Trade flows and the exchange rate in South Africa

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TRADE FLOWS AND THE EXCHANGE RATE IN SOUTH AFRICA

Abstract

The exchange rate plays a central role in public debate around trade and trade policy in South Africa. The general view is that depreciation enhances export competitiveness, encourages export diversification, protects domestic industries from imports and ultimately improves the trade balance. This paper reviews the theoretical and empirical relationship between the exchange rate and trade flows in South Africa. Trade volumes are found to be sensitive to real exchange rate movements but nominal depreciations have a limited long-run impact on trade volumes and the trade balance, as real effects are offset by domestic inflation. Policy should not focus on the exchange rate, but on the fundamental determinants of the profitability and competitiveness of domestic exporters and import competing industries: productivity enhancement, infrastructure, constraints to business operations and production costs, including labour costs.

1. Introduction

The exchange rate plays a central role in public debate around trade and trade policy in South Africa, with widespread calls for appreciation, depreciation or simple stabilisation. June 2005, for example, saw the Congress of South African Trade Unions (COSATU) march in pursuit of an in-principle agreement from government and business on the need for exchange rate depreciation. Business also argues that the rand's post-2001 strength has negatively affected manufacturing production (Business Day, 2003). The relationship is also emphasised in government policy documents. The Growth Employment and Redistribution (GEAR) macroeconomic policy emphasized the need for a 'competitive' exchange rate and, more recently, the Accelerated and Shared Growth Initiative in South Africa (ASGISA) initiative has identified exchange rate volatility as a significant constraint to growth.

This emphasis reflects a view that depreciation enhances export competitiveness, encourages export diversification, protects domestic industries from imports and ultimately improves the trade balance. We review the theoretical and empirical relationship between the exchange rate and trade flows, including imports, exports and the trade balance, in South Africa. We find that trade volumes are sensitive to real exchange rate movements but nominal depreciations have a limited long-run impact on trade volumes and the trade balance, as real effects are offset by domestic inflation. Policy should focus on fundamental determinants of the profitability and competitiveness of domestic exporters and import competing industries: productivity enhancement, infrastructure, constraints to business operations and production costs, including labour costs.

Sections 2, 3 and 4 analyse the relationship between the exchange rate and, respectively, exports, imports and the trade balance. In each case the relationship is explored using a simple theoretical model and a review of the domestic empirical evidence. Section 5 briefly highlights areas requiring further research, while Section 6 concludes and presents several policy recommendations.

2. The exchange rate and export performance

To critically evaluate the South African empirical literature, we require a clear understanding of the channels through which the exchange rate affects trade flows. We begin by building a simple model of the direct effect of nominal exchange rate movements on exports. We then extend this model to allow for domestic inflation and for asymmetric and lagged responses of

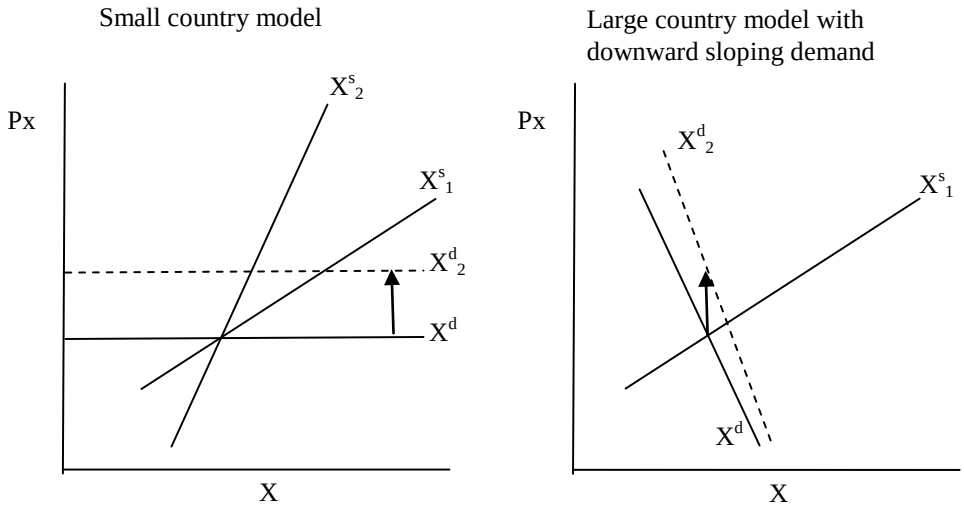
trade flows to exchange rate movements. Finally, we examine the export implications of currency volatility.

2.1 A simple model

Our model is based on the demand and supply framework represented in Figure 1. Export supply (X^s) is positively sloped, as increases in local currency export prices (P_x) relative to domestic costs or prices (P_d) raise the relative profitability of export production and hence boost export volumes. In contrast, foreign demand (X^d) for a country's exports is negatively related to foreign currency export prices, P_x/e, where e is the domestic/foreign exchange rate. The demand-supply intersection determines export volumes (X) and prices (P_x).

The elasticities of the export demand (X^d) and supply (X^s) determine export responses to depreciations. On the left of Figure 1 we depict a small country – a price taker in the international market. Export demand (X^d) is horizontal and domestic export prices are set equal to world price (P^*), valued in local currency units (i.e. $P_x = eP^*$). A devaluation (a rise in e) shifts the demand curve for exports upwards to X^d_2, raising the domestic currency export price by the full depreciation. Export volumes (and value, in local currency units) rise as the profitability of export supply increases, with a larger rise for a more elastic export supply.

Figure 1
Exchange rate and export volumes



On the right we depict a downward-sloping foreign demand curve. Firms in this model can influence the world price of their products through market power or product differentiation. A depreciation raises export demand, but exporters pass-through some of the depreciation to foreign consumers as a lower foreign currency price of their export good, so the local currency price of exports (P_x) rises by less than the depreciation.[1] Exports thus rise with a depreciation for two reasons: Firstly, a depreciation increases the local price of exports, raising the relative profitability of export supply. Secondly, a depreciation enables exporters to reduce the foreign currency price of their exports, increasing the quantity demanded by foreign consumers. This export response will be larger the more elastic are export demand and supply relationships.

The elasticities of supply and demand have important implications for exchange rate-based attempts to enhance export performance. A depreciation is unlikely to enhance export performance in the presence of inelastic export demand or supply constraints relating to

infrastructure, production capacity or input supplies. In the latter case, additional policies targeting supply constraints need to accompany the currency depreciation.

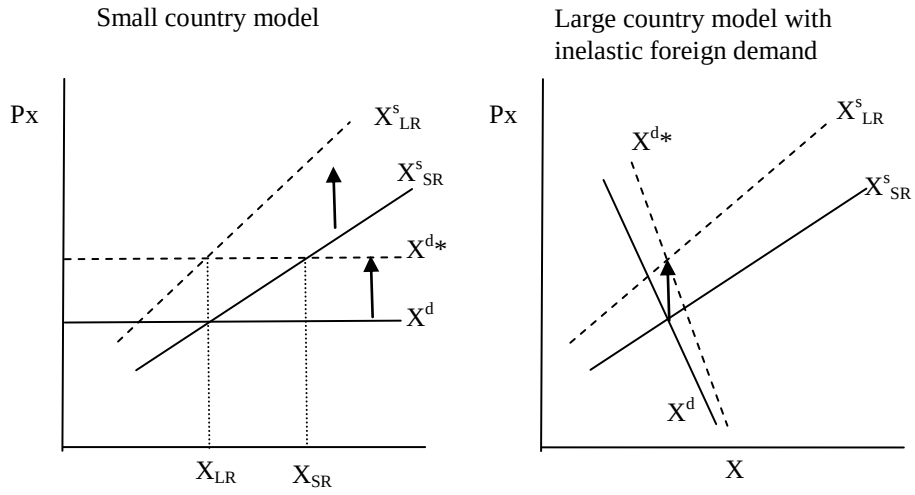
2.1.1 Including inflation

Any inflationary impact of a nominal depreciation will also influence the export response. Rising costs erode the improved profitability of export supply or restrict the firms' ability to lower their foreign currency export prices, thus reducing exports. Such increases in per-unit production costs may arise for a number of reasons.

A nominal depreciation increases the price of imported inputs and domestically produced import competing goods, raising per-unit production costs for any firm using such inputs. Higher profit margins on exports may spark price hikes by suppliers, particularly if these suppliers themselves face supply constraints. Rising consumer prices, particularly of imported final goods, can also lead to demands for increased wages. The export-enhancing effects of a nominal depreciation may be partially or entirely offset by increases in exporters' production costs, depicted in Figure 2 as an upward shift of the X^s curve. At the extreme, the export response may be offset entirely by rising domestic prices (at X^s_{LR}). Considering the second-order effects of a nominal depreciation, we see that a depreciation does not guarantee an increase in exports.[2]

Figure 2

Exchange rate and export volumes under inflation



2.1.2 Asymmetries and non-uniform responses

Export responses to depreciation and appreciation need not be symmetric. Asymmetric export responses may arise if domestic prices and wages are upwardly flexible but downwardly sticky. The positive export response to a depreciation will be muted, but the negative effect of an appreciation exacerbated.

Furthermore, different sectors are not uniformly affected by exchange rate movements. In resource abundant economies, such as South Africa, a commodity price boom can lead to a Dutch disease effect where non-commodity exports decline while commodity exports rise (Bell *et al*., 1999). International evidence on developing countries, including Africa, also indicates that the level, variability and misalignment of the real exchange rate strongly influence non-commodity and non-traditional export performance (Elbadawi, 2005). A real depreciation may therefore facilitate diversification, although the ability to do so may be constrained by a country's natural resource endowment (Wood and Mayer, 2001).

2.1.3 Volatility

Currency volatility also plays a potentially important role in determining trade flows, by increasing the uncertainty associated with returns on export activities. The predicted effects vary across different models but most agree that this uncertainty reduces aggregate exports. Greater availability of hedging options may reduce uncertainty and hence mitigate the export deterrent.

At the firm level, more precise predictions regarding the process of this export reduction can be made. If export transactions are denominated in domestic currency, importers of South African goods bear this risk, whereas the South African exporters bear this risk if export transactions are denominated in foreign currency. Firms may respond to such risk by diversifying, with South African exporters also selling to the domestic market and importers of South African goods also sourcing from other countries. Furthermore, currency volatility may deter South African firms from entering the export market and overseas firms from entering into import relationships with South African firms.

2.2 Empirical evidence

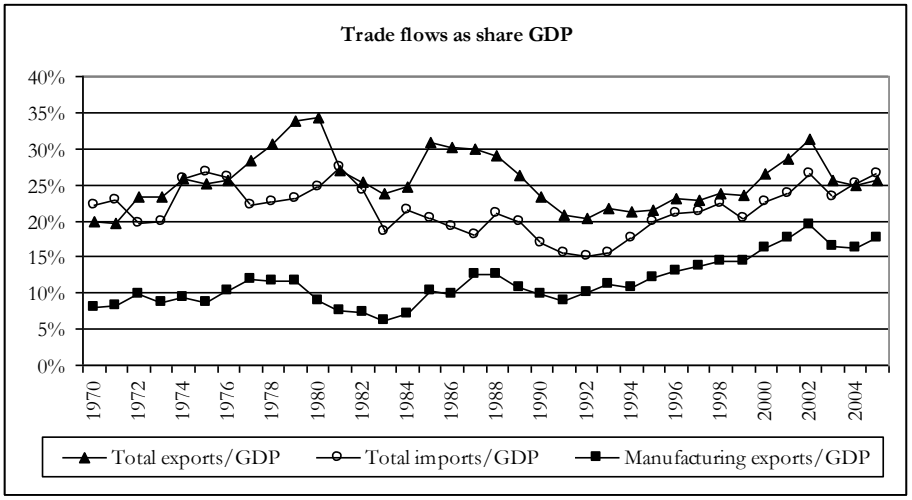
Our model identifies various channels through which the exchange rate affects export volumes. Here we consider the empirical evidence regarding each channel.

2.2.1 Aggregate exports

Preliminary inspection of South African merchandise exports and imports from 1970 to 2005 (Figure 3) suggests a positive association between exchange rate depreciations and export performance. Merchandise exports as a share of GDP fell during the 1970s and the early 1980s, largely responding to declining primary sector, particularly gold, exports. However, from the early 1990s, exports/GDP recovered, largely due to significant growth in manufactured exports. The improvement in manufactured exports and the manufacturing trade balance corresponds with rand depreciations in the mid-1980s and late 1990s. In particular, the improvement in exports/GDP following the sharp depreciation in 2001 was subsequently reversed as the currency appreciated.

Figure 3

Exports and imports as a share GDP



Source: Own calculations using Reserve Bank and Quantec (2005) data.

Available econometric evidence supports this relationship (Table 1). Few South African empirical studies estimate supply and demand relationships separately, instead estimating a reduced form equation of the form:[3]

$$X = \lambda_0 + \lambda_1 REER + \pi \Gamma \qquad (1)$$

where (all in logs), X is export volume, *REER* is the real effective exchange rate (P_d / eP_d^*) and Γ is a vector of other real variables that influence export demand and supply, including foreign income, tariffs, capacity utilisation and infrastructure.

Estimates on aggregated data yield long-run real exchange elasticities between -0.43 and -2.8, depending on the estimation technique, sector coverage, data frequency and period of analysis. Golub (2000) and Golub and Ceglowski (2002) use alternative REER measures based on unit labour costs, consumer prices, wholesale prices and value-added deflators to test the sensitivity of the REER elasticity for aggregate manufacturing exports. Although the level of the REER measure is sensitive to the choice of price index, all REER measures are negatively related to manufacturing export performance. A one percent rand depreciation is estimated to raise long-run manufacturing exports by 0.78 to 1.38 percent. Fallon and Pereira da Silva (1994), Smal (1996), Senhadji and Montenegro (1998) and Tsikata (1999) find consistent results.

An export response to a depreciation is also suggested by firm data. Chandra, *et al.* (2001), Edwards (2002), the Bureau of Economic Research (2004) and the World Bank (2005) show that firms see exchange rate appreciation as seriously threatening their export prospects. Black and Kahn (1998) suggest that post-1984 currency depreciations encouraged firms to adopt more export-orientated strategies.

2.2.2 Sector response

The responsiveness of exports to the REER varies across sectors as well as across countries. Edwards and Schoer (2002) note that the aggregate relationship fails to capture changes in competitiveness at a sectoral and regional level and is "likely to be misleading unless the trends in all the disaggregate categories are the same" (Wood, 1995: 70). This particularly concerned Bell, *et al.* (1999), who argued that commodity price boom induced rand appreciation saw the non-commodity manufactures share of total exports decline.

Sectoral variation in export volumes is clearly reflected in Figure 4 and Figure 5. Figure 4 depicts manufactured export volumes, separated into commodity and non-commodity manufactures, and the inverted real effective exchange rate (1/REER).[4] A real depreciation appears as an upward movement in the series and would be expected to exert a positive export response. Figure 5 depicts the relationship between primary export volumes, separated into gold and other primary products, and the inverted REER.

Between 1970 and the early 1980s, the gradual real depreciation to 1978 and the subsequent appreciation (in response to the gold price boom) to 1983 are mirrored by changes in exports of commodity manufactures, while non-commodity manufactures remained stagnant. Non-gold primary exports grew in this period in response to commodity price booms, with gold exports (in volume, not value) declining.

Table 1:

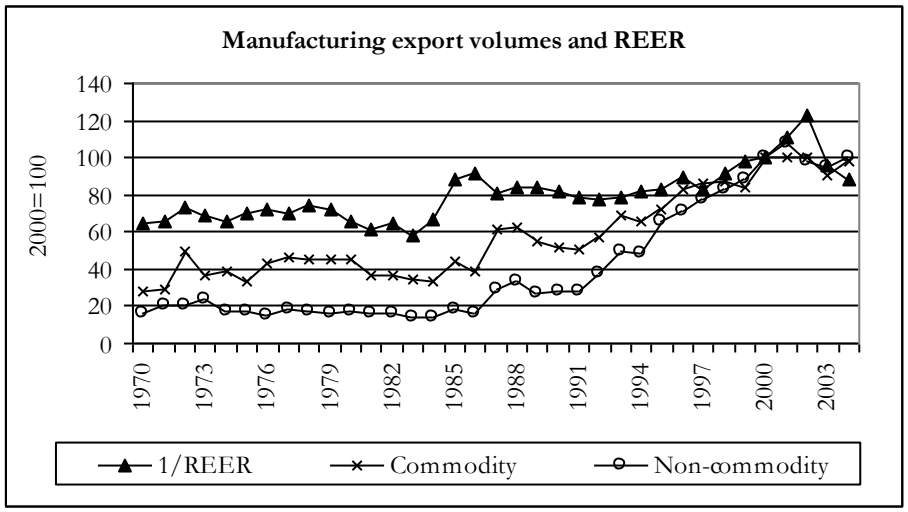
South African price, income and other export elasticities

Author	Price elasticity of demand or REER	Price elasticity of supply	Income	Other	Period	Comments
Edwards and Lawrence (2006)	-0.6 to -0.93 non-gold merchandise -1.3 to -1.6 manufacturing		0.93 to 1.4		1970-2004 Annual and quarterly data	Cointegration analysis
Alves and Edwards (2006)	infinity	1.81 to 2.05	1.2 to 1.61	Import penetration (0.23 to 0.55) Infrastructure (+)	1970-2002	Panel of data for 28 manufacturing sectors. Fixed effects and GMM estimators
Behar and Edwards (2004)	-3 to -6	0.76 to 1.3	2 to 3.5		1975q1 to 2000q4	Manufacturing. Uses VECM
Edwards and Golub (2004)	-1.62 to –2.76 (RULC)		1.28 to 3.19		1970-1997	Manufacturing. Uses panel data techniques Relative price is RULC
Golub and Ceglowski (2002)	-0.78 to -1.38		0.61 to 1.41		1970-98	Baseline specification. Study uses alternative price variables in REERs.
Golub (2000)	-0.78 to -1.37 -0.99 to –0.84		0.62 to 1.42 NS to 3.62		1970-98 1971-98	Uses alternative price variables in REERs.
Tsikata (1999)	-1.09 in SR –1.6 in LR -0.8		0.55 in SR 0.81 in LR. 0.45 (short run)	Tariff (0.77) Sanction (-0.14) Capacity (NS) Tariff (-0.86) Capacity (NS)	1970-96	Reduced form Export function OLS and 2SLS
Senhadji and Montenegro (1998)	-0.5		0.65		Obs = 34	Multi-country study
Smal (1996)	-0.58 for merchandise, -1.4 for manufacturing, -0.31 for minerals		0.76 to 1.04		1985Q1 to 1994Q4	
Fallon and Pereira de Silva (1994)	-0.43 in SR -0.63 in LR		0.02 (only for post 85)	Capacity (1.63 to –2.24)	1972-89	OLS
Bhorat (1998)		2.99 for Paper & paper products	1.01 for Food, beverages, tobacco		Quarterly data: 1990.02 –95:12	Export supply function using cointegration. 7 sectors.

Notes: RULC stands for Relative unit labour cost, NS stands for not significant.

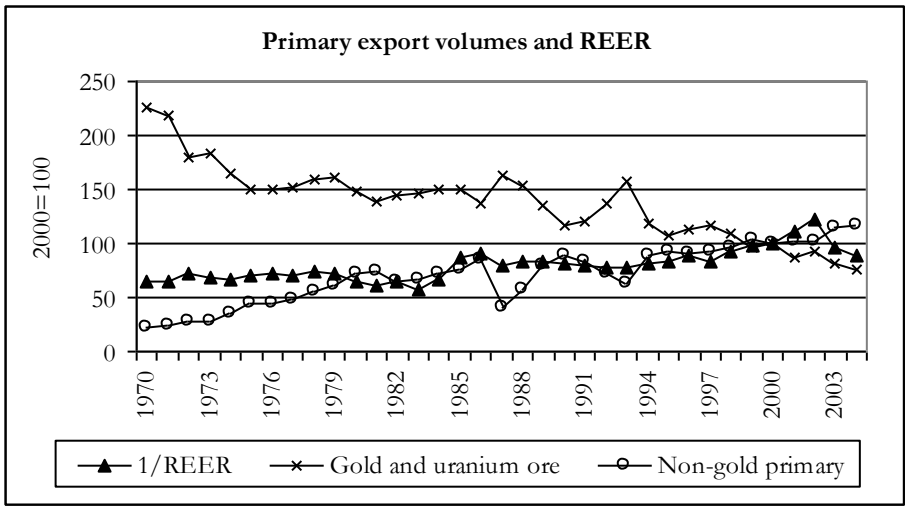
From the mid-1980s, the composition of South African exports changed substantially, to some extent corresponding with the mid-1980s depreciation. Gold volumes continued to decline and growth in non-gold primary exports moderated but exports of manufactured goods surged. In particular, export growth of non-commodity manufactures rose from 1 percent per annum from 1975-85 to 14 percent per annum from 1985-95. Annual export growth in commodity manufactures only rose from 3 percent to 5 percent over these periods.

Figure 4
Manufacturing export volumes and REER (2000 = 100)



Source: Trade data from Quantec (2005). REER from Edwards and Lawrence (2006)

Figure 5
Primary product export volumes and REER (2000 = 100)



Sector-level variation in export responsiveness to the REER is also reflected in estimates of the REER elasticity. As Table 2 shows, both panel data estimation (Edwards and Golub, 2003, 2004; Alves and Edwards, 2006; Edwards and Lawrence, 2006) and time series estimation on aggregated data (Smal, 1996; Edwards and Lawrence, 2006) have been used.

These estimations reveal several trends. Firstly, primary product exports are less responsive to REER shocks than manufacturing exports. Smal (1996) estimates REER elasticities of -0.3

for minerals and -1.4 for manufacturing. Similarly, Edwards and Lawrence (2006) find that non-gold merchandise exports (including manufacturing) are less responsive to exchange rate shocks (elasticity of -0.6 to -0.9) than manufacturing alone (-1.4).

The REER elasticity also differs across manufacturing sectors, although empirical research at this level is sparse. Using manufacturing industry panel data, Edwards and Golub (2004), Alves and Edwards (2006) and Edwards and Lawrence (2006) estimate average REER elasticities for various groupings of manufacturing sectors. While these groupings are not directly comparable, the export response in natural resource-based and machinery & metal product sectors is generally lower than in labour-intensive, chemical-intensive and beneficiated sectors.[5] Edwards and Lawrence's (2006) panel estimates also reveal greater export responsiveness in non-commodity based than commodity based sectors. Relatively rapid growth in non-commodity based exports during the 1990s can in part be attributed to real currency depreciation.

Table 2

Price responsiveness of South African exports by sector groupings

Author and Sector	REER elasticity	REER measure	Notes
Smal (1996)			
Merchandise	-0.6		1985q1-1994q4
Manufacturing	-1.4		1985q1-1994q4
Minerals	-0.3		1985q1-1994q4
Edwards and Golub (2003, 2004)			
Manufacturing	-1.7 to -1.6	REER based on ULC	1970-97. Panel of 28 firms. Mean group estimator
Natural resource	-1.29		1970-97, DFE
Labour-intensive	-2.68		1970-97, DFE
Chemical-intensive	-2.55		1970-97, DFE
Machinery & metal products	-1.52		1970-97, DFE
Alves and Edwards (2006)			
Manufacturing	-1.8 to -2.5	REER based on domestic	1980-99, 1970-99. Panel of
Beneficiated	-2.3	producer prices and	28 firms. DFE
Natural resource	-1.5	foreign output and import	1970-99, DFE
Machinery & metal products	-0.79 (NS)	prices	1970-99, DFE
Labour-intensive	-4.1		1970-99, DFE
Edwards and Lawrence (2006)			
Non-gold merchandise	-0.6 to -0.9	REER using producer prices	1975q1-2004q1, 1963-04. VECM model
Manufacturing	-1.4		1971-04, VECM
Non-commodity manufacturing	-1.3		1971-04, VECM
Commodity manufacturing	-1.6		1971-04, VECM
Manufacturing	-1.1	NEER/Sector producer price	1990-2002, Panel 44 sectors, Fixed Effect
Non-commodity manufacturing	-2.1		1990-2002, Panel 28 sectors, Fixed Effect
Commodity manufacturing	0.4 (NS)		1990-2002, Panel 16 sectors, Fixed Effect

Notes: DFE refers to dynamic fixed effects estimator. VECM refers to Vector Error Correction Model. NS refers to not significant.

2.2.3 Export supply and demand

Estimates using the reduced form equation above provide little insight into the mechanisms through which the exchange rate affects exports. For example, a depreciation may boost exports by raising the profitability of supply, lowering the foreign currency price of South African exports or both. As noted earlier, different mechanisms have significantly different policy implications.

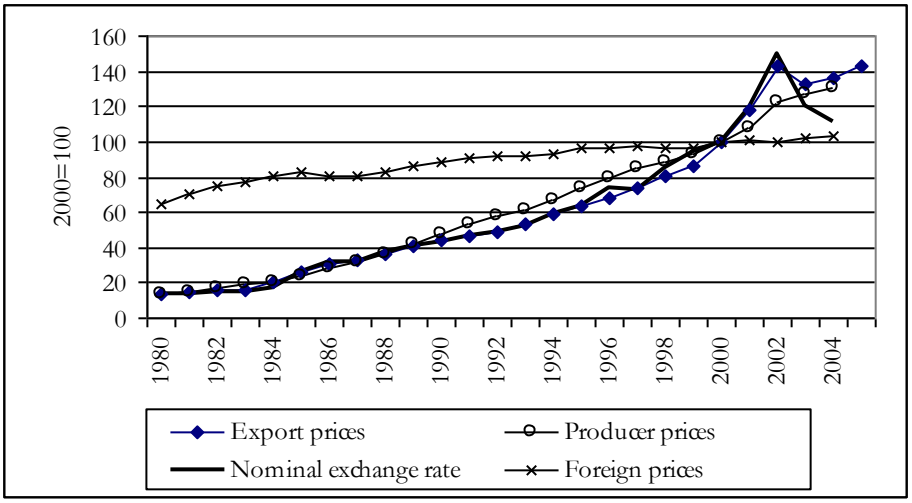
South African empirical evidence indicates that exporters of manufactured goods are generally price takers in the international market (Edwards and Willcox, 2005; Alves and Edwards, 2006). South Africa's share of world manufacturing exports is less than 0.5 percent, so changes in South Africa's export volumes are unlikely to impact on world prices. This is reflected in Figure 6, which plots indices (2000 = 100) of the non-gold merchandise export unit value (PX) the domestic producer price (PPIDOM), the nominal effective exchange rate (NEER) and a weighted average index of foreign producer prices (PPIF). In particular, export prices closely follow the nominal exchange rate prior to 2002, as predicted by our small-country model (Figure 1), in which a depreciation leads to an equivalent increase in export prices (in local currency units).

Econometric estimates are consistent with the above observations. Edwards and Willcox (2003) and Alves and Edwards (2006) estimate the export demand function normalised on export prices.[6] In the small country case, this reduces to a simple purchasing power parity relationship[7]:

$$\ln P_x = \beta_1 \ln e + \beta_2 \ln P^* \qquad (2)$$

where e is the R/foreign currency exchange rate, P^* is the foreign price and $\beta_1 = \beta_2 = 1$. Edwards and Willcox (2003) use aggregate data for manufacturing and non-gold merchandise exports and find nominal exchange rate elasticity (β_1) not significantly different from one, which is consistent with small-country price-taking behaviour. Alves and Edwards (2006) find similar results using manufacturing panel data over 1970-99, although the results are sensitive to the grouping of sectors, the period of analysis and the foreign price variable.

Figure 6
Export price pass-through relationship



Notes: The nominal effective exchange rate and foreign producer prices are constructed using the countries and weights used in the construction of the Reserve Bank REER.

This implies that South African non-gold merchandise export growth is supply driven and exporters respond positively to improvements in export profitability, whether induced by

increased export prices or lower production costs. Policy interventions such as lowering tariffs on intermediate inputs and improving infrastructure are thus effective ways of boosting exports (Alves and Edwards, 2006; Edwards and Lawrence, 2006). A real depreciation raises profitability by improving the export price received, but such depreciations may be not be possible for policy-makers to induce and may hurt consumers by raising traded goods' prices.

Export growth is also not constrained by inelastic foreign demand or South African producers' inability to price competitively in the export market (Alves and Edwards, 2006). Market access and foreign tariff reductions thus improve export performance if they raise the price exporters receive (in the domestic currency) but have little effect in the absence of price changes (Alves and Edwards, 2006). Similarly, improved market access for products that are supply constrained will yield few results.

2.2.4 Exports, exchange rates and inflation

The increased export supply arising from a nominal depreciation is, however, only sustained if domestic inflation does not erode the increased profits (see Figure 2). Equivalently, the nominal depreciation will only lead to sustained increases in export volumes if it results in a real depreciation.[8]

South African evidence suggests that historically a nominal depreciation has not led to a sustained improvement in export profitability. This is already evident in Figure 6, which shows domestic prices rising with the nominal exchange rate, although with less volatility. Jonsson (1999), Edwards and Willcox (2003) and Edwards and Lawrence (2006) also find that domestic producer prices are very responsive to the exchange rate in the long run. Their studies estimate that a 1 percent rise in aggregate foreign prices, resulting from a depreciation or foreign inflation, raises aggregate domestic producer prices by 0.85 to 1 percent in the long-run.[9] Aron, *et al.*, (2000) reach similar conclusions. The implication is that *inflation and wage growth undermine the positive impact of exchange rate depreciation on export performance in the long-run*.[10]

2.2.5 Volatility of the exchange rate

Theory predicts that volatility, combined with risk aversion, will reduce incentives to export and import. Todani and Munyama (2005) explicitly test this relationship for aggregate exports and for goods exports. They find that the former are unaffected by export volatility, while the latter are significantly affected. Both results, however, are highly sensitive to variable specification. Kumo (2006) finds a negative relationship between real exchange rate volatility and gross private investment. This suggests a negative relationship between exchange rates and exports, through the channel of investment.

The 2006 IMF country report for South Africa considers the aggregate relationships between volatility and trade flows. The report finds that volatility reduces exports, export growth, imports and import growth, at the sector and aggregate level. However, these relationships are neither robust to alternative model specifications nor statistically significant.

2.2.6 Other factors

Numerous other political and economic factors influence trade trends. Alves and Edwards (2006) ascribe part of South Africa's poor export performance compared to other middle-income economies to the collapse in infrastructure investment during the 1980s. Edwards and Golub (2004) find that South African unit labour costs are high relative to other developing countries and that the combination of improved labour productivity and wage moderation improves manufacturing export performance. Edwards and Lawrence (2006) find that the improvement in manufacturing exports during the 1990s, particularly in non-commodity sectors, is partly attributed to a falling anti-export bias arising from trade liberalisation.

Tsikata (1999) also finds that tariff liberalisation has boosted export volumes. Export growth during the late 1980s is also consistent with the 'vent-for-surplus' hypothesis (Fallon and Pereira de Silva, 1994), although excess capacity appears less important during the 1990s.

3. The exchange rate and import performance

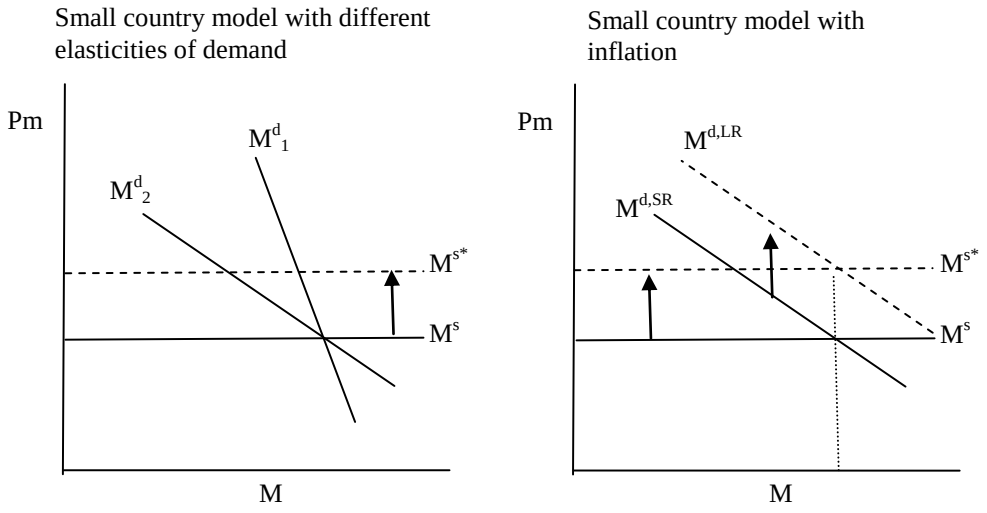
3.1 A simple model

Our simple export model is easily adapted to imports. Figure 7 shows the impact of exchange rate depreciation on import volumes and values, with the small-country (price-taking) assumption imposed (shown by the horizontal import supply curves). This assumption is common to most international and South African studies of the determinants of import volumes. Support for this assumption in South Africa is also provided by Ramkolowan (2005).

As with exports, a depreciation raises the rand price of imports by an equivalent amount (represented in Figure 7 by the import supply curve's upward shift from M^s to M^{s*}). The impact on the rand value and volume of imports depends on the price elasticity of import demand and the inflationary impact of the devaluation. Where few domestic substitutes are available, import demand is likely to be inelastic (e.g. M^d_1) and import volumes will decline only moderately. If the price elasticity of import demand is less than 1, the rand value of imports will actually increase. Where domestic substitutes are available and import demand is price elastic (M^d_2), the value and volume of imports will decline.

The decline in import volumes will be short lived if the price of domestic substitutes rises in response to the depreciation. Such price rises may occur in response to increased demand or increased production costs, due to wage inflation and/or rising prices of imported intermediate goods. Rising domestic prices offset the depreciation-induced relative price shift and are represented by a shift outward of the M^d curve. In the long-run, domestic inflation may completely erode the impact of the depreciation on import volumes, as is shown in the second diagram of Figure 7.

Figure 7
Exchange rates and import volumes



3.2 Empirical evidence

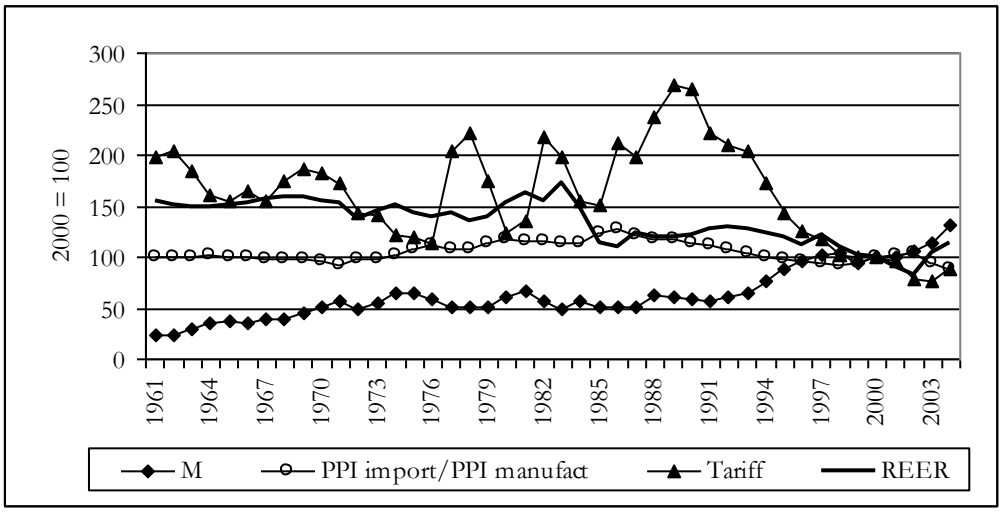
Figure 8 depicts trends in import volumes and various price measures over the period 1961-2004. We expect import volumes to be affected negatively by tariffs, negatively by increases

in the relative price of imports to manufacturing (*PPI import / PPI manufact*) and positively by REER appreciation. The graphical evidence does not support the expected negative REER relationship: import volumes stagnated in the 1980s while the REER appreciated and rose in the early 1990s while the REER depreciated.

Trends in import volumes are, however, consistent with changes in the relative price of imports and tariff protection. Import stagnation during the 1970s and early 1980s coincided with rising prices of imports relative to domestic goods, brought about by rising commodity prices in the early 1970s and nominal rand depreciation from 1983. Relative prices of imports fell towards the late 1980s as the rand appreciated, but imports remained stagnant, partly due to collapsing investment and the imposition of surcharges (Edwards and Lawrence, 2006). Post-1990 import growth appears driven by declining protection and a recovery in domestic expenditure, including investment.

Overall, import trends are consistent with changes in relative prices, including those induced by exchange rate movements. However, the exchange rate alone does not explain import volumes, with factors such as tariffs and gross domestic expenditure also relevant.

Figure 8
Import volumes and relative prices



Source: Edwards and Lawrence (2006)

There are far fewer empirical estimates of the effect of the REER on imports than on exports. However, the available evidence, presented in Table 3, is broadly supportive of the prediction that a real depreciation reduces import volumes.

The strength of this relationship varies greatly between studies.[11] Smal (1996), using quarterly data for 1984-1995, finds import price and income elasticities of demand of -0.85 and 1.47, respectively, while Edwards and Willcox (2003) find competing figures of -1.59 and 1.92 for 1972-2001. Golub (2000) finds that the import price elasticity ranges between 0.05 and -0.32 and the income elasticity between 0.93 and 1.04, depending the weighting used to calculate the real exchange rate. Edwards and Lawrence (2006) find more elastic import price elasticities when measuring relative prices by the import producer price index (-1.72) than the import unit value (-0.71). The former includes the effect of tariffs, suggesting that trade policy influences import volumes. Estimated price elasticities also vary across sectors: lower for capital-intensive goods than labour-intensive goods (Gumede, 1999, 2000).

These partial elasticities, however, exaggerate the long-run import impact of a nominal depreciation. Ramkolowan (2005) estimates a system of equations incorporating an import demand equation and a domestic price equation. His results are presented below:

$$p^* = p^f + e$$
$$p^d = 0.91p^f + 0.7e + 0.12nulc + 1.25tariff$$
$$m^d = 0.78p^d - 0.71p^* + 0.84y - 2.08tariff$$

where p^f is foreign price, *nulc* is nominal unit labour cost, p^d is domestic producer price (excluding imports), *y* is domestic income, *e* is the nominal effective exchange rate and *tariff* equals 1 plus the collection rate.

Like other studies, he finds that import demand is sensitive to import prices and domestic prices. Rising import prices (induced by a depreciation or rise in world prices) reduce import demand (elasticity = - 0.71) and domestic inflation raises import demand (elasticity = 0.78). However, the reduction in imports from a nominal depreciation is eroded by the subsequent inflationary impact. Domestic prices rise by 70% of the depreciation.[12] The net effect on imports of a 1 percent nominal depreciation in the long-run is therefore close to zero.

Thus, for both exports and imports, real exchange rates matter, but changes in the nominal exchange rate that are eroded by inflation have little long-run impact on trade volumes.

Table 3
Import demand studies for South Africa

Study	Price Elasticity	Income Elasticity	Period	Comment
Ramkolowan (2005)	-0.71	0.84	1962q1 – 2003q2	Johansen cointegration technique
Edwards and Lawrence (2006)	-0.87 to -1.72	Approx 1	1962Q1 – 2004Q3	Johansen cointegration technique
Bahmani-Oskooee and Niroomand (1998)	-0.53	0.43	1960 – 1992 Annual Data	Johansen cointegration technique for 30 countries
Edwards and Willcox (2003)	-1.59	1.92	1972Q1 – 2001Q4, Quarterly Data	Johansen cointegration technique
Golub (2000)	-0.05 to-0.32	0.93 to 1.04		Ordinary Least Squares, using varying effective exchange rate measures
Gumede (2000)	-0.71 for capital intensive goods -3.00 for labour intensive goods -1.56 total	1.06 total	1960 – 1996 Quarterly	Engle-Granger cointegration approach
Narayan and Narayan (2003)	-0.61	1.19	1960 – 1996 Quarterly Data	Bounds test cointegration approach
Senhadji (1997)	-1.00 in the long-run -0.44 in the short run	0.68	34 observations	Fully modified (FM) estimators using Monte Carlo method for 77 countries
Smal (1996)	-0.85	1.47	1985Q1 – 1994Q4, Quarterly Data	Ordinary Least Squares using non-oil imports
Bahmani-Oskooee (1998)	-1.37	2.174	1973-1990 Annual data	Johansen cointegration technique
Golub and Ceglowski (2002)	-0.48 to -1.05	1.06 to 1.88	1970- 1980 Annual data	OLS
Fallon and Pereira de Silva (1994)	-0.74 to -1.46	1.12 to 1.61 for GDP ΔInv/GDP = 0.53	1960 – 90 Annual data	OLS

4. The exchange rate and the trade balance

Weakening the currency is often seen as an important mechanism through which to boost exports, reduce imports and hence improve the trade balance. As will be shown below, the trade balance does not necessarily improve and the effect may differ in the short and the long run.

4.1 Theoretical model

To relate the exchange rate to trade flows and the trade balance, we follow the widely-used elasticities approach.[13] The effect of a devaluation of the currency on the balance of trade (B), measured in domestic currency, depends on how the value of exports (P_xX) and imports (P_mM) respond to this devaluation. This can be represented as

$$\frac{\Delta B}{\Delta e} = \frac{\Delta(P_x X)}{\Delta e} - \frac{\Delta(P_m M)}{\Delta e}$$

where Δ reflects 'change', e is exchange rate, P_x is the price of exports, X is the quantity of exports sold, P_m is the price of imports and M is the consumption of imports.

The impact of the depreciation on the trade balance thus depends on how trade volumes (X and M) and prices (P_x and P_m) respond to a depreciation. The models developed provide some insight into the effect. Figure 1 shows that, unless the export demand is perfectly inelastic, depreciation raises P_x and/or X and hence has an unambiguous positive effect on the trade balance (P_xX). The extent of this increase depends on the price elasticities of supply and demand. For a small country, where export demand is perfectly elastic, the value of exports in domestic currency will rise by at least the extent of the depreciation. For economies facing inelastic foreign demand curves, the depreciation will raise the value of exports by less than the extent of the depreciation.

The change in the value of imports in response to a depreciation is, however, ambiguous. As shown in Figure 7, the depreciation reduces import volumes (M), but raises the import price (P_M). The overall effect on the value of imports is therefore ambiguous. In the small country case, for example, the value of imports (in domestic currency) will rise if the import elasticity of demand is less than 1.

The impact on the trade balance is therefore ambiguous and depends on the price elasticities of demand for imports and exports. Table 4 presents the range of possible outcomes, using the standard Bickerdike-Robinson-Metzler (BRM) condition.[14]

Two cases are particularly important. The case of elastic supply is the well-known Marshall-Lerner (ML) condition: the overall effect on the trade balance of a nominal depreciation is positive if and only if the sum of the absolute values of the price elasticities of demand for imports and exports is greater than one. The small country case (inelastic supply) is characterised by an unambiguous improvement in the trade balance (normalised by the value of imports) in response to a depreciation.

However, the BRM condition makes a number of restrictive assumptions that may distort the relationship between exchange rates and the trade balance. Firstly, domestic price levels are assumed to remain constant. As discussed above, increases in domestic prices arising from a depreciation erode the initial changes in export and import volumes. The long-run impact of a depreciation on the trade balance may therefore be zero.[15]

Table 4
Variations in the impact of a depreciation on the trade balance

	Small country	**Elastic supply**	**Inelastic demand**	**Elastic demand**
Export demand elasticity (E_{DX})	$-\infty$	-	0	$-\infty$
Import demand elasticity (E_{DM})	-	-	0	$-\infty$
Export supply elasticity (E_{SX})	+	∞	+	+
Import supply elasticity (E_{SM})	∞	∞	+	+
Impact on trade balance	+	Ambiguous. + under balanced trade if $\lvert E_{DX} + E_{DM} \rvert > 1$	-	+

Note: Above relationships assume balanced trade and evaluate the effect on the trade balance normalised by the import value.

A further complication arises when the possibility of lagged responses to exchange rate movements is considered. Such lags may arise for a number of reasons. Junz and Romberg (1973) ascribe such delays to contractual lock-in – many import and export contracts cannot be immediately renegotiated, slowing traders' responses to exchange rate movements. Krueger (1983) focuses on the role of prices, arguing that prices specified in price and wage contracts are contractually fixed and hence sticky in the short-term. Magee (1973) also notes that consumers and producers may be slow to update information and may only switch purchasing decisions after a time lag.

These analyses raise the possibility of a "J-curve" response to a nominal exchange rate depreciation. In this case, the short-term impact on the trade balance is negative, as export volumes and prices are fixed but import prices are rising. In the medium-term, however, export volumes rise in response to the depreciation, cancelling the initial trade balance deterioration.

4.2 Empirical evidence

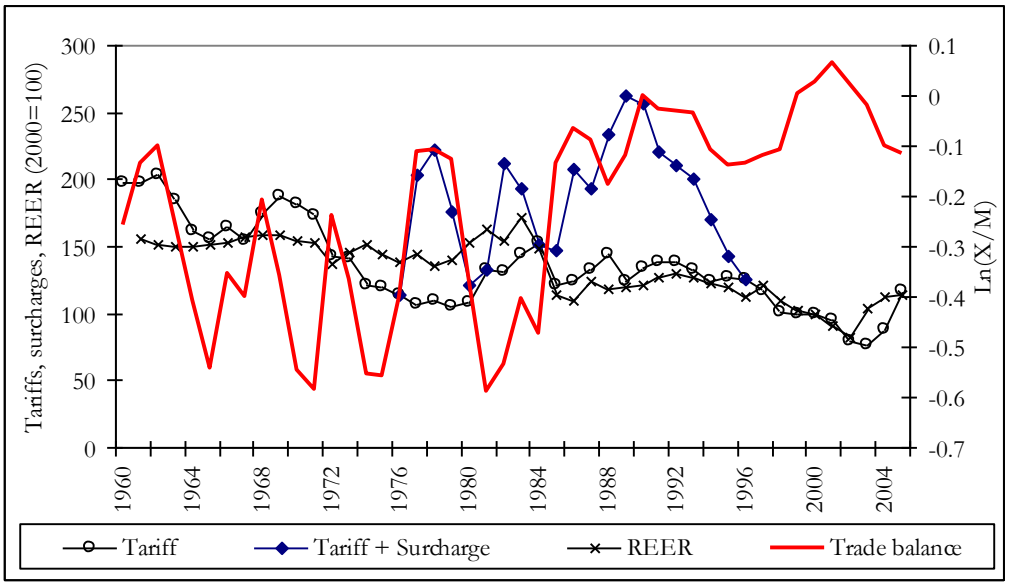
Figure 9 presents trends in the trade balance (ln(exports/imports)), REER, collection rates (Tariff) and surcharges from 1960 to 2004. The non-gold merchandise trade balance is highly volatile, with no clear trend during the 1960s and 1970s. As a result, there is no clear relationship between the trade balance and the REER or collection rates during these periods. However, the rise in surcharges in 1976 in response to capital outflows, was effective in improving the trade balance.

From the 1980s we see a clearer relationship between the REER and the trade balance. The currency appreciation in response to the gold boom in the late 1970s and early 1980s, led to a deterioration of the trade balance. The reversal in 1984/85 corresponds closely with the substantial real depreciation following the Rubicon speech and the subsequent debt crisis. The imposition of surcharges of 10% in September 1985, followed by further surcharges of up to 60% on luxury goods in 1988, contributed to the improved trade balance by severely restricting imports.

The trade balance fluctuated without a clear trend in the 1990s, worsening in the first half of the decade and improving from 1996 to 2002, after which it fell again. We see no close association between these trends and falling protection, achieved through lower tariffs and surcharge removals. In contrast, the improving trade balance from the mid-1990s corresponded with the real depreciation until 2001, while the subsequent worsening of the trade balance corresponded with a real appreciation.

These trends suggest that: (a) a real depreciation improves the trade balance, (b) a rise in surcharges has in the past corresponded with an improved trade balance and (c) there is no clear relationship between changes in tariff protection and the trade balance. The latter result suggests that the rise in imports from tariff liberalisation is offset by export growth (Edwards and Lawrence, 2006).

Figure 9
Non-gold merchandise trade balance and the REER



The empirical evidence generally supports the positive relationship between the trade balance and a real depreciation of the rand. Two approaches have been followed in the South African literature.

In the elasticities approach, the estimated export and import elasticities are applied to the BRM condition. As discussed earlier, South African exporters are generally price takers in the international market. Drawing on the BRM condition, the elasticity of the trade balance (normalised by the value of imports) with respect to currency depreciation is then given by:

$$\frac{V_X}{V_M} E_{SX} - E_{DM}$$

where V_X and V_M denote the value of export and imports, respectively. Using the estimated import demand elasticity of -0.8 from Edwards and Lawrence (2006) and Smal (1996), the estimated export supply elasticity of 1.15 for non-gold merchandise exports from Edwards and Willcox (2003) and the ratio of export value to import value for 2005 (0.88) into this equation, gives an exchange rate elasticity of the trade balance equal to roughly 1.8. This implies that a 1 percent depreciation improves the non-gold merchandise trade balance by 1.8 percent of the value of imports in the long-run. The manufacturing trade balance, with its larger export elasticities, will be more responsive.

However, this estimation assumes zero inflationary impact from a depreciation. Modifying the BRM condition to allow for inflation reduces the estimated elasticity to between zero and one half.[16] Real depreciations, not nominal depreciations, therefore matter for the trade balance.

Edwards and Lawrence (2006) find a similar result by estimating a simple trade balance equation using a panel of data for 44 manufacturing industries for 1990-2002. Their equation is

$$TB_{it} = \mu_i + \beta_1 TAR_{it} + \beta_2 ADVALOR_{it} + \beta_3 REER_{it} + \beta_4 VOL_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

where *TB* is the trade balance measured as ln(export value/import value), *TAR* is a measure of tariff protection using scheduled tariff rates (tariff rate, effective rate of protection, export tax), *ADVALOR* is a measure of the complexity of the tariff schedule (the proportion of HS 8 digit tariffs within each sector that are *ad valorem*), *REER* is the relative price index calculated as the SA PPI relative to US PPI price (measured in common currency), and *VOL* is an index of domestic production per sector. In addition to these variables, they include sector fixed effects (μ_i) and time fixed effects (λ_t). Table 5 presents their preferred estimate of the trade balance relationship.

A depreciation of the bilateral real exchange rate *vis-à-vis* the USA improves the trade balance, but mainly for non-commodity manufactures. A 1 percent depreciation is estimated to raise the value of exports relative to imports by approximately 0.7 percent. However, they find no such relationship for commodity exports where the coefficient is negative, although mostly insignificant. The negative coefficient on commodities may reflect the rise in commodity exports and appreciation of the rand corresponding to commodity booms.[17] They also find ambiguous impacts of trade policy on the trade balance. Surcharges improve the trade balance by reducing import volumes, but tariffs on intermediate inputs (export taxes) also worsen the trade balance by reducing export volumes.

Table 5
Determinants of manufacturing trade balance

	Nominal tariffs and export taxes		
	All sectors	**Commodities**	**Non-commodities**
	Coef.	**Coef.**	**Coef.**
Tariff	-1.26 ***	-0.75	-0.05
Export tax	-0.19	-0.20	-1.28 ***
ERP			
Surcharges	2.00 **	6.27 ***	3.05 ***
Advalorem	-0.07	-0.38	0.39
REER	-0.25 ***	0.82 ***	-0.72 ***
Volume	-0.09	-1.47 ***	0.46 ***
K/L	0.00 **	0.00 **	0.00
Skill share	1.18	-16.56 ***	12.87 ***
DMIDP	0.37 ***		-0.12
F-statistic	7.43 ***	4.84 ***	14.7 ***
obs	572	208	364
groups	44	16	28

Source: Edwards and Lawrence (2006). DMIDP is a dummy for the Motor Industry Development Programme.

5. Further research

While the breadth and depth of research into the exchange rate-trade balance relationship has expanded significantly in recent years, several areas require further attention.

The long-run impact of exchange rate movements on exports and, in particular, imports is still not entirely clear. The impact of endogenous domestic prices and wages on the long-run

equilibrium is particularly important. Furthermore, the short run dynamics and the possibility of a J-curve effect are not fully understood.

There is room for considerably more disaggregated research at the firm- or sector-level. However, firm level studies are constrained by the lack of sufficient data over time, suggesting the need for a comprehensive panel study of South African firms involved with or affected by exports and/or imports.

Some studies have examined the impact of exchange rate movements on commodity and non-commodity exports but the import side remains under-researched. There is room for further disaggregation of both exports and imports. The effect of depreciation on the trade balance may also vary significantly across countries or regions. Trade balance equations using bilateral trade and exchange rate data are easily conducted, but to our knowledge have not yet been done for South Africa.

Moreover, studies of the impact of exchange rate volatility on exports are scarce and the impact of such volatility on imports is almost entirely unknown. The possibility of an asymmetrical relationship between exchange rate movements and prices has received no attention in the South African literature. There is therefore considerable scope for further research in this area.

6. Conclusions and policy recommendations

This paper reviews existing empirical literature on the exchange rate-trade performance relationship in South Africa, measuring trade performance in terms of imports, exports and the trade balance. Several conclusions emerge from this review.

Trade flows and the trade balance are sensitive to changes in the real exchange rate. A real depreciation is effective in raising export volumes, reducing import volumes and improving the trade balance. A real depreciation is also effective in diversifying exports away from primary commodities towards manufacturing and particularly non-commodity manufacturing.

However, nominal depreciations are unlikely to have a sustained impact on trade flows if the depreciation is eroded by domestic inflation and wage increases. Historically, this has often been the case.

The review also provides insight into the determinants of trade flows. Non-gold exports respond positively to improved profitability of export production. A currency depreciation may achieve this by raising the price received by exporters. However, this may not be the optimal approach to improving export performance. The depreciation feeds into domestic inflation, putting upward pressure on interest rates, as well as raising the cost of imported capital, intermediate and final goods.

Policy should rather focus on factors that constrain export and import growth. In this regard, this paper presents evidence that South African exports are not demand constrained but rather supply constrained, by factors such as infrastructure availability and the relative profitability of export supply. As argued by Edwards and Golub (2004), profitability of export production can be improved by enhanced productivity growth combined with wage moderation. South Africa unit labour costs are low relative to developed economies but high relative to developing countries. Policies that encourage productivity improvements and wage moderation will thus enhance export growth.

Trade policy may further enhance trade flows. Edwards and Lawrence (2006) find strong evidence that restrictive trade policy during the 1980s constrained imports, exports and export diversification. Liberalisation during the 1990s has encouraged growth in imports and exports, particularly of non-commodity manufactures, but has not harmed the trade balance. This increased openness has the additional benefit of reducing vulnerability to commodity price shocks; previously a common problem for the South African economy. Tariff reductions

and increased openness also lower the cost of access to foreign technology and induce productivity gains through increased international competition (Belli, *et al.*, 1993); Fallon and Pereira de Silva, 1994; Jonsson and Subramanian, 2001; Fedderke, 2006 and Harding and Rattsø, 2005).

A focus by policy makers on the fundamentals, including those affecting the real exchange rate, is likely to yield superior trade responses to policies concentrating on the exchange rate alone.

Endnotes

1. A small country faces a fixed P^*, hence P_x (= eP^*) rises by the full depreciation. P^* is not fixed for a large country and falls due to the depreciation; hence P_x rises by less than the depreciation.
2. We abstract away from other important macroeconomic relationships, such as currency movements in response to trade surpluses or deficits.
3. Let $X^s = X^s\left(P_x / P_d, \Omega\right)$, where Ω represents other factors influencing export profitability, and $X^d = X^d\left(P_x / eP_d^*, Z\right)$ where Z represents other factors influencing export demand. Solving for $X^s = X^d = X$, yields the reduced form equation. See Alves and Edwards (2006) for the full derivation.
4. Edwards and Lawrence (2006) define commodity manufactures as having a high share of primary commodity inputs in their total costs. They include: Coke & refined petroleum, Food, Tobacco, Basic iron & steel, Other manufacturing, Non-metallic minerals, Wood & wood products, Basic chemicals, Basic non-ferrous metals and Glass & glass products. Non-commodity manufactures are all remaining manufacturing sectors.
5. In general, beneficiated manufactures consist of Iron & steel, Chemicals and Non-ferrous metals. Natural resource-based manufactures include beneficiated products, Paper products and Food, beverages & tobacco. Metal products include Metal products, Machinery & equipment, Electrical machinery, Motor vehicles and Other transportation equipment. Labour-intensive products include Textiles, Wearing apparel, Footwear, Leather and Furniture.
6. These studies explicitly deal with endogeneity problems associated with estimating systems of supply and demand equations. Most studies estimate either the demand or supply relationship and therefore may suffer from simultaneous equation bias.
7. See Alves and Edwards (2006) for the relevant derivations.
8. If a nominal depreciation induces an equivalent increase in domestic prices, the real exchange rate (P/eP^*) is unaffected.
9. Nell (2000), Aron, *et al.* (2003), Kaseeram, *et al.* (2004) and Fedderke and Schaling (2005) find lower price effects, but they do not estimate a simple purchasing power parity relationship so their results are not directly comparable.
10. Kaseeram, *et al.* (2004) and Fedderke and Schaling (2005) find a positive two-way relationship between unit labour costs and inflation in South Africa.
11. These studies generally estimate a simple import demand function of the form $M = \alpha_0 + \alpha_1 RP + \alpha_2 Y + \alpha_3 \Omega$, where M is import volumes, RP is relative price (REER import prices relative to domestic prices), Y is domestic income (GDP or gross domestic expenditure) and Ω represents other variables (tariffs, infrastructure, etc.).
12. Ramkolowan (2005) estimates that a 1 percent nominal depreciation raises manufacturing producer prices by 0.7 percent in the long run. Jonsson (1999), Edwards and Willcox (2003) and Edwards and Lawrence (2006) report estimates ranging up to 1.
13. Other means of analysing this relationship include the absorption and monetarist approaches. The absorption approach maintains the national income accounting identity so a devaluation improves the trade balance if the substitution towards consumption of domestic goods boosts output more than absorption. The monetarist approach regards a balance of payments deficit as entirely a monetary phenomenon, caused by excessively expansionary monetary policy.
14. See Edwards and Willcox (2003) for further details.
15. If the trade balance is initially in deficit, a depreciation will worsen the deficit (measured in local currency), even though trade volume in unchanged, and *vice versa* for a trade surplus. However, under balanced trade (or if we normalise the trade balance on import values), a depreciation will have no effect on the trade balance when trade volumes do not change.
16. The modified condition can be written as: $(1-\eta)(V_X/V_M E_{SX} - E_{DM})$ where η is the responsiveness of domestic prices to a depreciation. To obtain the above range, we assume η = 0.75, in line with Edwards and

Lawrence (2006) and Ramkolowan (2005), and $\eta = 1$, as found by Jonsson (1999) and some of the estimates of Edwards and Lawrence (2006).

17. See Bell *et al*. (1999) on changes in the commodity composition of manufacturing in response to commodity price cycles.

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