular sector, it will not tell us what the net impact on the whole economy might be. Furthermore, it is possible that interactions between industries and other economy-wide feedbacks might counteract impacts predicted by a sector-focused analysis. The price reducing effects on inputs will somewhat off-set those on exported outputs, so that even an export oriented industry may not be as seriously affected as an isolated sector study might suggest.

The current study therefore uses an economy-wide approach (computable general equilibrium (CGE) model) to disentangle the impact of an exchange rate appreciation on employment. This will allow us to take into account interactions in the economy in a consistent manner. Unlike a partial equilibrium approach, an economy-wide approach captures all sectoral and inter-sectoral price linkages simultaneously rather than analyzing each commodity market separately. Whenever there is a change in the exchange rate there are bound to be winners and losers and the net effects on the economy will depend on the interaction between them. Furthermore, the CGE framework allows the exchange rate to be determined endogenously rather than being estimated from a separate model. Responses of sectors to the exchange appreciation can thus feedback and affect the exchange rate further. Since this is one of the few studies that uses an economy wide approach to analyze the impact of the exchange rate on employment it will be interesting to compare the results with those that focus on the manufacturing sector.

We use the standard computable general equilibrium (CGE) model developed by the International Food Policy Research Institute (IFPRI), as adapted to South Africa by Thurlow & van Seventer (2002). Since they present the model in detail, we will only provide a brief overview here (for a detailed presentation of the model see Thurlow & van Seventer, 2002).

The model combines an input-output structure, which captures the interactions between sectors, with an extended functional distribution of income and a detailed institutional structure. The Social Accounting Matrix (SAM), which forms the database of the model, exhibits a high degree of differentiation among sectors (sectoral distribution), factors of production (extended functional distribution) and households (socio-economic distribution).

According to Löfgren et al. (2002) the Standard model defines all the payments that are recorded in the SAM; it thus follows the SAM disaggregation of factors, activities, commodities, and institutions. The model consists of a set of simultaneous equations, many of which are non-linear. There is no objective function and the equations define the behaviour of the different actors. Production and consumption decisions and behaviour are captured by non-linear, first-order optimality conditions. Model equations include constraints that have to be satisfied by the system as a whole but which are not necessarily considered by any individual actor. These constraints cover markets (for factors and commodities) and macroeconomic aggregates (balances for savings-investment, the government, and the current account).

To examine the effects of a currency appreciation, we simulate an increase in the world price of minerals. In this respect we take a view on the causes of the recent appreciation outlined in the introduction, influenced by dominant views when we started the project. We deliberately base the model on the 2000 SAM (even though a more up-to-date on is available) because we want to start from a snap-shot of the economy before the appreciation occurred. This allows us to avoid any impact that the appreciation might have had on the economic structure.

It has to be emphasised that we are not trying to describe what has happened to the South African economy over the past few years, but to understand the impact of a commodity boom. The modelling approach allows us to focus on the impact of the appreciation, separate from any other changes that might have taken place over the period (like interest rate changes). It allows us to undertake a controlled experiment, isolating the effect of one factor from all other influences that have occurred in real history.

The Thurlow and van Seventer model is constructed around 43 sectors and 14 households. We carried out the simulations with the same structure. However, to facilitate interpretation, we have aggregated results into a smaller set of 14 sectors, distinguished by a mix of factor/skill intensities and end uses (see Appendix 2, Table 7). This aggregation has been constructed for a broader project which will draw some insights from this paper. It is intended to capture various relevant aspects of the South African economy: the resource base, the importance of skills constraints, the role of consumer goods in poverty issues, the significance of services in the economy, and so on.

4. Simulations and results

This section presents and interprets the results of the different experiments highlighting the underlying assumptions. However, before looking at the actual results it might be interesting to consider intuitively how an appreciation might play through the economy. The story can be told using the standard small open economy model (Corden & Neary, 1982). An increase in the world price of a country's major export will in the first instance improve the current account and raise aggregate domestic demand, providing an expansionary impetus to the economy. At the same time there will be microeconomic effects. Prices of goods traded on international markets ('traded goods') are effectively controlled by those markets, so the increased demand will be met by inflows of imports or by exporters switching to the domestic market if possible. In contrast, the price of goods sold only in domestic markets ('non-traded goods') will rise. The prices of non-traded goods will therefore rise relative to those of traded goods, stimulating a structural shift in production and employment away from traded towards non-traded sectors. The standard open small economy model assumes full employment, essentially assuming away the possibility of changes in the level of aggregate employment, so the impact is confined to changes in the sectoral pattern of employment. The real exchange rate appreciates, counteracting the expansionary impetus of the initial world price increase.

We assume in our analysis that there can be unemployment, so that the level of employment can change. This complicates the above story, introducing the possibility of output as well as price responses in domestic markets. Not only will there no longer be only composition effects, but these may also be altered by the output responses. Precisely how the economy responds will be conditioned by the characteristics of individual sectors and the nature of macroeconomic adjustment processes.

Table 1 indicates the main sectoral structure of the South African economy in 2000 prior to the appreciation. Although we present results in the 14 aggregated sectors, the model runs according to the characteristics of the 43 sectors. We thus have to consider these when thinking about how the model works. The relevant economy wide averages are simple not weighted averages. All sectors participate in international trade at this level of aggregation, so we are not able to classify them precisely as theory requires. Rather than thinking of sectors being either tradable or non-tradable, we have to judge where they lie along a continuum that moves from completely non-traded to completely traded. We can use export intensities (the share of exports in total sales) and import penetration (the share of imports in total domestic sales) to make this judgement. The average export intensity is 24.4%. 16 of the 43 sectors have ratios equal to or higher than this average, while 27 have lower. Mining is the most export intense and government services is the least. The only service sector that has significant exports is hotel and catering, while the only manufacturing sectors that do not export more than ten percent of their output are those producing plastic products and non-metallic mineral products. The average import penetration ratio is 14.4%, with 19 sectors having the same or higher ratios and 24 lower. The only service sector

that experiences significant import penetration is communication services, and even there the ratio is low at 6.1%. These data suggest that most primary and secondary sectors can be regarded as tradable activities, while most tertiary can be regarded as non-tradable. Export intensities are relatively high for mining and most of manufacturing and relatively low for most service sectors. Import penetration is relatively high for most of the manufacturing sectors, while most service sectors face very little import competition. Although we have focused on all 43 sectors, Table 2 presents similar data for the aggregated 14, to allow easy interpretation. In this classification we can regard agriculture, mining and manufacturing as being largely traded (with agriculture and capital intensive consumer goods being on the margin) and construction, electricity and water, and services as being non-traded (with both low-skill services sectors being on the margin of being traded).

We anticipate therefore that an appreciation should cause a shift away from primary and secondary towards tertiary sectors. Of course we exclude the mining sector from this, even though it is tradable, since it is the beneficiary of the initial rise in world mineral prices (the booming sector).

The process by which macroeconomic adjustment takes place will also influence the impact of the price rise. The current account balance has improved and aggregate demand has increased. There are many different ways in which the macro economy could respond. The improved current account balance implies foreign savings has fallen. It is possible that this affects domestic savings levels or that investment adjusts. We assume that savings rates adjust to maintain a fixed level of aggregate investment. The impact of the demand increase will depend in part upon how government policy reacts. We assume government keeps all tax rates fixed, and that the current budget deficit (government saving) is flexible. Finally, we assume that the real exchange rate is flexible while the level of foreign savings (i.e. the trade balance) is fixed.

As indicated above, a significant difference between the standard small open economy model and our application is that we do not assume full employment. While we do assume that the high skilled labour is fully employed, we assume that there are perfectly elastic supplies of both low-skilled and skilled labour. Thus, any rise in demand for high-skilled labour by a given sector can only be met by pulling it out of other sectors. This requires the demanding sector to push up wages. On the other hand, if demand for high skilled labour falls, so too will its wages. We assume that increases in demand for both low-skilled and skilled labour are met by pulling in supplies from a pool of the unemployed, while reduced demand results in higher unemployment. As with most static analyses, we assume that sectoral stocks of capital are fixed and fully employed. This means that the sectoral pattern of returns to capital will be affected by the shocks.

4.1 Results

We assume a world commodity market boom that leads to a 30% increase in the price of minerals in three sectors - gold, other mining and coal (mining in the 14 sector aggregation). This represents an improvement in South Africa's terms of trade. Tables 3 and 4 summarise the microeconomic impact of this while Table 5 provides some

macroeconomic outcomes. These results are the general economy-wide results after all interactions and feedbacks have worked through the economy. They thus show the net effects.

As Table 3 shows the impact on output and employment varies across sectors. Broadly speaking outputs of tradable sectors fall and those of non-tradables rise. The exception is the booming sector, mining. Sectoral employment changes tend (with a few exceptions) to follow the same pattern. The net effect on employment, shown at the bottom of Table 3, is positive. Low skilled employment rises by 0.9% and skilled by 2.0%; high skilled employment is fixed by assumption. This effect is not surprising: the positive shock to the terms of trade has a positive net effect on the economy since a favourable terms of trade shift makes the economy richer (as well as appreciating the exchange rate). The terms of trade gains are thus the primary source of the absorption expansion whilst the increase in total employment is the secondary source of gain.

However, Table 3 also shows that output and employment in some sectors, mainly tradable, decline. It is this impact that underlies the concern about the impact of the commodity price boom on the economy. We need to know what lies behind this changing structure of the economy.

The crucial feature is that there is a net appreciation (7.5%) of the real exchange rate (Table 5). As we expect, exports fall in all sectors (Table 4). The appreciation has reduced the rand price of exports relative to sales in the domestic market. Producers thus switch market destinations away from the world market. The exception is the booming sector, mining, which continues to benefit from the initial price increase (although by less than it would have without the appreciation). The largest decreases are in labour intensive intermediate, consumer and capital goods (-8.7%, -6.4% and -7.2% respectively). This can only be understood by considering the other changes taking place simultaneously. The patterns of both domestic demand and imports also change. This can affect the possibilities of selling in the domestic market and therefore the possibility of switching away from exporting. This effect will differ from sector to sector.

As imports become cheaper due to the appreciation more of them are purchased as shown in Table 4. All sectors experience increased import penetration, except mining (the booming sector) and capital intensive intermediate goods. The largest increases are in capital-intensive consumer goods (29.7%) and low skill intensive intermediate services (18.7%), although several other sectors see imports rise by more than 10%. These changes in imports affect domestic sales, since they compete for the same market. However, both are also affected by changes in demand arising from macroeconomic effects (arising from both the increased employment and changes to savings required by the adjustment process) and from changing factor prices and uses (and therefore changing factor incomes).

A look at gross domestic exports (GDP) and its components (Table 5) shows that total absorption increases by 3.2%. Under the assumptions outlined above, all of this increase comes from private consumption, which rises by 4.9%: investment and government consumption are fixed in real terms. This rise in domestic absorption is

offset by falling exports (-3.1%) and rising imports (7.9%), so that the net effect on GDP is a small increase (0.2%). Thus, although tradable output (largely manufacturing) falls, the effect on GDP is more than offset by the rise in non-tradable production (largely services).

The rise in private consumption occurs because there is a rise in household incomes. The total income of skilled and high skilled labour both rise (by 1.3% and 3.3% respectively), as does capital income (3.2%). We might expect this to be true of low skilled labour as well, since more is employed and sectoral wages are constant. However, it turns out that the changing pattern of employment reallocates low skilled labour from higher to lower wage sectors, so that despite the increased employment, its total income falls (-0.2%).

These changing factor incomes feed into changing household incomes. All households experience a rise in income, but there are higher percentage increases for richer households. This is as we would expect: rich households derive more of their income from capital and from high skilled labour, which are the factors most benefited by the commodity price boom.

These higher incomes are what lie behind the higher aggregate private consumption. This feeds into higher demand for goods. This will be met by a rise in imports in sectors where import penetration is high, and by higher domestic production in those where it is low. The former tend to be tradable manufactures and the latter non-tradable services. Thus we are likely to see output and employment rising in the former and falling in the latter, as was shown in Table 3.

With respect to factor and skill intensity, it seems as if the effects of the appreciation are determined by whether the sector is tradable or non-tradable, rather than whether it is labour or capital intensive. Output declines in both labour and capital intensive tradable sectors, and rises in both low-skill and skill intensive non-tradable sectors.

Change in relative factor prices underlie the resource reallocations described above. Although wages of low-skilled and skilled labour are constant in terms of the consumer price index, they change relative to sector prices. These real product wages fall in the non-tradable sectors and rise in tradable sectors. The real product wage of high-skilled labour rises in almost all sectors. Finally, there are changes in the returns to capital in each sector. Since capital is sector specific and fully employed, there are fairly large changes in its returns. These fall in all tradable sectors, in some cases by as much as 28%. They rise in all non-tradable sectors and in the booming sector.

It can be seen from the results that the impact of an appreciation generates interesting industry and sectoral effects. There is a clear bias against manufacturing which exports a large proportion of its output whilst those sectors that do not rely on exports seem not to be affected by the appreciation. The results of this experiment are driven by the boom and the wealth and spending effect it creates which fuel private consumption expenditures on imports and services.

4.2 Discussion

The sharp contrast in the performance of the different sectors in the model tells a very standard booming sector story with strong Dutch disease implications. The experiments conducted involved increasing the world export price of three commodities, gold, other mining and coal. This has several effects on the economy: the exchange rate appreciates and both GDP and employment rise marginally. The performance of GDP and employment is driven mainly by the boom which creates a wealth and a spending effect. This spending effect (one of the principal effects of a boom the other being the resource movement effect) can be expected to dominate in the South African case. The resource movement effect is only effective when resources can be easily drawn from elsewhere in the economy into the booming sector. Since this is not the case in South Africa, the major impact of the boom and the resultant higher incomes lead to extra spending on all goods (consumer boom) 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 then have labour shifting from the tradables sector to the non-tradables sector resulting in a contraction of the non-booming tradables sector.

The commodity boom has a positive impact on the economy in the short run. Thus we would expect to see a rise in GDP and possibly in employment. The exchange rate appreciation reflects this boom: the rand gets stronger because the economy is doing well. However, when we look behind these aggregate figures we see the potential for Dutch disease effects in the longer term. Almost all traded sectors (except of course the ones receiving increased prices for their exports) are affected negatively by the appreciation. In contrast, non-traded sectors experience a boost in face of the appreciation.

This raises questions about what the position of the economy will be when the commodity price boom is over. Will manufacturing sectors that have shrunk or remained stagnant during the boom be able to recover sufficiently to replace the earnings lost when commodity prices fall? Unfortunately our model does not address this dynamic question. However, as we saw, returns to capital fall in the non-booming tradable sectors. One would expect this to affect the dynamic response of sectors. Either capital will move out, or future investment will be directed towards other sectors. This suggests that if the boom is sustained there will be negative impacts on the capacity of these sectors. For them to revive at the end of the boom will require investment, not simply more intense use of existing capacity. For us to answer this question we need a better understanding of firm level responses and of the determinants of sectoral investment patterns in South Africa.

More significantly, the results raise questions about appropriate growth paths for South Africa. If we are trying to get onto a higher labour-absorbing growth path on the basis of growth in higher value goods and services for global markets, is it sensible that the sectors producing these goods are subject to the vagaries of world mineral market prices? Can we afford stagnation or reversal in their growth every time there is a commodity price boom? Though the model is a static one and does not address

such issues of sustained growth, the results do beg the question: to what extent is the growth seen in the model value-adding and sustainable? Is there an alignment to an overall economic strategy as was found in successful sustained high growth economies? To what extent can we expect greater diversification in the South African economy given the challenges faced by the manufacturing sector following the appreciation? This is especially important given the dominance of resource based exports in the country.

These questions have very compelling implications with respect to South Africa's ability to meet its employment targets. The implications that are engendered by a commodity price exchange rate relationship and the sectoral biases that it creates are lucidly discussed by Deaton (1999) who argues that mineral wealth is often seen as particularly subject to a commodity curse. Ownership of minerals is often concentrated, so that the benefits of the export income are not widely spread and mining results in a particularly unequal distribution of income – South Africa being only the most dramatic example (Simkins, 1998). The "enclave" production typical of mining lacks the forward and backward linkages that can drive broad-based development (Hirschman, 1977). Foreign trade is the engine that provides the motive power, but this engine cannot move the economy unless it is provided with adequate transmission lines" (Issawi,1961).

The importance of backward and forwards linkages is reiterated by Sachs & Warner (1995) who argue that Dutch Disease can be a source of chronic slow growth if there is something special about the sources of growth in manufacturing, such as "backward and forward linkages" or learning-by-doing. If manufacturing is characterised by externalities in production, then the shrinkage of the manufacturing sector caused by resource abundance can lead to a socially inefficient decline in growth. The economy loses the benefits of the external economies to manufacturing. According to Sachs and Warner, however, the links of these Dutch Disease effects to the loss of production externalities remains speculative and as yet unproven.

In reconciling the results of this study with existing literature it might seem that the international experience contradicts our findings of an overall positive impact of an appreciation mainly on employment. However, one has to remember that these studies only concentrated on manufacturing. Our analysis being an economy wide analysis has the advantage of analyzing what's happening in the non-manufacturing sectors. This study like most of the studies reviewed, for example, the Branson & Love studies (1987 and 1988), also finds that an appreciation has a negative impact on manufacturing employment. Of course other studies also find that there is a positive impact for various reasons. In Turkey (Filiztekin, 2004) the positive impact is engendered by the reliance of Turkish industries on imported intermediate inputs. It is therefore important to note that once the analysis moves from an industry to an economy wide analysis then issues that relate to the contribution to employment of the traded sector relative to the non-traded sector become important and the employment shares in these sectors will determine what happens to overall employment in an economy in the face of an appreciation. In our case we find that government services, other producers and business services which have the largest employment shares benefit from the boom. This probably explains the overall net effect on employment.

Though resource depended countries face a unique set of challenges such as increased vulnerability to external shocks, the risk of 'Dutch disease' type effects, and the risk of developing specific institutional pathologies, these can be overcome or avoid by implementing, the right economic policies. The rents from resources can be used to diversify the rest of the economy given supportive industrial policies; this has been done in countries such Norway, Australia and Canada. One way of achieving this diversity is through tax incentives to assistant non-resource based sectors. To reduce vulnerability from the countries main resource export, good fiscal policy becomes very important and the objective should be to keep the budget in balance across the commodity-price cycle. It should be based on conservative assumptions for the major export commodities, as such a budget that balances only because of high commodity prices is therefore not in balance[1]. One of the fears that arise from an appreciation of the exchange rate in a country with high unemployment is that firms will import more capital and as such substitute it for labour thus worsening the unemployment problem. However, the increased revenues accruing to government during the commodity boom can be used to import capital goods that cannot be made locally such as computer equipment for schools, medical equipment for public hospitals, and backbone communication infrastructure. The advantage with this kind of investment is that it improves the competitive position of the economy and generates little exchange rate appreciation.

[1] Rudiger A. (2004)

5. Conclusions

This paper sought to analyze the impact of an appreciation on the South African economy. Mineral resource economies have been known to create certain biases against the traded sector through they impact on the exchange rate. The implication of this is that movements in commodity prices are going to have a strong influence on the real economy and given its bias against the traded sector the performance of this sector will continue to be hindered by swings in commodity prices. If the subsequent growth of the country is being driven by the commodity cycle then one can expect a commodity-based economy to have a rate of growth that rises and falls with the commodity price cycle.

The major thrust was to see how the different sectors of the economy are affected by a mineral induced appreciation of the currency. Does the appreciation favour certain sectors over others? If so which sectors benefit and which sectors find it difficult to operate? How are traded and non-trade sectors affected? All these questions are important in as far as they help policy makers identify the sectors that are negatively impacted and allows them to try and come up with solutions that mitigate the negative impact of the appreciation on these sectors

This analysis highlights the importance of interactions within the economy which are completely ignored in partial equilibrium work. It is clear that the simultaneous losses of output across all export sectors, and the fall in labour demand result in negative impacts on the economy that cannot be ignored. Though the appreciation has the direct impact of improving household welfare due to cheaper imports this scenario paints a worrying picture for South Africa with respect to the sustainability of a trade deficit.

It is clear that in the face of a commodity boom the non-traded sector does better than the traded sector. Given the strong linkages that exist between the traded goods sector and the rest of the economy it is important to find strategies that alleviate the challenges that firms in this sector face.

Appendix 1: Tables

Table 1 – Sectoral structure of the SA economy based on 2000 SAM

	Composition (%)				Ratios (%)		Rank	
	X	VA	EX	IM	EX/X	IM/Q	EX/X	IM/Q
Other Mining	3.2	3.4	19.9	10.0	94.4	29.4	1	5
Gold	1.8	2.1	10.1	0.0	84.2	0.0	2	43
Transport Equipment	0.2	0.1	1.1	3.2	68.4	53.7	3	2
Scientific Equipment	0.1	0.1	0.4	2.7	57.2	41.7	4	4
Other Industries	0.4	0.2	1.5	1.4	55.9	19.0	5	12
Leather Products	0.1	0.0	0.4	0.2	51.7	19.2	6	11
Machinery	1.4	0.9	4.6	13.1	50.5	41.9	7	3
Basic Iron and Steel	2.3	1.2	7.2	1.0	48.1	5.0	8	30
Coal	1.2	1.3	3.4	0.2	42.3	1.7	9	37
Non-Ferrous Metals	1.3	1.0	3.5	1.7	42.1	15.7	10	18
Furniture	0.4	0.3	1.1	0.4	40.0	6.1	11	28
Chemical Products	1.7	1.0	3.8	4.6	34.4	25.5	12	7
Communication Equipment	0.3	0.2	0.7	5.5	33.5	56.1	13	1
Hotels and Catering	1.5	2.0	2.6	1.9	27.2	17.2	14	16
Petroleum Products	2.2	1.5	3.5	1.2	24.4	4.6	15	31
Paper Products	1.6	0.9	2.4	1.2	24.3	8.5	16	24
Rubber Products	0.3	0.2	0.5	0.8	22.2	22.0	17	8
Vehicles	3.6	1.4	5.0	12.2	21.7	27.3	18	6
Wood Products	0.6	0.5	0.8	0.5	19.3	9.9	19	23
Wearing Apparel	0.5	0.5	0.7	0.8	18.8	7.4	20	26
Textiles	0.8	0.5	0.9	1.7	18.6	17.2	21	15
Electrical Machinery	0.9	0.6	1.0	2.5	16.7	21.2	22	9
Glass Products	0.2	0.1	0.2	0.3	16.3	16.0	23	17
Beverages and Tobacco	1.8	1.4	1.6	1.0	14.5	4.5	24	32
Transport Services	5.6	6.2	5.3	8.8	14.4	17.8	25	14
Other Chemical Products	2.1	1.2	1.9	5.1	13.9	18.7	26	13
Food Processing	4.2	1.9	3.6	3.6	13.4	7.9	27	25
Agriculture	3.3	3.3	2.7	1.6	12.6	5.7	28	29
Metal Products	1.7	1.2	1.1	1.7	10.5	12.7	29	22
Footwear	0.2	0.1	0.1	0.8	10.5	20.6	30	10
Plastic Products	0.7	0.6	0.3	0.9	7.8	14.4	31	19
Non-Metallic Mineral Products	0.8	0.6	0.4	1.0	7.6	13.5	32	21
Printing and Publishing	0.8	0.7	0.4	1.0	7.4	13.7	33	20
Financial and Real Estate Services	8.2	10.1	3.0	1.9	5.5	3.2	34	34
Communication Services	3.3	3.9	1.1	1.6	5.2	6.1	35	27
Other Producers	3.0	4.2	0.9	1.3	4.6	3.8	36	33
Electricity and Gas	1.9	2.4	0.5	0.1	3.7	0.9	37	38
Medical and Other Services	1.9	1.9	0.3	0.4	2.7	2.5	38	36
Business Services	7.0	9.0	1.0	1.7	2.2	2.6	39	35
Water	0.6	0.4	0.0	0.0	0.5	0.7	40	40
Trade Services	10.1	11.1	0.2	0.2	0.3	0.2	41	41
Construction	4.7	3.0	0.1	0.3	0.2	0.8	42	39
Government Services	11.2	16.6	0.0	0.0	0.0	0.0	43	42

Source: Author SA SAM 2000

X = Output, VA = Value-added, EX = Exports, IM = Imports, Q = Absorption

Table 2 – Economic structure in the base (14 sector aggregation)

		Value-added share	Prodn share	Employment share	Export share	Import share	Share of exports in output	Share of imports in demand
1	Agriculture	3.29	3.26	9.78	2.71	1.60	11.68	7.65
2	Mining	6.60	6.11	4.91	33.44	10.20	82.33	58.82
3	Labour intensive intermediate goods	8.20	13.58	7.34	16.87	34.97	16.58	31.96
4	Labour intensive consumer goods	2.85	5.53	4.35	7.02	6.96	13.60	16.71
5	Labour intensive capital goods	1.07	1.68	1.14	5.32	18.53	40.89	71.19
6	Capital intensive intermediate goods	4.36	6.92	1.12	17.99	8.54	36.25	21.30
7	Capital intensive consumer goods	1.27	1.58	0.21	1.65	1.00	12.25	8.50
8	Construction	3.27	4.92	4.36	0.05	0.30	0.16	0.92
9	Electricity and water	2.77	2.50	0.51	0.48	0.16	2.96	0.99
10	Low skill intensive intermediate services	21.32	19.32	15.71	6.60	10.55	5.26	7.50
11	Low skill intensive consumer services	7.10	5.70	15.37	3.54	3.26	9.57	8.68
12	Skill intensive intermediate services	19.34	15.79	14.10	3.98	3.52	3.89	3.24
13	Skill intensive consumer services	1.93	1.92	3.93	0.34	0.38	2.76	2.93
14	Government services	16.63	11.20	17.17	0.01	0.02	0.02	0.02
	Total	100.0	100.0	100.0	100.0	100.0	-	-

Table 3 – Changes in sectoral outputs and employment

		Output	Low skilled	Skilled	High skilled
	Sector	% Ch	% Ch	% Ch	% Ch
1	Agriculture	-0.5	-1.1	-1.1	-3.0
2	Mining	1.6	3.8	4.2	3.6
3	Labour-intensive intermediate goods	-3.0	-5.0	-3.9	-6.0
4	Labour-intensive consumer goods	0.1	-0.3	0.3	-0.9
5	Labour-intensive capital goods	-4.4	-5.0	-4.9	-5.5
6	Capital-intensive intermediate goods	-2.4	-7.5	-7.3	-8.4
7	Capital-intensive consumer goods	-0.1	0.1	0.1	-0.8
8	Electricity and water	0.1	1.3	1.3	-0.6
9	Construction	-0.1	0.3	0.3	-1.6
10	Low skill-intensive intermediate services	0.2	1.6	1.8	0.0
11	Low skill-intensive consumer services	2.3	4.7	3.4	0.9
12	Skill-intensive intermediate services	1.0	4.3	4.0	1.9
13	Skill-intensive consumer services	2.3	5.9	5.9	4.0
14	Government services	0.1	1.1	1.1	-0.8
	Total	n.a.	0.9	2.0	n.a.

Table 4 – Changes in quantities of sectoral exports, imports and domestic sales

		Exports	Imports	Domestic sales
	Sector	% change	% change	% change
1	Agriculture	-4.9	16.9	0.1
2	Mining	2.2	-1.8	-1.7
3	Labour-intensive intermediate goods	-8.7	9.5	-2.3
4	Labour-intensive consumer goods	-6.4	15.1	1.1
5	Labour-intensive capital goods	-7.2	2.5	-2.4
6	Capital-intensive intermediate goods	-3.2	-0.8	-2.2
7	Capital-intensive consumer goods	-6.3	29.7	0.7
8	Electricity and water	-5.0	6.9	0.4
9	Construction	-4.0	4.7	0.0
10	Low skill-intensive intermediate services	-5.1	18.7	0.4
11	Low skill-intensive consumer services	-4.5	10.5	2.2
12	Skill-intensive intermediate services	-5.4	9.8	1.1
13	Skill-intensive consumer services	-3.9	10.5	2.5

Table 5 – Macroeconomic indicators

	% change
Absorption	3.2
Private consumption	4.9
Fixed investment	
Government consumption	
Exports	-3.1
Imports	7.9
GDP market prices	0.2
Real exchange rate	-7.5

Table 6 – Changes in the price of capital

Sector	% change
Agriculture	-2.2
Mining	33.5
Labour-intensive intermediate goods	-10.6
Labour-intensive consumer goods	-0.4
Labour-intensive capital goods	-28.2
Capital-intensive intermediate goods	-26.4
Capital-intensive consumer goods	0.3
Electricity and water	2.3
Construction	0.6
Low skill-intensive intermediate services	4.1
Low skill-intensive consumer services	3.7
Skill-intensive intermediate services	7.2
Skill-intensive consumer services	12.2
Government services	2.3

Appendix 2

Table 7 – Sector aggregation

	New activity code	Description	Old activity code	Old description	SIC
1	AAGR	Agriculture	AAGRI	agriculture	1
2	AMIN	Mining	ACOAL	coal	21
			AGOLD	gold	23
			AOTHM	other mining	22/24/25/29
3	ALIG	Labour-intensive intermediate goods	ATEXT	textiles	311-312
			ALEAT	leather products	316
			AWOOD	wood products	321-322
			APAPR	paper products	323
			APRNT	printing and publishing	324-326
			AOCHM	other chemical products	335-336
			ARUBB	rubber products	337
			APLAS	plastic products	338
			AGLAS	glass products	341
			ANMMP	non-metallic metal products	342
			AMETP	metal products	353-355
			AELMA	electrical machinery	361-366
			ASCIE	scientific equipment	374-376
			AVEHI	vehicles	381-383
			ATRNE	transport equipment	384-387
4	ALCG	Labour-intensive consumer goods	AFOOD	food processing	301-304
			AAPPA	wearing apparel	313-315
			AFOOT	footwear	317
			AFURN	furniture	391
			AOTHI	other industries	392-393
5	ALKG	Labour-intensive capital goods	AMACH	machinery	356-359
			ACOME	communication equipment	371-373
6	AKIG	Capital-intensive intermediate goods	APETR	petroleum products	331-333
			ABCHM	chemical products	334
			AIRON	basic iron and steel	351
			ANFRM	non-ferrous metals	352
7	AKCG	Capital-intensive consumer goods	ABEVT	beverages and tobacco	305-306
8	AELW	Electricity and water	AELEG	electricity and gas	41
			AWATR	water	42
9	ACON	Construction	ACONS	construction	5
10	AUIS	Low skill-intensive intermediate services	ATRAD	trade services	61-63
			ATRAN	transport services	71-74
			ACOMM	communication services	75
11	AUCS	Low skill-intensive consumer services	AHCAT	hotels and catering	64
			AOTHP	other producers	92, 95-96, 99
12	ASIS	Skill-intensive intermediate services	AFINS	financial and real estate services	81-82
			ABUSS	business services	83-88
13	ASCS	Skill intensive consumer services	AMAOS	medical and other services	93
14	AGOV	Government services	AGOVS	government services	91, 94

Source: Davies 2006

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