EXCHANGE RATES AND EMPLOYMENT

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Abstract

The analysis of exchange rates and employment has received scant attention in development economics. This is surprising, since there appears to be a number of well-defined transmission channels through which exchange rates impact on employment. In South Africa this is particularly important given the rand's higher volatility relative to other emerging economies. The main focus of this paper is to give an overview of the transmission channels through which exchange rates affect employment and to discuss the standard methodological approach to conceptualising the impact of exchange rates on employment. Given the sector-specific impact of exchange rates which are conditioned by industry characteristics, such as the degree of external orientation, there will always be winners and losers in the face of a currency shock. This means the full impact of exchange rates on employment can only be dealt with in an economy-wide framework. Results from a computable general equilibrium (CGE) model are presented to demonstrate that even in a country with unreliable employment data such as South Africa, one can still analyse exchange rate and employment issues.

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1. INTRODUCTION

There are several well-defined channels through which exchange rates influence employment. However, this issue has received very little attention in development economics. Exchange rates and employment have only been discussed where the analysis was concerned with short-run macroeconomic problems, with long-term analysis being focused more on external and financial sustainability rather than on growth and employment.[1] This shortcoming of development economics has not gone unnoticed. For example, there is new work that focuses on trying to find an exchange rate policy with developmental objectives.[2] Furthermore, some development economists now see a competitive real exchange rate (RER) as a crucial requirement for development and a necessary condition for creating an environment conducive to employment creation.[3] When examining the future evolution of employment in South Africa, the exchange rate and its impact on the traded sector emerge as a factor that might affect the economy's ability to create jobs. In the South African context, the exchange rate and employment question is necessitated by the relatively high volatility of the rand compared to other emerging economies. Changes in the currency imply changes in relative production costs, which in turn have a significant impact on the allocation of labour within and across industries. Coupled with the high volatility of the rand there seem to be some empirical

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[1] Frenkel and Ros (2006).
[2] Williamson (1997).
[3] Rodrik (2003).

evidence to suggest that the exchange rate exerts a strong influence on employment dynamics within an economy. South Africa's ability to tackle the volatility issue is important in as far as the exchange rate has been implicated as an integral variable in the success of high-growth countries. The situation is further complicated by the possible overvaluation of the rand, on the one hand, which has had a negative impact on the manufacturing sector.[4] On the other hand, there is evidence to suggest that a weaker rand could introduce strong inflationary pressures, which might have a negative impact on growth in the long run.[5]

Given the foregoing it is therefore important to try and quantify the impact of exchange rate movements on employment. This requires choosing a methodological approach that best animates the interaction between the two. The aim of this paper is to discuss the channels through which the exchange rate impacts on employment, and more importantly, to review the methodological approaches that have been used to date to try to understand the relationship. Finally, this paper outlines the value of CGE models in providing us with a nuanced understanding of the employment-exchange rate nexus.

2. EXCHANGE RATES AND EMPLOYMENT: CHANNELS

There are a number of channels through which exchange rates impact on employment and a few of them are discussed in this section. They can be divided into two broad groups: the first two can be described as macroeconomic channels whilst the industry-specific channels can be classified as micro-channels.

(a) Developmental Channel
A competitive RER aligned with an appropriately specified, outward-oriented industrial strategy can induce a labour-absorbing growth process. For a competitive RER to have a significant influence on a country's growth rate, the rate of capital accumulation in the traded sector must be a positive function of profitability, and profitability in the traded sector must depend positively on the RER. This holds true bearing in mind that a higher RER reduces the product wage in the traded goods sector and increases the profit rate. Frenkel and Ros (2006) argue that when viewed in this way, a competitive RER operates as an industrial policy designed to distort relative prices in favour of tradable goods activities. On the one hand, a more depreciated currency is then seen as a uniform tariff on imports; on the other hand, it acts as a subsidy on exports.

(b) Macroeconomic Channel
The rationale behind the macroeconomic channel has its roots in Keynesian aggregate demand theory. In the case of a depreciation, Keynesian open-economy macroeconomics argues that a country should depreciate its currency to enhance the cost-competitiveness of its exports. The argument is that a currency depreciation will boost domestic real income, output and net exports. The balance of payments is expected to improve through the process of expenditure switching with a reduction in imports as demand is directed towards domestically produced goods, and with an increase in exports. Increased exports,

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[4] Saayman (2007) finds that in the case of South Africa, the degree of misalignment depends on the type of deflator used to determine the RER; relative labour costs indicate a grossly overvalued rand.

[5] See Hodge (2005) for a detailed discussion on inflation and growth in South Africa.

through the multiplier effect, are expected to increase aggregate demand, and ultimately domestic production and employment. Given that a depreciation tends to be inflationary, it is argued that the increase in the overall price level leads to a lowering of the real wage, which will lead to more hiring and increased production, assuming that there is unemployment in the economy. This approach has however been criticized for neglecting the possibility that the intended expenditure switching might not occur, more so in developing countries which tend to be import dependent. Depending on the level of exchange rate pass-through this might have a significant impact on inflation which might erode the competitiveness of the country's exports. As a result, this approach needs to be supplemented by macroeconomic policies that minimize the risk of inflation.

We now turn to the industry-specific channels through which exchange rates impact on employment.

(c) Factor Intensity Channel
This channel operates through changes in the relative prices of intermediate goods and capital *vis-à-vis* labour. In the event of an appreciation, all things being constant, we can expect the price of imported intermediates and capital goods to fall in domestic currency terms. Depending on the relative factor substitution of a given sector, producers might substitute labour with imported machinery. This will have an impact on total employment in the tradable sector. If the appreciation is sustained over the medium to long term, we can expect the impact on employment to be large. It is also important to note that these changes will only manifest if the new relative prices are sustained over the medium to long term.[6]

Changes in relative prices which come about as a result of changes in the exchange rate might be persistent if there is a permanent fluctuation in the currency. Relative to transitory changes in the exchange rate, permanent changes will have the largest impact on employment.[7] In general, the more labour-intensive the production process, the less responsive labour demand will be to changes in the exchange rate.

(d) External Orientation Channels
Campa and Goldberg (1997) refer to an industry's reliance on international markets as its external orientation. This captures three important transmission channels through which exchange rates impact on employment. These transmission channels refer to the extent to which manufacturers sell products to foreign markets (export orientation), use foreign-made inputs (imported input channel) and, more indirectly, compete with foreign manufacturers in domestic markets through imports (import penetration channel).

(e) Export Orientation
Industries with greater export orientation will show greater sensitivity of labour demand to movements in the exchange rate than industries that produce mainly for the domestic market. This is largely because greater export orientation broadens the positive stimuli to revenues, increasing with currency depreciations and falling with currency appreciations.[8]

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[6] Frenkel and Ros (2006).
[7] Goldberg (2004) finds that permanent fluctuations have a greater effect on regular employment and hours of United States (US) workers.
[8] Campa and Goldberg (2001).

(f) Imported Input Channel

Firms that import most of their inputs tend to be affected by changes in the currency, with appreciations lowering the price of inputs. In the case of the factor intensity channel, it is the relative price of capital to labour that determines the degree of factor substitution and the subsequent impact on labour demand. In this case it is the overall proportion of imported inputs in the firm's total output that matters. The higher this proportion, the greater the employment elasticity to exchange rate movements.

(g) Import Penetration Channel

Industries that face significant foreign competition will exhibit greater employment elasticity of exchange rates. When the exchange rate appreciates, domestic consumption will be directed towards cheaper foreign substitutes.

(h) Market Structure and Labour Market Regulation

Market and regulatory forces can also determine the magnitude of the response of output and employment to an exchange rate shock. Competitive industries will be more responsive to changes in foreign prices, whereas imperfect markets, which are characterised by product differentiation and market power, will experience smaller changes. Domestic market regulation will also exert a strong influence on the response of prices to changes in the exchange rate, with protected markets showing smaller changes in price and import penetration. Labour regulation can also determine the impact of exchange rate changes on employment. In the presence of labour regulations that make it hard to hire and fire workers, changes in exchange rates will not result in changes in employment, and firms might be forced to absorb the impact by allowing their profits to vary.

These channels are broad generalisations whose attainment in reality depends on many conditions being satisfied. For example, the employment impact of an exchange rate change *via* the factor intensity channel might not materialise if changes in relative prices are not maintained long enough to act as a signal to producers to substitute one factor for another. Improved growth and employment *via* the macroeconomic channel can only be realised if the depreciation succeeds in undervaluing the country's currency. Finally, there are a number of channels through which depreciations can be contractionary. For example, new investments may be constrained by a depreciating currency, since capital equipment, which is usually sourced from overseas, will become relatively more expensive and might hamper the rate of capital accumulation in both the traded sector and non-traded sectors of the economy.

3. METHODOLOGICAL APPROACHES AND GLOBAL EVIDENCE

The limited amount of research on employment and exchange rates is widely recognised in the literature (Campa and Goldberg, 2001; Kim, 2005). Most of the studies have been confined to developed countries, with very little being done on less developed countries. The majority of the latter studies has been on Latin America.[9] Kim (2005) argues that since the country and industry characteristics in developing countries are very different from developed countries, the effects of RER fluctuations on employment are different

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[9] Camargo (1999); Damill *et al.* (2002); Damill and Frenkel (2003); Frenkel and Ros (2004) and Ros (2004).

from those in developed countries. Some of these differences include market structure, the regulation of international trade through tariffs and the regulation of the labour market, which is related to adjustment costs of labour.

(a) Early Studies: Deindustrialisation and the Exchange Rate
Most of the earlier studies on exchange rates and employment focused on the US, with the main concern being the possible deindustrialisation of the US economy. Their main focus was on the impact of the dollar appreciation during the first half of the 1980s on manufacturing employment. The theoretical foundation of this work was based on three sector models reminiscent of those from traditional trade theory, which include an exportables, import-competing and non-traded goods sector.[10] The rationale behind this was a need to focus on exportables and import-competing production and not only on trade in exports and imports. The non-traded goods sector was included to ensure a consistent model of the economy. In each of the three sectors, demand was assumed to be sensitive to the relative price of home and foreign goods, with the nominal exchange rate influencing this relative price. There was imperfect substitution between exportables and import-competing goods, and markets did not clear instantly. Under these assumptions, an appreciation of the home currency reduced the relative price of foreign to home goods, shifting the demand from the home to the foreign market. This led to a reduction in output and employment in all three producing sectors.

On the supply side, it was assumed that each sector's output depended on its price relative to the nominal wage, increasing as the real product wage fell. No attempt was made to model inter-sectoral supply reactions as relative prices changed, since the common nominal wage rate meant that the supply functions contained all relative prices. This meant that there was a model of supply and demand in each of the three sectors, with supply being sensitive to the product wage and demand being sensitive to the relative price of home and foreign goods and the relevant income variables. After deriving log-linear models of demand and supply for exportables, import-competing goods and non-tradables, a general reduced form model was applied to all manufacturing sectors, with the left-hand variables being the natural logs of employment and output, and the right-hand independent variables being three variables to capture secular, cyclical and structural changes in demand and the RER.

The findings from this body of work show that exchange rates have significant effects on US manufacturing employment (Branson and Love, 1986, 1987, 1988; Branson and Marston, 1989). There is evidence to show that the impact of exchange rates on employment is sector-specific, with sectors such as durable goods, primary metals, fabricated metal products and non-electrical machinery responding negatively to exchange rate appreciations. The biggest losers in terms of employment losses when the dollar appreciated were stone, clay and glass products, transportation, instruments, textiles and apparel, chemicals, rubber and leather goods. There was also evidence that certain regions in the US tended to be more sensitive to exchange rate movements than others. In particular, exchange rate movements were found to have a much larger impact in the areas outside of New York City than in the metropolitan area. This result was consistent with earlier work that found employment in management or research to be less sensitive to exchange rate movements relative to employment in production processes.

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[10] Branson and Love (1987).

For the country as a whole, movements in the RER led to the loss of about one million manufacturing jobs as a result of the appreciation of the dollar in the 1980s.

(b) Recent Studies: Price Adjustment and Industry-Specific Characteristics

Recent studies have shifted the focus from deindustrialisation to the analysis of pricing decisions and industry characteristics. Most of the research has been concerned with price adjustments that arise as a result of movements in the exchange rate. The major thrust of this work has been the extent to which – in the face of exchange rate fluctuations – a firm's external orientation, the proportion of imported inputs and the level of import penetration influence its pricing, employment and output decisions. Though the discussion of exchange rate pass-through does not feature prominently in the exchange rate and employment literature its importance should not be overlooked. The various channels of adjustment through relative prices will be strongly influenced by the level of pass-through. A number of recent studies (Hellerstein, 2004; Marazzi *et al.*, 2005; Reyes, 2007) have shown that the level of exchange rate pass-through has been declining over the past decade in the United States, Europe and most inflation targeting countries. There is also evidence to show that the level of pass-through is time dependent and as such it will tend to delay the adjustment process. Campa *et al.* (2005) show that for the Euro area the transmission of exchange rate changes to import prices in the short run has been high, although incomplete, and that it differs across industries and countries and in the long run, exchange rate pass-through is higher and close to 1.

Panel econometrics has been used extensively since it has the advantage of blending inter-individual differences and intra-individual dynamics amongst sectors. This allows greater capacity to capture the complexity of industry behaviour than a single cross-section or time series data could ever do.[11] The only differences between studies have been in the choice and focus of transmission channels.

This research takes a microeconomic approach by starting with a profit maximising firm, and then deriving labour demand functions by maximising profits under constraints in production technology, product demand and adjustment cost of labour, and by using a given specification of the production function. Several assumptions are made regarding domestic demand, foreign demand and labour supply. It is assumed that the domestic demand of a product is an increasing function of aggregate demand and the exchange rate, whilst the foreign demand of domestic products is assumed to be an increasing function of foreign aggregate demand and exchange rates. Exchange rates influence the demand of a product by shifting the relative prices of home products versus those of foreign competitors. Labour supply is assumed to be an increasing function of wages. Equilibrium employment is derived as a function of the export-orientation ratio, import penetration, imported input, income in the home country and foreign country, exchange rates and the unit cost of non-labour inputs in the home and foreign country. Due to the focus on industry characteristics, this strand of the literature seems to suggest that in the event of an appreciation, the more open an industry is to foreign competition, the less scope there is to raise prices. Under such circumstances, more competitive industries will show greater responses to exchange rates through the adjustment of quantities, profits, investment and labour demand (Dekle, 1998).

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[11] See Hsiao (2007) for a full discussion of the advantages and challenges of using panel data.

A good example of how industry-specific transmission channels from exchange rates to employment are modelled is presented in Campa and Goldberg (2001). Their approach has become one of the starting points for conceptualising how labour markets interact with exchange rates. They present a dynamic model of the labour market where a combination of employment and wage adjustments equilibrate labour markets in response to shocks. Exchange rate shocks are assumed to influence labour demand by affecting the marginal revenue product of labour. These effects arise through changes in a producer's domestic and foreign sales and in its cost of imported inputs into the production process. They derive labour demand by solving a profit maximising problem with constraints in production technology, product demand and adjustment cost of labour. Producers selling in both domestic and foreign markets are faced with current and future demand shocks. Production uses three factors – domestic labour, domestic capital and other domestic inputs, and imported productive inputs. Producers choose factor inputs and total output in order to maximise expected current and future profits. Profits depend on sales in the home and foreign markets, which in turn depend on aggregate demand conditions in the respective markets. Exchange rate movements are then assumed to influence demand by potentially shifting the relative price of home products versus those of foreign competitors and therefore affecting the demand faced by the domestic firm. Their specification of labour demand and the exchange rate highlights three channels through which optimal labour demand is exposed to exchange rate movements and shows the key roles played by industry features. The three channels are through industry import penetration, export orientation and imported input use.

This analysis highlights four industry features that either magnify or reduce the importance of these channels (Campa and Goldberg, 2001):

(i) When production is labour-intensive, labour demand is less responsive to exchange rates.
(ii) Greater import penetration of domestic markets raises the sensitivity of labour demand to exchange rates.
(iii) Higher export orientation of an industry increases the sensitivity of its labour demand to exchange rates.
(iv) Industries that rely more heavily on imported inputs into production receive a contractionary labour demand impetus following a domestic currency depreciation, since domestic currency depreciation raises the cost of a factor of production.

The description of labour markets is completed by specifying the nature of labour supply, which is treated as an increasing function of wages and a decreasing function of aggregate demand. Equating labour demand to labour supply produces a solution of simultaneous equations for employment and wages. Within this framework, labour demand will be more sensitive to exchange rates if foreign firms have pricing power in domestic markets. Furthermore, the higher the price elasticity of demand facing producers and the lower the implied price-over-cost mark-ups in the industry, the more responsive labour demand will be to exchange rates.

The importance of export orientation and imported input shares in the firm's response to exchange rates is highlighted by Goldberg and Tracy (2000). They find that exchange rates have statistically significant wage and employment implications in local US 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 (increases) for high and low profit margin industry groups. As industries increase their export orientation, the adverse consequences of appreciations for employment also increase. Some of these adverse effects are counteracted as industries increase their reliance on imported inputs. Dollar appreciations against export partners are associated with employment declines, while appreciations against input providers are associated with employment expansion. Using the approach just outlined on manufacturing industries in the US, Campa and Goldberg (2001) find that exchange rate implications for jobs and hours worked were small and less precisely measured, with overtime wages and overtime hours having a higher response to transitory exchange rate movements. Precisely, they find that the average industry real wage elasticity to a permanent RER change was 0.06 for all manufacturing during this period, while the average employment elasticity was only −0.01. Changes in the exchange rate can also have far-reaching consequences on a firm's investment decisions. Goldberg and Crockett (1998) show evidence that the 1997-1998 rise in the dollar significantly reduced US producers' profits and compelled firms to scale down their investment in new plants and equipment.

Kim (2005) uses a similar approach to Campa and Goldberg (2001) in an analysis of the relationship between exchange rates and employment in Korea. He finds similar results in that Korean employment responds positively to exchange rate shocks, with all industries with high openness and low imported input ratio showing a positive sign in employment to the shocks. Industries with middle or low openness showed a negative sign in the employment response to the shocks. The major difference between the US and Korea was that employment in the latter responded more to exchange rate shocks than US employment. Hua (2007) uses a similar approach to analyse the impact of the RER on employment and its channels for manufacturing employment in China. Using an extended labour demand function, three channels through which the RER affects employment are identified. He finds that the real appreciation of the *renminbi* exerts a statistically significant negative effect on Chinese manufacturing employment.

In the event of exchange rate fluctuations, the impact on employment will be determined largely by the pricing and output decisions of the firm. Branson and Marston (1989) find that in the case of Japan, prices change rapidly in response to changes in the exchange rate. This rapid change in prices shows that there is substantial pricing to market, which means that in Japan, mark-ups rather than output and employment change with exchange rate fluctuations. Burgess and Knetter (1998) find no evidence of pricing to market in US manufacturing, such that employment and output tend to be more sensitive to the exchange rate. In the same study they also find that, generally, employment in Europe on aggregate is much less influenced by the exchange rate and is slower to adjust to long-run steady states, whereas for the US, Japan, Canada, the UK and Italy adjustment happens quickly. The significance of mark-ups in Italy is further confirmed by Nucci and Pozzolo (2004), who find that exchange rate fluctuations have a significant effect on employment and hours worked in the Italian manufacturing sector. The effect of the RER on labour inputs is stronger for firms with low price-cost margins than for firms with a high mark-up. They also find that depreciations cause an expansion in the number of hours worked in the subsequent year through the revenue side and a contraction through the cost side.

In trying to analyse industry-specific effects of exchange rates, the type of data used is important. Goldberg (2004) highlights that aggregate trade weight exchange rates cannot highlight industry-specific distinctions in how firms respond to exchange rate changes. Using industry-specific exchange rates, Dekle (1998) finds that an exchange rate-induced change in foreign industry-specific prices has a significant influence on manufacturing employment in Japan in the long run. No differences are found between high and low export sectors in their response to exchange rate movements, which is probably explained by the pricing to market behaviour of Japanese firms. Koren (2001) also uses firm-specific RERs in his study on the labour demand response of Hungarian exporting firms to RER movements. He finds that the relative importance of the demand and cost effect tends to be industry specific and that only the machinery and food industries have a significant positive demand-side exchange rate elasticity – a 10% real depreciation causes labour demand to rise by 0.36% in the food industry. The overall effect of the exchange rate on labour demand remains ambiguous and export share does not affect exchange rate exposure.

Different industry characteristics with respect to price adjustments in the face of exchange rate movements and overall external orientation will always result in winners and losers in the event of an exchange rate shock. Thus, exchange rate fluctuations are bound to lead to inter- and intra-sectoral job reallocations. Gourinchas (1999) studied the impact of exchange rate fluctuations on inter- and intra-sectoral job reallocation in France between 1984 and 1992. He finds that movements in the exchange rate affect the profitability of production units and the pattern of entry and exit, with traded industries being very responsive to RER movements – a 1% appreciation of the RER will destroy 0.95% of tradable jobs over the next two years, with job creation being more volatile than job destruction.

Filiztekin (2004) shows that in cases where an industry relies heavily on imported inputs, exchange rate depreciations – which have been associated with positive employment responses in countries such as the US – can actually lead to negative impacts on employment. This has been the case in Turkey, where the reliance of Turkish industries on imported inputs outweighed the benefits of improved competitiveness from an exchange rate depreciation. This study thus highlights the importance of the imported input transmission channel in Turkey, where, on average, a 10% depreciation of the Turkish Lira has been found to cause a 1.6% decline in manufacturing employment. There is, however, considerable variation across industries. The industry most hurt by devaluations has been clothing, which generated the most employment growth throughout the 1980s.

(c) Trade Liberalisation and Openness

Other studies have concentrated on openness as a transmission channel. Welfare gains from trade tend to be reduced by adjustment costs associated with factor reallocation. Klein *et al.* (2003) estimated the effects of the RER on labour reallocation and found that trend RERs significantly affected job reallocation but not net employment, whereas cyclical RERs seemed to affect net employment through job destruction. Haltiwanger *et al.* (2004) argue that openness to international competition can lead to enhanced resource allocation, with factor reallocation being essential for the attainment of net benefits from trade liberalisation. However, this process generates costs for both transitioning workers and employers undergoing employee turnover. Net welfare gains

result if the benefits from higher productivity exceed the costs due to factor redeployment. As inefficient import competing industries contract, the increased openness will also lead to the creation of new export opportunities for other producers. In Latin America, tariff reductions and exchange rate appreciations have been found to increase the pace of job reallocation within sectors, with evidence of declining net employment growth.

(d) Latin America

In recent years, Latin America has witnessed an increase in its unemployment rate. What is even more intriguing is that even during the period of stabilisation programmes (the 1980s) that brought inflation down and saw a resumption in growth, unemployment remained relatively high.[12] Frenkel (2004) gives a review of studies on Latin America which analysed the impact of exchange rates on employment. Since some of these studies are in Spanish, this section will give a brief summary.[13] According to Ros (2004), the deindustrialisation processes that led to sharp increases in unemployment in several South American countries can be explained by two factors operating in the 1990s – the real appreciation of the exchange rates and the reorientation of the trade pattern towards natural resources. Damill *et al.* (2002) investigated the effects of the RER appreciation on the labour market and income distribution for Argentina in the Convertibility period. The RER strongly appreciated in 1990-1991 and the appreciated level remained (comparatively) stable until 2001. They find that the change in relative prices that took place in the beginning of the decade and persisted afterwards induced a contractive trend in the full-time employment rate of 1.45 percentage points (of total urban population) per semester (about 3 percentage points per year). They show that during the period of RER appreciation, employment was driven largely by changes in the currency, and after the exchange rate stabilised, from 1996 onwards, changes in employment were explained by changes in output. In a comparison of the results from three Latin American countries (Argentina, Brazil and Mexico), Camargo (1999) shows that in these countries the combination of RER appreciation and trade opening generated high negative trends in labour utilisation per unit of output. In Argentina and Brazil, those negative trends were largely higher than the expansionary trends induced by the increase in output, resulting in important net contractions of employment. In Mexico, there was a small net increase in industrial employment because the positive effect of output expansion was higher than the negative trend. Frenkel and Ros (2006) looked at the relationship between the RER and employment in four Latin American countries. They find that the emergence of mass unemployment in several South American countries and the persistence of high unemployment have a variety of causes, including a slow process of capital accumulation, a tendency to real currency appreciation and a pattern of trade specialisation oriented towards natural resource-intensive products. They also note that the pattern of trade, oriented towards primary exports and natural resource-intensive manufactures, has had a limited capacity for employment absorption.

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[12] For a breakdown of unemployment rates and their determinants in different Latin American countries, see Frenkel and Ros (2006).

[13] For a detailed discussion of the studies, please refer to Frenkel (2004).

4. FROM PARTIAL EQUILIBRIUM ANALYSIS TO AN ECONOMY-WIDE FRAMEWORK

(a) Data Problems

In South Africa, work on employment is complicated by the poor quality and availability of employment data, which makes it difficult to conduct any work using both time series and panel data analysis. Given the recent introduction of the Labour Force Survey (LFS), it means that there is no long data series to work with. Some studies have attempted to construct a longer series by combining the old October Household Survey (OHS) with the LFS, but this has not been without its problems, especially in terms of employment totals. To this end, it has been argued that the two sources should only be compared cautiously. The second alternative when it comes to employment data is the unofficial South African Standardised Industry Database (SASID), which is provided by South African-based consultancy, Quantec Research. The SASID data are based on a number of sources, of which the main one is the Survey of Employment and Earnings (SEE) and the Quarterly Employment Survey (QES). Companies in this survey are drawn from a register of companies which is updated periodically. The main drawback is that the register on which the SEE is based is not representative of the entire economy, particularly up to 2001. Furthermore, it excludes the informal sector, small enterprises with a turnover below R300,000 per annum, new enterprises not yet included in the register, and agricultural and domestic work. Services employment also tends to be underestimated in the SASID because services firms disproportionately fall into the categories which are unsampled or undersampled in the SEE. The QES, which was introduced in 2005, is more representative, and covers non-agricultural businesses that are registered for income tax.

(b) Computable General Equilibrium Models

CGE models are relevant in developing countries like South Africa where time series data on employment are scarce and of poor quality. Since CGE models rely on strong, reasonable assumptions embedded in the model to replace historical evidence found in time series data, it is possible to construct reasonable datasets to conduct policy research. The Social Accounting Matrix (SAM) which forms the database of the CGE model is constructed with these assumptions in mind. To the best of our knowledge, no CGE studies have looked at the impact of exchange rates and employment. Three factors therefore motivate the need to use CGE models to analyse exchange rates and employment in South Africa. The first factor is the data problems discussed above, while the second is the relatively high volatility of the rand exchange rate, which necessitates that we gain an understanding of how employment is responding to exchange rate movements, especially in the traded sector. Third, given the sector-specific transmission channels through which exchange rates affect employment, an economy-wide framework will give us a sense of the net impact on employment within the economy. An advantage of CGE models is that the exchange rate is determined endogenously, allowing for feedback effects that are crucial in determining the overall impact of exchange rates on employment. CGE models also have other advantages over partial equilibrium approaches in that price adjustments from inter-sectoral and sectoral market interactions are captured simultaneously. The latter is the result of the neo-classical assumptions built into CGE models where adjustments are price driven and optimal. This means the corresponding results might differ from real-world

outcomes. The other shortcoming of CGE models is that they are usually static and most focus on the real side of the economy, this means it is not possible to tackle dynamic issues concerning the evolution of economic adjustment that arises from a currency change.

We use the standard International Food Policy Research Institute (IFPRI) CGE model (for a detailed presentation of the model, see Thurlow and van Seventer, 2002). Like most CGE models, the IFPRI model is neo-classical in nature and combines an input–output structure, which captures the interactions between sectors, with an extended functional distribution of income and a detailed institutional structure. The 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). 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).

(c) The Experiment

Several ways can be used to analyse the impact of exchange rates on employment in a CGE model, such as fixing the exchange rate and then devaluing it by a given percentage. Alternatively, the exchange rate can remain flexible whilst assuming a change in one of its determinants; for example, an increase in capital inflows should have the impact of appreciating the currency. This paper uses a similar approach as Ngandu (forthcoming), where an exchange rate appreciation comes about as a result of an increase in the world price of three resource sectors – gold, coal and other mining. The experiment assumes an increase in the price of minerals of 30%, which leads to a 7.5% appreciation in the RER. The aim is to explore the employment effects and show that CGE models are capable of generating results that shed the same light as partial equilibrium methods, with a less stringent data requirement. The 2000 SAM is used, since we want a snap-shot of the economy before the appreciation, which allows us to avoid any impact that the appreciation might have had on the economy.

From the literature review, the external orientation (export intensity, import intensity and the level of import penetration) of an industry is important in determining how that industry responds to an exchange rate shock. Table 1 gives us the structure of the South African economy in the base year, with the figures representing simple averages. Though most of the sectors engage in some form of trade, we can use the export and import intensities as an indication of what is tradable and what is not. The average export intensity is 22.04%, and 16 of the 43 sectors have export shares higher than this. Other mining and gold have the highest export intensities, whilst water and government have the lowest. The average import penetration ratio is 23.81%, with 17 sectors having a ranking higher than this average. The data suggest that most primary and secondary sectors can be regarded as tradable activities, while most tertiary sectors can be regarded as non-tradable. Mining and manufacturing seem to have relatively high export intensities, whilst services sectors tend to have lower intensities. As expected, the services

Table 1. Economic structure in the base (43 sector aggregation)

	Value added share	Production share	Employment share	Export share	Import share	Share of imports in demand	Share of exports in output	Rank export share	Rank import share
Other mining	3.23	3.07	2.04	19.90	10.03	93.41	96.60	1	1
Gold	2.09	1.81	2.23	10.11	0.00	0.05	86.01	2	42
Transport equipment	0.15	0.25	0.20	1.09	3.21	83.18	63.01	3	2
Leather products	0.05	0.12	0.10	0.43	0.22	38.35	52.12	4	9
Basic iron and steel	1.20	2.23	0.42	7.21	0.97	10.72	44.11	5	28
Machinery	0.88	1.40	1.05	4.62	13.05	68.02	42.18	6	5
Non-ferrous metals	1.01	1.24	0.18	3.48	1.75	26.81	41.86	7	15
Coal	1.27	1.23	0.64	3.42	0.16	3.25	41.47	8	35
Other industries	0.20	0.41	0.66	1.48	1.35	39.63	38.04	9	7
Communication equipment	0.19	0.28	0.09	0.70	5.48	80.55	34.56	10	3
Hotels and catering	1.62	1.21	1.61	2.64	1.94	26.64	33.64	11	16
Scientific equipment	0.08	0.12	0.16	0.40	2.69	70.25	33.21	12	4
Chemical products	1.00	1.68	0.36	3.77	4.62	38.69	33.01	13	8
Petroleum products	1.15	1.76	0.16	3.53	1.21	10.41	25.39	14	29
Furniture	0.29	0.44	0.47	1.10	0.40	13.20	22.95	15	26
Paper products	0.87	1.45	0.60	2.45	1.16	14.56	22.65	16	24
Vehicles	1.37	3.33	0.93	5.05	12.16	40.90	20.49	17	6
Rubber products	0.20	0.30	0.25	0.45	0.84	37.77	20.36	18	10
Wood products	0.41	0.57	0.50	0.80	0.51	14.80	19.69	19	23
Textiles	0.44	0.73	0.62	0.93	1.68	28.65	15.35	20	13
Transport services	6.24	5.65	1.62	5.29	8.80	20.19	14.43	21	18
Electrical machinery	0.60	0.92	0.43	0.96	2.49	32.74	13.65	22	12
Glass products	0.13	0.17	0.07	0.16	0.28	24.64	13.46	23	17
Beverages and tobacco	1.27	1.58	0.21	1.65	1.00	8.50	12.25	24	30
Agriculture	3.29	3.26	9.78	2.71	1.60	7.65	11.68	25	31
Metal products	0.96	1.39	1.09	1.13	1.67	18.14	11.63	26	21
Other chemical products	1.17	2.05	0.74	1.90	5.12	28.39	11.08	27	14
Food processing	1.76	3.91	1.68	3.63	3.60	12.96	10.91	28	27
Wearing apparel	0.45	0.56	1.33	0.66	0.80	13.88	9.36	29	25
Printing and publishing	0.62	0.72	0.53	0.40	1.03	18.77	7.47	30	20
Plastic products	0.54	0.69	0.52	0.35	0.94	19.82	7.38	31	19
Non-metallic metal products	0.62	0.79	0.61	0.38	0.98	17.94	7.03	32	22
Footwear	0.14	0.20	0.22	0.13	0.81	36.74	6.77	33	11
Fin and real estate services	9.26	7.56	3.84	2.96	1.86	3.51	6.02	34	34
Communication services	3.86	3.26	0.83	1.11	1.58	7.11	5.23	35	32
Electricity and gas	2.36	1.87	0.45	0.46	0.13	1.05	3.79	36	38
Other producers	5.48	4.49	13.75	0.90	1.32	4.36	3.09	37	33
Medical and other services	1.93	1.92	3.93	0.34	0.38	2.93	2.76	38	37
Business services	10.08	8.23	10.26	1.03	1.66	3.00	1.92	39	36
Water	0.41	0.63	0.06	0.02	0.03	0.83	0.47	40	40
Trade services	11.23	10.41	13.26	0.20	0.17	0.25	0.29	41	41
Construction	3.27	4.92	4.36	0.05	0.30	0.92	0.16	42	39
Government services	16.63	11.20	17.17	0.01	0.02	0.02	0.02	43	43

sector tends to have relatively low import penetration ratios, whilst manufacturing has higher penetration ratios.

Judging from the above data, we can expect the relatively more tradable sectors to be more sensitive to exchange rate movements than the services sector with lower export and import intensity ratios. From Table 2 it can be seen that, generally, all trade sectors are negatively affected as a result of the appreciation induced by an increase in commodity prices. The services sector does better in its employment performance, to the point where it manages to offset the employment losses in manufacturing. Not only do we see the economy growing by 0.2%, but we also see an increase in employment. Since high-skilled labour is assumed to be fixed in this experiment, it is low-skilled and skilled labour that experience an increase in employment of 0.9% and 2.0%, respectively. In this particular scenario, the growth in gross domestic product (GDP) can be explained by the positive wealth effect that emanates from the commodity boom. Whereas a partial equilibrium analysis that only focuses on the manufacturing sector might conclude that the

Table 2. Changes in sectoral outputs and employment (% changes)

	Output	Low-skilled labour	Skilled labour	High-skilled labour
Agriculture	−0.5	−1.1	−1.1	−3.0
Coal	1.3	3.2	3.2	2.6
Gold	1.6	2.4	2.4	1.8
Other mining	1.7	5.7	5.7	5.1
Food processing	0.8	1.5	1.5	1.1
Beverages and tobacco	−0.1	0.1	0.1	−0.8
Textiles	−4.6	−5.4	−5.4	−5.8
Wearing apparel	0.3	0.6	0.6	−1.3
Leather products	−23.8	−36.7	−36.7	−37.9
Footwear	−5.6	−10.1	−10.1	−11.1
Wood products	−2.5	−3.4	−3.4	−3.9
Paper products	−1.5	−2.7	−2.7	−4.9
Printing and publishing	1.4	2.4	2.4	1.1
Petroleum products	−1.0	−5.8	−5.8	−7.4
Chemical products	−5.3	−12.0	−12.0	−13.7
Other chemical products	−1.3	−1.2	−1.2	−3.0
Rubber products	−1.8	−2.1	−2.1	−3.7
Plastic products	−4.0	−4.1	−4.1	−5.7
Glass products	−3.7	−4.8	−4.8	−6.1
Non-metallic metal products	−0.7	−1.4	−1.4	−3.6
Basic iron and steel	−3.4	−5.9	−5.9	−6.2
Non-ferrous metals	−0.6	−2.7	−2.7	−3.0
Metal products	−3.0	−4.2	−4.2	−6.0
Machinery	−4.2	−4.8	−4.8	−5.2
Electrical machinery	−2.6	−4.3	−4.3	−6.1
Communication equipment	−5.2	−6.6	−6.6	−8.4
Scientific equipment	−5.4	−6.9	−6.9	−8.6
Vehicles	−3.8	−6.1	−6.1	−6.8
Transport equipment	−37.0	−38.0	−38.0	−38.5
Furniture	−1.1	−1.4	−1.4	−2.2
Other industries	−1.0	−1.4	−1.4	−3.3
Electricity and gas	0.0	0.9	0.9	−1.0
Water	1.0	4.2	4.2	2.3
Construction	−0.1	0.3	0.3	−1.6
Trade services	0.9	2.3	2.3	0.4
Hotels and catering	−0.1	0.1	0.1	−1.8
Transport services	−1.5	−2.9	−2.9	−4.7
Communication services	0.9	2.8	2.8	0.9
Financial and real estate services	0.9	3.0	3.0	1.1
Business services	1.0	4.4	4.4	2.4
Medical and other services	2.3	5.9	5.9	4.0
Other producers	3.5	4.9	4.9	3.0
Government services	0.1	1.1	1.1	−0.8
		0.9	2.0	

Table 3. Changes in quantities of sectoral exports, imports and domestic sales (% changes)

	Exports	Imports	Domestic sales
Agriculture	−4.9	16.9	0.1
Coal	5.2	7.4	−1.7
Gold	1.7	−50.7	0.1
Other mining	1.9	−1.9	−6.4
Food processing	−6.0	10.7	1.5
Beverages and tobacco	−6.3	29.7	0.7
Textiles	−8.2	15.7	−3.8
Wearing apparel	−9.0	24.8	0.8
Leather products	−25.2	16.7	−22.0
Footwear	−9.0	30.5	−5.2
Wood products	−6.1	4.3	−1.7
Paper products	−5.9	5.2	−0.1
Printing and publishing	−4.5	6.8	1.7
Petroleum products	−3.3	7.1	−0.3
Chemical products	−5.5	−0.3	−4.0
Other chemical products	−6.7	14.0	−0.9
Rubber products	−6.0	15.2	−0.8
Plastic products	−7.4	9.2	−3.6
Glass products	−7.7	2.1	−3.1
Non-metallic metal products	−4.6	3.9	−0.7
Basic iron and steel	−3.7	−3.5	−3.1
Non-ferrous metals	0.3	−5.0	−1.2
Metal products	−5.8	7.9	−2.7
Machinery	−7.1	2.3	−2.0
Electrical machinery	−5.8	2.1	−2.3
Communication equipment	−8.1	2.8	−3.8
Scientific equipment	−10.0	7.2	−2.3
Vehicles	−5.6	11.5	−3.4
Transport equipment	−36.2	3.0	−32.9
Furniture	−8.0	25.4	0.5
Other industries	−5.6	10.6	1.4
Electricity and gas	−5.0	6.5	0.2
Water	−4.9	8.4	1.0
Construction	−4.0	4.7	0.0
Trade services	−4.8	7.7	0.8
Hotels and catering	−4.9	11.2	2.2
Transport services	−5.2	21.0	−0.9
Communication services	−4.5	8.3	1.2
Financial and real estate services	−5.2	10.1	1.3
Business services	−5.9	9.5	0.9
Medical and other services	−3.9	10.5	2.5
Other producers	−3.5	9.4	2.2
Government services	−5.1	6.4	0.1

appreciation has had a negative impact on employment, we notice that by taking into consideration the economy-wide impacts, we can have an overall positive impact on employment from an appreciation. The four worst-affected sectors in terms of employment include transport equipment, leather products, chemical products and footwear. The sectors that respond positively to the exchange rate include business services, other producers, other mining, and medical and other services. As expected, Table 3 shows a decline in exports in virtually all sectors, whilst there is a general increase in imports.

5. CONCLUSION

This paper has highlighted the different channels through which movements in exchange rates impact on employment. A brief description of the standard approach to analysing exchange rates and employment was given, together with a review of the global evidence

to date. It was shown that in countries such as South Africa where employment data are generally unreliable, CGE models can be used to explore the impact of exchange rates on employment. Their advantage is that they do not rely on long series of data; the strong assumptions that are built into the model are used to replace historical information found in time series data. The results also showed that by simply concentrating on the manufacturing sector, partial equilibrium studies might fail to capture important economy-wide impacts, where losses in employment in one sector are offset by gains in another, leading to an overall positive impact of an exchange rate appreciation.

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