South African Journal of Economics Vol. 74:3 September 2006

SOUTH AFRICA'S EXPORT PERFORMANCE: DETERMINANTS OF EXPORT SUPPLY

LAWRENCE EDWARDS AND PHIL ALVES*

Abstract
This paper presents both a comparative analysis of South Africa's export structure and performance and an econometric investigation of the determinants of export volumes. The paper finds that the improved growth and diversification of South African manufactured exports during the 1990s lag those of East Asia and a few other resource-based economies. This performance in part reflects relatively low world growth in resource-based products, but factors that affect the profitability of export supply, such as the real effective exchange rate, infrastructure costs, tariff rates and skilled labour, are also shown to be important. Export demand and the ability to compete in the export market on the basis of price are not found to be a major constraint to export growth.
JEL Classification: F10, F14, C33
Keywords: Export determinants, South Africa, Panel estimation

1. INTRODUCTION

In 1994, the new democratically elected government inherited an economic system characterised by declining economic and employment growth. In response to these pressures, the government initiated a number of policy reforms to stimulate growth, employment and redistribution. The macroeconomic reforms were encapsulated in the Growth, Employment and Redistribution macroeconomic policy (GEAR) strategy. In addition to encouraging growth and employment, this strategy aimed to transform South Africa into a "competitive, outward orientated economy" (RSA, 1996). Measures to reduce unit costs and an exchange rate policy to keep the real effective exchange rate stable at a competitive level formed key components of this strategy. To differentiate itself from the previous protectionist government, the new government agreed to an ambitious trade liberalisation program, jointly negotiated with the Apartheid government during the Uruguay Round of (the then) General Agreement on Tariffs and Trade negotiations. Average tariffs in manufacturing subsequently fell from 23% in 1994 to 8.6% in 2004 (Edwards, 2005). Numerous other policy changes relating to labour markets and competition have also been implemented.

This paper evaluates the extent to which the composition and level of manufacturing exports have responded to these initiatives in the 1990s. We find that the successes of these policies in generating export growth have been mixed. Exports of manufactures have increased but not by enough to generate an export-led growth boom similar to those of East Asia and a few other, more resource-based economies. Moreover, South African manufactured exports remain resource-based and the country has lagged others in diversifying into new and fast growing export sectors. The inability to re-structure exports

* Senior Lecturer and researcher, respectively, at the School of Economics, University of Cape Town. We would like to thank Zeljko Bogetic and an anonomous referee for comments on an earlier draft of this paper. The World Bank provided financial assistance for this paper.

towards these dynamic high technology products is one explanation for the relatively poor export performance of South African manufacturing during the 1990s.

The paper also investigates the determinants of South African manufacturing export performance by estimating export supply and demand functions. The analysis finds evidence that South African manufacturers are on average price-takers in the international market and that exports are supply driven. Export growth is therefore not predominantly dependent on the economic prosperity of South Africa's trading partners or on their ability to compete in the export market on the basis of price. The constraints to export growth can be found in factors that negatively affect the profitability of export supply. The real effective exchange rate, infrastructure costs, tariff rates and skilled labour are found to be important determinants of export supply.

Section 2 investigates the changing composition of South Africa's exports and its dynamic export performance in a cross-country comparative perspective. Section 3 develops the export model used to identify the determinants of export performance. The results of the estimations are discussed in Sections 4 and 5. Finally, Section 6 contains concluding remarks and some policy implications.

2. SOUTH AFRICA'S EXPORT PERFORMANCE: A CROSS-COUNTRY COMPARISON

The ways in which export patterns change over time have profound implications for the relationship between trade on the one hand, and industrialisation and economic growth on the other. "Success in entering lines of production with significant potential for global demand expansion, high value added and rapid productivity growth widens the scope for the exploitation of increasing returns from larger markets, and enhances the role of trade in economic growth" UNCTAD (2002:52). In contrast, a high concentration of exports in sluggish global markets or activities with limited potential for productivity growth endangers growth processes.

This section, therefore, presents a comparative analysis of South Africa's export structure and performance using two different indicators of export dynamism. Following UNCTAD (2002), exports are analysed according to their global demand growth potential (market-dynamic products), and productivity growth potential (supply-dynamic products). We begin with the latter.

(a) Supply-dynamism

Performance in supply-dynamic products is assessed using a technology-based product classification, developed by Lall (2000), and used in UNCTAD (2002) and UNIDO (2004). Alves and Kaplan (2004) have applied the classification to South African data.

As shown in Table 1, exports are classified using 3-digit Standard International Trade Classification (SITC) data into primary products (PP), resource based manufactures (RB), low technology manufactures (LT), medium technology manufactures (MT) and high technology manufactures (HT). Primary products and resource-based manufactures tend to be unskilled-labour- and scale-intensive, and skill requirements tend to rise with the degree of technological complexity (see Lall (2000) for a complete description of each technology category).

Such a classification has a number of merits. "Since increased application of human capital and technology tends to raise labour productivity, such a classification can be

Table 1. The Technological Classification of Exports[1]

PRIMARY PRODUCTS	Fresh fruit, meat, rice, cocoa, tea, coffee, wood, coal, crude petroleum, gas, metals
MANUFACTURED PRODUCTS	
Resource based manufactures	
RB1: Agro/forest-based products	Prepared meats/fruits, beverages, wood products, vegetable oils
RB2: Minerals-based products	Ores & concentrates, petroleum/rubber products, cement, cut gems, glass
Low technology manufactures	
LT1: 'Fashion cluster'	Textile fabrics, clothing, headgear, footwear, leather manufactures, travel goods
LT2: Other low technology	Pottery, simple metal parts/structures, furniture, jewellery, toys, plastic products
Medium technology manufactures	
MT1: Automotive products	Passenger vehicles and parts, commercial vehicles, motorcycles and parts
MT2: Process industries	Synthetic fibres, chemicals and paints, fertilisers, plastics, iron, pipes/tubes
MT3: Engineering industries	Engines, motors, industrial machinery, pumps, switchgears, ships, watches
High technology manufactures	
HT1: Electronics and electrical products	Office/data processing/telecommunications equip, TVs, transistors, turbines, power generating equipment
HT2: Other high technology	Pharmaceuticals, aerospace, optical/measuring instruments, cameras
"SPECIAL" TRANSACTIONS	Electricity, cinema film, printed matter, art, coins, pets, non-monetary gold

Source: Lall (2000).

expected to provide a reasonably good guide to sectoral differences in the potential for productivity growth" (UNCTAD, 2002:66). In other words, the more skills and technology involved, the more growth is driven by productivity gains. Thus the ability of a country to shift exports into technologically complex products has important implications for the sustainability of long run output growth, once factor accumulation rates normalise. Technology intensive products also tend to grow faster in trade (see later): they tend to be highly income elastic, create new demand, and substitute faster for older products. (Lall, 2000:5). Therefore, there are important market demand reasons for diversifying into high technology products.

An economy's trade in high technology products is also an important indicator of a country's technological capabilities- the ability to seek, acquire, modify and adopt useful technologies – which, Lall (2000) argues are an important driver of comparative advantage and competitiveness. Technology capabilities are also likely to play a large role in attracting foreign direct investment (FDI), particularly high quality investment targeting the production of high value added, technologically complex products. For example, East Asia's high technology exports are largely driven and controlled by multinational corporations from Japan and the West, which have, over time, developed a tightly integrated set of production networks spanning many countries.

Finally, export structures tend to be "*path dependent and difficult to change*" (Lall, 2000:6), as they are the outcome of long, cumulative processes of learning, agglomeration, institution building and business culture. Assessing how quickly the

[1] This study moves non-monetary gold (SITC 971) from "special transactions" into the primary products category, and precious and semi-precious stones (SITC 667) from resource-based manufactures to primary products.

export structures of difference developing countries are changing over time may point to useful policy interventions that could be applied by the 'laggards'.

There are, however, number of important limitations to Lall's (2000) technology-based classifications. Firstly, there is no differentiation between product and process technological input (Abbot *et al.*, 1989). For example, electronic products are classified as high technology manufactures, but the final product is often assembled using relatively simple low-skill-intensive processes. Wood (2003, cited in UNIDO, 2004:9) also points out that resource-based development is not all low-technology, out-of-date or unsuccessful; some resource-based activities are hi-tech and technologically dynamic. Secondly, the aggregated 3-digit SITC categories used in the technology classification include products of different technological complexity (advanced mobile phones and simple plastic receivers) and different quality (fashion and. mass-produced clothing) (Lall, 2000).

Thirdly, technology-based classifications may only be informative to the extent that an economy's factor endowments enable diversification into technology-intensive products. The comparative advantage of most African economies lies in resource-based products and diversification into high technology products is currently neither feasible nor desirable (Wood and Mayer, 2001). Finally, increased production fragmentation in medium and high technology manufactures (e.g. electronic products), combined with cross-border trade of products at different phases of processing and production sharing exaggerate both the share and growth of high technology exports in many regions, such as the East Asia and Pacific (EAP) region. Despite these caveats, the approach is useful in providing insight into the changing technological structure of exports over time.

To evaluate South Africa's comparative export performance, we draw on export data, obtained from UNComtrade, for 98 countries for which data were available for 1988 and 2002.[2] South African export data are sourced from Customs and Excise, the Minerals Production and Sales Statistics database, the South African Reserve Bank (SARB) and the South African Department of Trade and Industry. Together these 98 countries account for 94.5% of the total available value of exports (129 countries) in 2002. All data are measured in current US dollars.

Table 2 presents the relevant export data, including the sectoral composition of South African exports in 1988 and 2002 and the average annual growth in exports for South Africa and selected regions between 1988 and 2002. Only the simple average growth rates for countries within each region are presented, as the conclusions derived from weighted averages or median growth rates are very similar. Finally, a "Resources Group", comprised of twenty-five countries with similar shares of natural resource dependent products (primary products + resource-based manufactures) in total exports to South Africa in the late 1980s, is also included.[3] See the Appendix for more details on the selection process.

The following caveats regarding this group of countries are important to bear in mind. First, they do not comprise a group of countries from a single natural geographic region, or a group of countries with similar policy histories and current policy frameworks.

[2] Data in 2002 for Thailand and Bangladesh were missing, so the average of 2001 and 2003 was used. Major oil exporters are excluded. Due to irregular data SITC 286, 323, 333, 334, 675 and 688 are excluded. These make up a small percentage of overall exports.

[3] Most of the countries are low- and middle-income countries from Latin America and Sub-Saharan Africa, but also included were Australia, New Zealand, Norway and Indonesia.

Table 2. South Africa's export structure and annual average growth rates for selected countries and regions, 1988 to 2002 (%)

	Share structure of SA exports		**Simple average annual growth rate, 1988-2002**							
	1988 (1)	**2002 (2)**	**South Africa (3)**	**High income (4)**	**Low income (5)**	**Lower middle income (6)**	**Upper middle income (7)**	**Resource Group (8)**	**EAP (9)**	**World (10)**
Total Trade			2.0%	5.4%	1.7%	6.6%	7.4%	5.1%	7%	4.6%
Primary products	71.8%	46.2%	−1.1%	3.2%	0.6%	2.6%	4.7%	3.2%	3%	2.4%
Total Manufacturing	27.7%	53.4%	6.9%	5.7%	6.5%	9.5%	8.6%	7.8%	7%	8.1%
Manufacturing sub-sectors	100%	100%								
Resource-based	*44.7%*	*31.4%*	*4.3%*	*4.4%*	*6.9%*	*8.1%*	*7.7%*	*7.5%*	*4.4%*	*6.7%*
RB1: Agro-based	17.5%	14.2%	5.3%	4.0%	8.9%	8.4%	8.3%	7.7%	4%	7.6%
RB2: Minerals-based	27.2%	17.2%	3.5%	4.7%	7.3%	9.1%	7.7%	8.3%	7%	7.2%
Low technology	*19.4%*	*16.3%*	*5.6%*	*4.5%*	*9.3%*	*9.4%*	*7.3%*	*8.3%*	*6.9%*	*7.9%*
LT1: Fashion cluster	4.7%	4.4%	6.3%	2.9%	7.6%	8.4%	6.9%	7.4%	6%	6.6%
LT2: Other	14.7%	11.9%	5.3%	5.7%	12.8%	11.6%	8.9%	11.3%	7%	10.3%
Medium technology	*33.2%*	*47.5%*	*9.7%*	*5.5%*	*8.0%*	*11.5%*	*8.3%*	*7.7%*	*9.6%*	*8.3%*
MT1: Automotive	2.3%	13.9%	21.7%	7.6%	16.5%	19.6%	9.4%	15.2%	11%	13.7%
MT2: Process	25.7%	19.9%	5.0%	4.1%	9.9%	8.6%	7.8%	7.0%	8%	7.9%
MT3: Engineering	5.3%	13.7%	14.4%	5.8%	9.5%	14.9%	7.4%	11.3%	12%	9.5%
High technology	*2.7%*	*4.9%*	*11.5%*	*9.2%*	*8.8%*	*19.0%*	*12.1%*	*13.4%*	*16.9%*	*11.7%*
HT1: Electronic	1.4%	2.9%	12.8%	8.8%	10.4%	18.7%	13.9%	15.0%	17%	12.4%
HT2: Other	1.3%	1.9%	9.9%	10.4%	6.9%	19.4%	11.3%	12.9%	16%	11.3%
Number of countries				22	37	22	17	25	11	98

Notes: Growth rates for the regions are the simple average country growth rate. EAP is East Asia and Pacific. Primary product and manufactures shares do not sum to 100% due to the omission of special transactions and unallocated products. The manufacturing sectors sum to 100%.

Second, they do not represent all natural resources exports, or even the majority thereof (the Group accounted for about 46% of world primary product and resource-based manufactures exports in 2002, up from 40% in 1988). And third, the selection process is in some respects arbitrary and 'data-driven'. However, it should be highlighted that this is inevitable, and that other authors using different approaches have encountered similar problems. These include UNIDO (2004), Wood and Berge (1997), Mayer, (1997) and Wood and Mayer (2001).

The data in Table 2 reveal a number of broad structural shifts in the pattern of world and South African exports. Firstly, high technology products are the fastest growing in world trade, with particularly strong growth in exports of these products by middle-income economies. Average annual global growth of high technology products between 1988 and 2002 (11.7%) exceeded that of low technology (7.9%), medium technology (8.3%) and resource-based (6.7%) products. In response, the share of high technology products in world trade rose from 16% in 1988 to 24% in 2002. Middle-income economies accounted for much of the overall growth in exports, with particularly strong growth in high technology (12% to 19%) and medium technology products (8.3% to 11.5%). While the share of total exports accounted for by middle-income countries rose from 18% in 1988 to 27% in 2002, their share of high technology exports more than doubled from 15% to 34% over the same period.

Secondly, a similar structural shift towards high technology products has occurred in South Africa, but a high dependence on resource based exports remains. Manufacturing exports rose as a share of total exports from 27.7% in 1988 to 53.4% in 2004, although much of this increase is due to the rapid contraction in gold exports, which also explains the negative overall growth rate (−1.1%) in the primary product category. Within manufacturing we also find a diversification away from resource based products, whose share of manufacturing exports declined from 44.7% to 31.4% between 1988 and 2002. This is primarily due to the phenomenal growth in medium technology exports, MT1 (automotive) in particular. Under the Motor Industry Development Programme (MIDP) the share of automotive products in manufactured exports rose from 2.3% to nearly 14%, and in total exports from 0.6% to over 7%.

Nevertheless, resource dependence remains a salient feature of South Africa's export profile. Adding the categories RB1 (agro-based manufactures) and RB2 (minerals-based manufactures) to primary exports takes the share of natural resource intensive products in total exports to over 60% in 2002, meaning that 'pure manufactures' still account for less than 40%. If glass, earthenware, and many iron and steel products – all reliant on cheap and readily available natural resources – found in the LT2 category are included, the estimated dependence on mineral based exports is even higher.

Thirdly, South Africa has experienced relatively poor export growth during the 1990s, a result also found by Alves and Kaplan (2004). South Africa's world market share (WMS) of total exports declined from 0.89% to 0.53% between 1988 and 2002. While this is largely due to the decline in gold exports, South Africa's WMS of total *manufactured* exports rose only marginally from 0.3% to 0.33% during this period.

Of greater concern is that South Africa's manufacturing export growth (6.9%) lagged the average for middle-income economies (8.6% to 9.5%) and the Resources Group (7.8%). It was only in the Automotive (MT1) and Engineering (MT3) products that South Africa performed relatively well, with growth rates in excess of 14%. Thus, South Africa's export performance has on average been worse than other middle-income economies and similar resource endowed economies. The similar global market conditions experienced by these countries suggest that South Africa's relatively poor export performance may reflect the domestic policy environment or various export supply constraints. This is explored in more detail later.

(b) Market-dynamism

The second indicator of South Africa's export dynamism is its ability to take advantage of high-growth, 'market-dynamic' products. Countries that are able to shift export production towards products with a strong global demand potential will reduce the risk of declining export growth and declining terms of trade. Previous analyses have noted weaknesses in South Africa's export performance from this perspective (Van Seventer and Gibson, 2004; Tsikata, 1999).[4] In this section, we extend these analyses and compare South Africa's export performance with East Asia's and the Resources Group's.

The approach used here is similar to that of Tsikata (1999) and Van Seventer and Gibson (2004), but anchors the analysis around those products that contributed the most to each country or region's export growth during the 1990s.[5] The country's top 20 products (at 3-digit SITC level) are then identified and the changes in their world market share (WMS) between 1988 and 2002 are calculated. These WMS changes are then plotted against the global growth rates in trade of these products, as presented in Fig. 1 to 3. A country or region is positioned optimally in terms of global demand potential if its top 20 products are in markets that are growing above the average annual growth in world trade by value of 6% (the horizontal dotted line in each figure). Further, a country is specialising in growing markets (dynamic markets) if its WMS in these markets is rising. In short, 'good' market positioning is reflected by a large proportion of the 20 products situated in the top right hand 'quadrant' (above the dotted line and to the right of the vertical axis). Using Tsikata's (1999) terminology, these would be 'rising stars'.

By contrast, a country may be said to suffer poor market positioning, if a) it is achieving a greater WMS in stagnating world markets (bottom right 'quadrant'), or b) it is losing WMS in dynamic world markets (top left 'quadrant'). The bottom left quadrant below average world growth reflects products in which the economy is rapidly retreating from stagnating world markets, which could be viewed as healthy restructuring.

As can be seen from Fig. 1, countries in the EAP region have experienced very good market positioning during the 1990s, and coupled that with exceptional export performance. The top 20 product groups grew from 35% of the region's total exports to

[4] Van Seventer and Gibson (2004) find a low share of South African exports in the top 40 demand-dynamic products identified by UNCTAD (2002). Tsikata (1999) finds that relative to a range of middle-income economies (Korea, Mexico, Taiwan, Malaysia, Thailand, Brazil), South Africa exports a relatively high proportion of products for which world markets are not growing very rapidly.

[5] This is done as follows. First the overall percentage change in export value for each SITC 3-digit level product group between 1988 and 2002 is calculated. This is then multiplied by that product group's share in total exports in 2002. Finally, that product is divided by the percentage change in total export value between 1988 and 2002. This is a more accurate way of establishing which exports are a country's most important, as it combines growth with relative size. Taking either on their own is often misleading: exports with small 1988 values tend to show high growth rates or percentage changes, overstating their importance, while those with large base values tend to show low growth, but are clearly important to aggregate export performance.

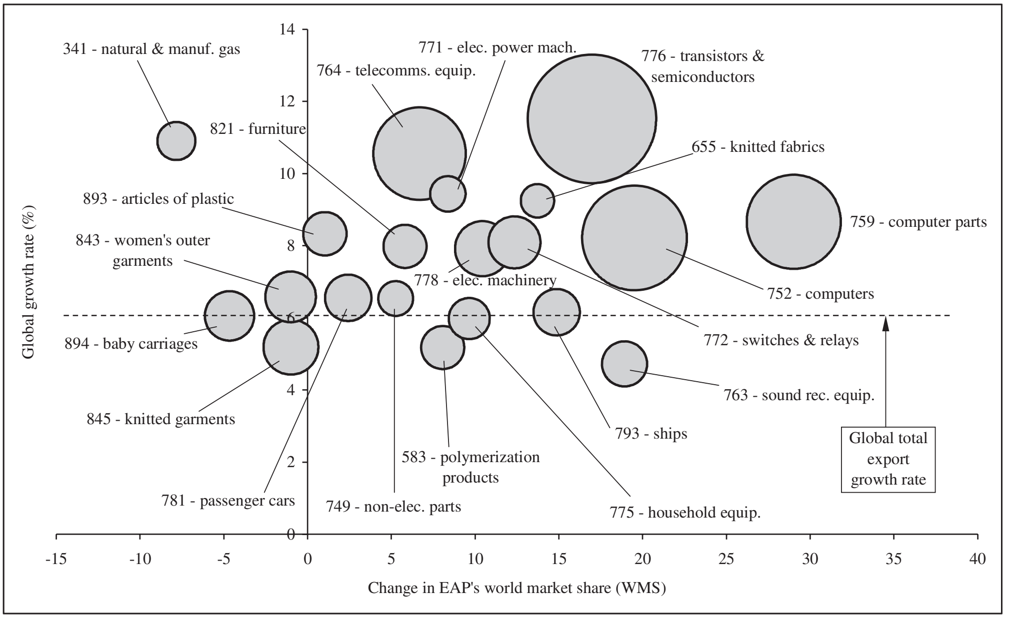

Figure 1. Market positioning and performance of East Asia and Pacific region
Notes: Dotted line is world growth for all products. WMS changes expressed as percentage points. Bubble size denotes export value in 2002.

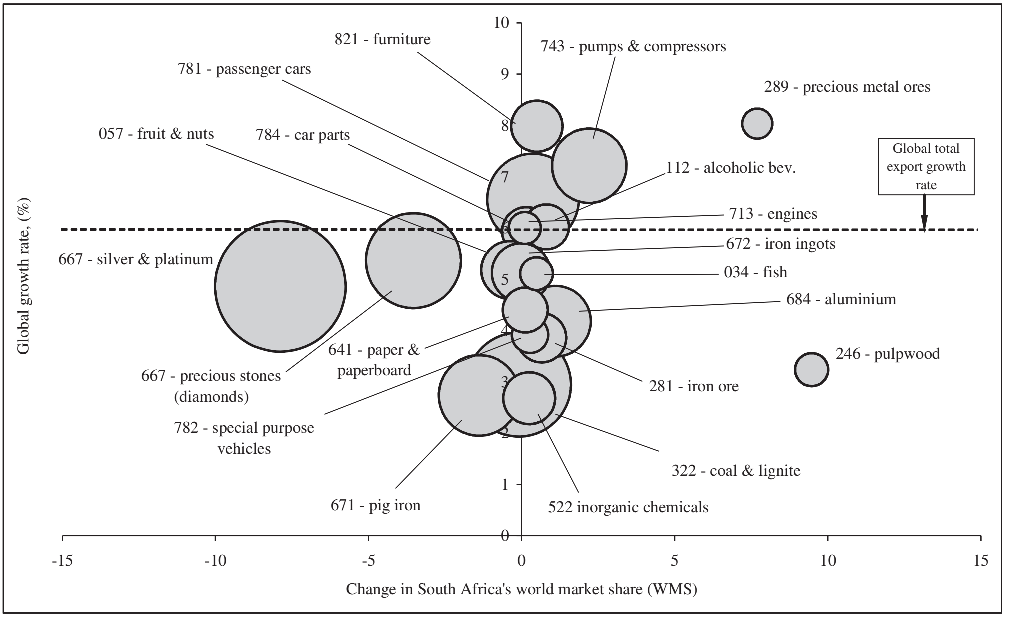

Figure 2. The market positioning of South Africa's top 20 exports
Notes: Dotted line is world growth for all products. WMS changes expressed as percentage points. Bubble size denotes export value in 2002.

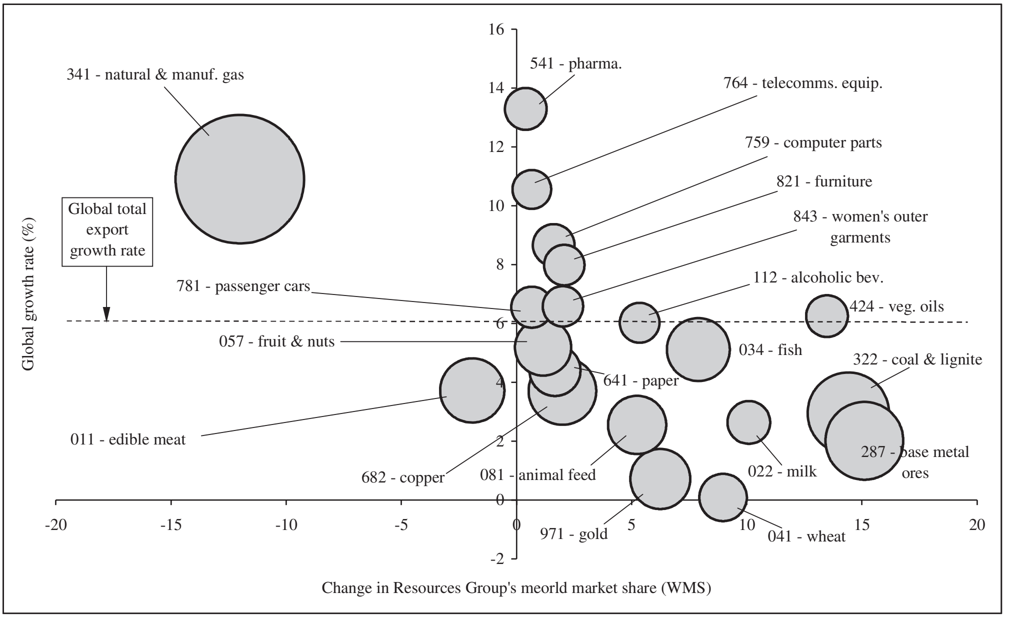

Figure 3. The market positioning of the Resource Group's top 20 exports
Notes: Dotted line is world growth for all products. WMS changes expressed as percentage points. Bubble size denotes export value in 2002.

almost 54% in 2002. 16 of the top 20 exports are in dynamic world markets, and thirteen of these fall in the top right hand quadrant. In other words, most of East Asia's top exports are in markets experiencing above world average growth, and its WMS in many of them is rising.

As with the EAP countries, South Africa's 20 most important exports accounted for 54% of total exports in 2002, up from 32% in 1988. However, Fig. 2 shows clearly that the South Africa's market positioning is comparatively poor: the majority of the top 20 product groups are in stagnating world markets (below the dotted line). Very few of South Africa's most important exports are found in the top right hand 'quadrant'. The major sectors that do fall into this category are passenger cars (SITC 781), pumps & compressors (SITC 743), furniture (SITC 821) and precious metals (SITC 289). Together these sectors only account for 12% of total South African exports.

The Resources Group's top 20 exports comprised 37% of total group exports in 1988, rising to 45% in 2002. Like South Africa, the Group's market positioning has been poor, with a high proportion of products located in the lower right 'quadrant' (see Fig. 3). Export growth in these countries has been adversely affected by a high concentration of exports in primary and natural resource-based products, for which world markets during the 1990s mostly stagnated or shrank. Further, these economies have been unable to restructure significantly into dynamic world markets.

(c) Concluding points

The evidence shows that while South Africa's manufactured export growth increased, it has not been sufficient to generate an export-led boom as has been experienced in many middle-income economies, particularly within East Asia. The question is why?

One of the reasons for the relatively poor export growth appears to be the concentration of exports in natural-resource-based products, which experienced relative low growth in world markets. Natural resource endowments are an important determinant of export performance and the ability to diversify, as is also argued by Wood and Mayer (2001) in relation to Africa. The ability of these economies to diversify into high technology products is constrained by the comparative advantage in resource-based products that the rich natural resource endowment provides them with.

However, South Africa's export performance was weak even in natural resource-based products, when compared to some of the countries in the Resources Group. This suggests that there were important domestic constraints to export growth during the 1990s. In the following section we draw upon various techniques, including econometric estimations of export supply and demand function, to investigate the various determinants South African manufacturing export performance.

3. DETERMINANTS OF SOUTH AFRICAN MANUFACTURING EXPORT PERFORMANCE

There is a diverse and growing empirical literature on the determinants of South Africa's export performance. This literature includes cost or price competitiveness analyses through the use of real effective exchange rates (IMF, 1998; Kahn, 1998; Walters and de Beer, 1999 and Golub, 2000); Revealed Comparative Advantage studies (Valentine and Krasnik, 2000); shift-share analyses of the composition of exports (Nordas, 1996; Bell *et al.*, 1999; Edwards and Schoër, 2002); market positioning studies (Edwards and Schoër, 2002; Van Seventer and Gibson, 2004); and econometric estimates of export supply and demand functions (Smal, 1996; Senhadji and Montenegro, 1998; Tsikata, 1999; Golub and Ceglowski, 2001; Edwards and Wilcox, 2003; Edwards and Golub, 2004).

To investigate the determinants of South African manufacturing export performance, this section estimates export demand and supply relationships using a panel of manufacturing industry data covering the period 1970-2002. The analysis extends existing empirical work in South Africa in two ways. Firstly, a fuller specification of the export supply relationship is estimated. Secondly, an attempt is made to deal with the endogeneity of export volumes and export prices, which is frequently ignored in similar studies.

(a) Specification and econometric methodology

We use a variant of the imperfect substitution model outlined in Goldstein and Khan (1985) and discussed further in Edwards and Wilcox (2003).[6] This model is represented as a system of equations for export supply (X^s) and export demand (X^d), which simultaneously determine the export price and the export quantity. The long run export demand (X^d) and supply (X^s) relationships are given by the following log-linear structures:

$$X^d = \delta_0 - \delta_1 P_X + \delta_2 e + \delta_3 P^* + \delta_4 Y^*, \quad \delta_i > 0 \qquad (1)$$

[6] The model is an imperfect substitutes model where imperfect substitutability between domestic and export products enables domestic and export prices to differ from one another (Goldstein and Khan, 1985).

and

$$X^s = \alpha_0 + \alpha_1 P_X - \alpha_2 P - \alpha_3 C + \Psi Z, \quad \alpha_i > 0 \tag{2}$$

where (all variables in logs):
X = volume of exports
Y^* = real foreign income
P^* = foreign domestic price
P_X = domestic price of exports
e = domestic to foreign currency exchange rate
P = domestic price
C = nominal variable cost
Z = vector of other variables that influence the supply of exports.

Export demand is positively affected by foreign income (Y^*) and the price of competing foreign goods (P^*), but is negatively affected by the foreign price of domestic exports ($Px^* = P_X/e$).[7] The quantity of exports supplied is specified as a positive function of its own price and a negative function of the domestic price index and variable costs.[8] As export sales become profitable relative to domestic sales (P_X/P rises) firms shift production towards the export market. Other supply side variables include tariff rates, import penetration, infrastructure costs, capacity utilisation and trend income.

Following Fallon and Pereira da Silva (1994), Tsikata (1999), Behar and Edwards (2004) and Edwards and Golub (2004), capacity utilisation is included to test the "vent-for-surplus" hypothesis.[9] A negative coefficient is expected. Tariff liberalisation reduces the anti-export bias of production and thus positively affects export production. Trend income is included as a proxy for non-price improvements in competitiveness (infrastructure, total factor productivity, export supply networks, learning by doing) arising from increased economic activity. Finally, infrastructure constraints are expected to negatively affect export supply.

An important consideration in estimating the export supply and demand functions is that P_X and X are endogenous variables. Failure to account for this endogeneity gives rise to simultaneous equation bias when estimating either equation.[10] However, this is less of a problem in small price-taking economies where the export price is exogenous and the demand for exports is infinite. As export prices are no longer endogenous, the export supply function can be estimated independently of the demand equation.

Two approaches to the estimation of the export demand and export supply functions are followed in this study. Firstly, we first estimate the export demand function and test

---

[7] Normally it is assumed that the demand function is homogenous of degree zero in prices and the restriction $-\delta_1(=\delta_2) + \delta_3 = 0$ is imposed, i.e. P_X/eP^* is included on the right hand side.

[8] Homogeneity on the supply function requires the restriction that $\alpha_1 + \alpha_2 + \alpha_3 = 0$. Alternatively, the supply function can be specified in terms of real variable costs and the relative price of exports to domestic prices (P_X/P).

[9] The hypothesis is that the increase in exports was partly in response to declines in domestic demand and therefore accompanied by low rates of capacity utilisation.

[10] This arises because the export volume and price in the demand and supply relationship are correlated with the error terms. Domestic prices, wages and the exchange rate may also be endogenous. Export growth can affect the exchange rate, which in turn affects inflation and wages.

whether the small country assumption holds in the case of South Africa. Following Riedel (1988) export demand (equation 1) is normalised on P_X to obtain

$$Px = \frac{\delta_0}{\delta_1} - \frac{1}{\delta_1} X^d + \frac{\delta_2}{\delta_1} e + \frac{\delta_3}{\delta_1} P^* + \frac{\delta_4}{\delta_1} Y^* \tag{3}$$

In a small price taking country, the export price elasticity of demand (δ_1) tends towards negative infinity and the coefficient on X^d and Y^* therefore tend towards zero.[11] Equation (3) then becomes the standard PPP relationship in which export prices, measured in domestic currency, equal foreign prices multiplied by exchange rate. If price homogeneity holds, the coefficients on the exchange rate and foreign prices equal one, i.e. $\delta_2/\delta_1 = \delta_3/\delta_1 = 1$.

Secondly, we estimate the reduced form function for export volumes.[12] Imposing the homogeneity assumptions and expressing the export demand and supply functions in terms of relative prices (i.e. $\delta_1 = \delta_2 = \delta_3 = \delta_p$ and $\alpha_1 = \alpha_2 = \alpha_p$) and real unit labour costs (RC), the reduced form equation for exports is expressed as:

$$X = \frac{1}{1+\lambda_1}[\lambda_0 + \lambda_2(e + P^* - P) + \lambda_3 Y^* - \lambda_4 RC + \lambda_5 Z], \quad \lambda_i > 0 \tag{4}$$

where

$$\lambda_0 = \alpha_0 + \frac{\alpha_1\delta_0}{\delta_1}, \quad \lambda_1 = \frac{\alpha_1}{\delta_1}, \quad \lambda_2 = \alpha_1, \quad \lambda_3 = \frac{\alpha_1\delta_4}{\delta_1}, \quad \lambda_4 = \alpha_3, \quad \lambda_5 = \Psi$$

$(e + P^* - P)$ is the Real Effective Exchange rate measuring the price of foreign products relative to South African products, valued in a common currency. A real depreciation ($e + P^* - P$ rises) positively affects exports. Note that in a small price-taking economy, the reduced form equation effectively becomes the export supply equation (2).

We draw on various data sources to construct a panel of data for 28 manufacturing sectors over the period 1970-2002. The data are mostly obtained from Quantec (2004), the World Development Indicators, the UNIDO INSTAT database, Statistics South Africa and the IMF International Financial Statistics. The Quantec (2004) data is compiled by combining a set of industry and national account indicators with a consistent input-output framework spanning three decades. In particular, the data are manipulated to ensure consistency with the Statistics SA, national accounts data and the Input-output (IO) structure of the Supply-Use tables prepared by Statistics South Africa. Sector level data for the years between the available IO tables are mostly interpolated. This may induce significant errors into the data, particularly during the period subsequent to the last official manufacturing Census in 1996. Some caution in interpreting these results is thus required. Further details are presented in Tables B and C in the Appendix.

[11] However, rising world demand for a particular product will affect export supply through its impact on world prices.

[12] Initial estimates of the export supply function (2) gave a negative instead of positive coefficient for the relative price of exports to domestic products (P_X/P); a result also found by Fallon and da Silva (1994). It was thus decided to concentrate on the reduced form results.

To capture the short-run dynamics, the long-run relationships (equations (2, 3 and 4) are embodied in an autoregressive distributed lag (ARDL) model.[13] To capture the influence on exports of industry specific variables that are constant over time, sector specific effects (η_i) are included.

The export functions are estimated using two estimators. Firstly, the dynamic fixed effects (DFE) estimator, which pools the data and imposes homogeneity for all parameters other than the sector fixed effects (η_i), is used. As a result, we assume common long run relationships and short run dynamics across all sectors.[14] If the true coefficients differ across sectors, the pooling of the data can give "potentially highly misleading estimates of the coefficients" (Pesaran and Smith, 1995:80). To test for the possible biases arising from parameter heterogeneity export functions were therefore also estimated for a number of broadly defined manufacturing sub-sectors: Beneficiated, natural resource-based, metal and labour-intensive products.[15]

A further problem is that the lagged dependent variable is correlated with the fixed effect (η_i), which biases the estimated coefficient of the lagged dependent variable upwards (Hsiao, 2003). However, the bias is of order (1/T) and the inconsistency disappears as $T \to \infty$. As we are dealing with a relatively large period, this bias is expected to be small.

More importantly, if any of the explanatory variables are endogenous the estimated coefficients will be biased as the endogenous variable is correlated with the error term. This problem is potentially severe in the estimation of the export supply and demand functions as both price and export volumes are endogenously determined by the system of equations. We therefore also estimate the export supply and demand function using the "difference" and "system" General Methods of Moments (GMM) estimators developed by Arellano and Bond (1991) and Blundell and Bond (1998), respectively. When using the

---

[13] The ARDL(p,q) can be represented as $y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \gamma'_{ij} \mathbf{x}_{i,t-j} + \eta_i + \mu_{it}$. This can be reparametised as an error correction model imbedding the long run relationship ($y_{it} = \theta' x_{it} + \varepsilon_{it}$). This ECM is represented as

$$\Delta y_{it} = \phi_i (y_{i,t-1} - \theta'_i x_{i,t-1}) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \gamma'_{ij} \Delta x_{i,t-j} + \eta_i + \mu_{it}$$

where $\phi_i = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right), \quad \theta'_i = \sum_{j=0}^{q} \gamma'_{ij} \Big/ \left(1 - \sum_{j=1}^{p} \lambda_{ij}\right).$

ϕ_i is the error correction coefficient and measures the speed of adjustment towards long run equilibrium. The larger the value the quicker the convergence to the long-run equilibrium. For stability we require that $\phi_i < 0$.

[14] Alternative estimators are the Mean Group estimator of Pesaran and Smith (1995:80) and the Pooled Mean Group Estimator of Pesaran, Shin and Smith (1999). The former allows for heterogeneity in short and long run coefficients, while the latter constrains the long run coefficients to be the same for each sector, but allows for short-run heterogeneity across sectors.

[15] Beneficiated consists of iron & steel, chemicals and non-ferrous metals. Natural-resource based includes beneficiated products, paper products and food products (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.

Table 3. Long-run average export demand coefficients for manufacturing

	Using US Import Price				**Using Foreign output deflator**							
	DFE 1982-99		**GMM**		**DFE 1970-99**		**GMM**		**DFE 1980-99**		**GMM**	
Export	0.084	ns	0.000	ns	−0.103	**	−0.048	*	−0.021	ns	−0.008	ns
Exchange rate	1.000	***	1.077	***	1.205	***	1.414	***	0.916	***	1.081	***
Foreign price	0.934	**	0.435	*	0.948	***	0.941	***	1.186	***	0.259	*
Foreign output	−0.005	ns	0.077	ns	0.455	***	0.581	***	−0.136	ns	0.035	ns
Adjustment term	−0.104	***	−0.109	***	−0.173	***	−0.048	***	−0.123	***	−0.152	***
Tests (H0)												
Exchange rate = 1		ns		ns		**		***		ns		ns
Foreign price = 1		ns		**		ns		ns		ns		***
Erate = Pfor		ns		ns		ns		ns		ns		***
R2	0.57				0.40				0.54			
F	16.06	***	20,239	***	13.61	***	33,138	***	16.70	***	11,685	***
Obs	428		428		812				560			
AR(1)				***				***				***
AR(2)				ns				ns				ns

Notes: Lag limit set to 10 for GMM estimations, except for the period 1970-99 where it is set to 5 (to solve problem of autocorrelation). *, ** and *** reflect significance at the 10%, 5% and 1% significance level, respectively. ns reflects lack of significance at the 10% level.

Table 4. Long-run average export demand coefficients for natural resource products

	Using US Import Price				**Using Foreign output deflator**							
	DFE 1982-99		**GMM**		**DFE 1970-99**		**GMM**		**DFE 1980-99**		**GMM**	
Export	−0.262	*	−0.040	*	−0.250	**	−0.097	***	−0.278	**	−0.048	ns
Exchange rate	0.440	ns	0.575	**	0.809	***	0.964	***	0.421	ns	0.797	***
Foreign price	1.227	***	0.936	***	0.763	***	0.838	***	1.275	***	0.640	**
Foreign output	1.513	*	1.060	**	1.314	***	1.140	***	1.280	*	0.622	**
Adjustment term	−0.129	***	−0.111	***	−0.137	***	−0.109	***	−0.129	***	−0.129	***
Tests (H0)												
Exchange rate = 1		**		ns		ns		ns		**		ns
Foreign price = 1		ns		ns		ns		ns		ns		ns
Erate = Pfor		ns		ns		ns		ns		ns		ns
R2	0.57				0.44				0.55			
F	11.57	***	61.78	***	11.40	***	99	***	12.87	***	773	***
Obs	177		177		319.00				220.00			
AR(1)				**				***				***
AR(2)				ns				ns				ns

Notes: *, ** and *** reflect significance at the 10%, 5% and 1% significance level, respectively. ns reflects lack of significance at the 10% level.

GMM estimator, export volumes, prices and the exchange rate are treated as endogenous variables. As in the DFE estimations, the data are pooled and homogeneity is imposed for all parameters other than the sector fixed effects (η_i).

4. EXPORT DEMAND

To test the sensitivity of the export demand function to the selection of foreign prices two data sources are used: (a) US import prices, obtained from the Bureau of Labour Statistics, and (b) a weighted average output deflator for developed countries, constructed from the UNIDO INSTAT (2001) database. The estimations using the foreign output price deflators are estimated over the periods 1970-99 and 1980-99 to enable comparisons with the results using the US import prices. Table 3 presents the estimated long-run average coefficients for the full sample of manufacturing industries and Tables 4 to 6 present the results for the sub-groupings.

Table 5. Long-run average export demand coefficients for metal products

	Using US Import Price				Using Foreign output deflator							
	DFE 1982-99		**GMM**		**DFE 1970-99**		**GMM**		**DFE 1980-99**		**GMM**	
Export	0.073	ns	0.055	***	−0.106	ns	0.038	ns	0.074	ns	0.029	ns
Exchange rate	1.398	***	1.279	***	1.096	***	0.716	***	0.935	***	1.325	***
Foreign price	−0.394	ns	−0.537	*	1.066	***	1.270	***	0.742	ns	−0.792	ns
Foreign output	−0.837	ns	−0.549	ns	0.551	***	0.967	***	−0.079	ns	−0.699	*
Adjustment term	−0.209	***	−0.195	***	−0.409	***	−0.219	***	−0.231	***	−0.220	***
Tests (H0)												
Exchange rate = 1		ns		ns		ns		**		ns		ns
Foreign price = 1		**		***		ns		ns		ns		***
Erate = Pfor		**		ns		ns		**		ns		***
R2	0.62				0.50				0.58			
F	11.38	***	11.96	***	10.81	***	22	***	10.74	***	5	**
Obs	126		126		203.00				140.00			
AR(1)				**				**				**
AR(2)				ns				*				**

Notes: *, ** and *** reflect significance at the 10%, 5% and 1% significance level, respectively. ns reflects lack of significance at the 10% level.

Table 6. Long-run average export demand coefficients for labour-intensive products

	Using US Import Price				Using Foreign output deflator							
	DFE 1982-99		**GMM**		**DFE 1970-99**		**GMM**		**DFE 1980-99**		**GMM**	
Export	−0.012	ns	0.027	ns	−0.158	***	−0.042	*	−0.019	ns	−0.004	ns
Exchange rate	1.620	***	1.384	***	1.163	***	1.027	***	1.215	***	1.293	***
Foreign price	−0.119	ns	−0.072	ns	2.771	***	1.232	***	1.342	*	0.205	ns
Foreign output	−0.137	ns	−0.323	ns	0.254	ns	−0.234	ns	−0.332	ns	−0.256	**
Adjustment term	−0.230	**	−0.266	***	−0.587	***	−0.423	***	−0.378	***	−0.493	***
Tests (H0)												
Exchange rate = 1		*		ns		*		ns		ns		**
Foreign price = 1		ns		ns		***		**		ns		**
Erate = Pfor		ns		ns		ns		ns		ns		**
R2	0.58				0.48				0.61			
F	7.23	***	5.42	*	8.29	***	22	***	10.28	***	3	ns
Obs	72		72		145.00				100.00			
AR(1)				*				**				**
AR(2)				ns				ns				ns

Notes: *, ** and *** reflect significance at the 10%, 5% and 1% significance level, respectively. ns reflects lack of significance at the 10% level.

The estimation results present supportive evidence for the “small country” hypothesis for total manufacturing when the sample is restricted to the 1980s and 1990s. The coefficient on export volumes and foreign output during this period is insignificantly different from zero and the result is robust to changes in the foreign price variable or the estimator (DFE or GMM). The results are less robust when the sample is extended to include the 1970s. The long-run average coefficients on exports and foreign output estimated using the DFE are significantly different from zero and imply a price elasticity of export demand of −10 and an income elasticity of export demand of 4, respectively. However, the GMM estimator suggests that when the endogeneity of export volumes and the nominal effective exchange rate are accounted for, the export volume coefficient is only significant at the 10% level.[16] Thus the small country hypothesis holds once endogeneity problems are dealt with.

[16] The implied price elasticity of demand and income elasticity of demand are −21 and 12, respectively.

There is also strong evidence that the long run average coefficients on the nominal effective exchange rate and the foreign price variable are insignificantly different from each other and are equal to 1. The null hypothesis of equality of coefficients is only rejected in the GMM estimator results when using foreign output deflators over the period 1980-1999. In most cases it is also not possible to reject the hypothesis that the long-run coefficient on the exchange rate or foreign price equals 1. This provides strong evidence that domestic exporters are price-takers in the international market and hence that export prices rise by the full increase in foreign prices or the depreciation of the exchange rate.[17] These results are consistent with those found by Edwards and Wilcox (2003) for aggregate non-gold merchandise exports.

Although some variation is found, the results for the sub-groups are broadly consistent with those for total manufacturing.[18] There is strong evidence that the metal product and labour-intensive industries are price-takers in the international market and therefore face an infinite demand for their products. In both these sub-groupings, the coefficient on export volumes is mostly insignificant. Amongst natural resource based industries, a significant negative coefficient on export volumes is found during the 1970-99 period (giving an implied price elasticity of export demand of −4 to −10), but this becomes insignificant once the endogeneity of export volumes and the exchange rate are dealt with and the sample is restricted to the 1980s and 1990s (see the GMM results). Similarly, in most cases the equality of the exchange rate and foreign price coefficients cannot be rejected. In cases where they diverge (mainly metal products) export prices are generally found to be more strongly affected by the exchange rate (equal to or greater than 1) than foreign prices.

Overall, therefore, the results provide strong evidence that South African industries are price-takers in the international market. Various implications arise from these results.

Firstly, export volumes are determined by the profitability of export supply. Factors that raise the output price received by exporter and reduce their cost of production will therefore enhance export performance.

Secondly, exchange rate depreciations on average positively affect export performance by raising the profitability of export supply, and not by increasing the cost competitiveness of South African products. Exporters raise their prices by the depreciation rate and do not, on average, lower the foreign currency price of their products in order to capture market share.[19]

Thirdly, export growth is not constrained by inelastic foreign demand curves or the inability of South African producers to compete in the export market on the basis of price. This does not imply that world demand and foreign market access are unimportant. While world demand does not directly affect export performance via the demand

[17] The adjustment lag is relatively slow, suggesting that export prices adjust to correct 10% to 17% of the disequilibrium in the long-run equilibrium each year. However, the short-run coefficients suggest that between 21% and over 100% of the adjustment takes place within the same year, implying a relatively quick adjustment period.

[18] The results for beneficiated products have been omitted as they are similar to that of natural resource based products.

[19] A further implication of this point is that a depreciation of the currency will improve (or rather will not worsen) the trade balance.

Table 7. Reduced form average coefficients for manufacturing

	Using US import prices		**Using foreign output deflators**			
	1982-1999		**1970-1999**		**1980-1999**	
	Coef.		**Coef.**		**Coef.**	
Long run						
Relative price	2.05	***	2.45	***	1.81	***
Foreign output	1.38	***	1.20	***	1.61	***
ULC	0.37	ns	−0.51	ns	0.11	ns
Output	0.54	ns	0.33	ns	0.57	**
Output deviation	−0.77	ns	−0.28	ns	−0.75	ns
Import penetration	0.37	**	0.23	ns	0.55	***
Rail capacity	2.05	*	1.95	*	2.34	***
Fuel P	−1.38	***	0.20	ns	−1.17	***
Adjustment term	−0.20	***	−0.19	***	−0.25	***
Short run						
Relative price	0.37	***	0.77	***	0.32	***
Foreign output			1.22	***		
ULC			−0.19	*		
Output			0.80	**		
Import penetration	0.42	***	0.42	***	0.50	***
Output deviation	−0.61	***	−0.47	**	−0.68	***
Rail capacity	1.10	***	1.78	***	1.29	***
Other						
K/L	−0.07	ns	−0.76	**	−0.40	ns
Skill share	2.00	***	3.02	***	1.98	***
Sanctions	−0.06	*	−0.02	ns	−0.09	***
Adj R-squared	0.27		0.24		0.30	
F(41, 410)	5.05	***	5.91	***	6.35	***
Number of obs	452		784		560	

Notes: The error correction parameterization of the ARDL model is estimated. Dummy variables are included for each sector, the MIDP programme (1995-2002), political turmoil in 1976 and the debt crisis (1984-86). Insignificant short run coefficients have been eliminated. *, ** and *** reflect significance at the 10%, 5% and 1% significance level, respectively. ns reflects lack of significance at the 10% level.

relationship, it affects export supply via its impact on world prices. Similarly, preferential reductions in foreign tariffs and market access will improve export performance if they raise the price received by exporters. Improved market access without improved export prices (measured in domestic currency) is unlikely to lead to a significant response in export volumes.

5. EXPORT SUPPLY

The export demand analysis identifies the importance of analysing factors that affect export supply. Some of the most important results arising from the estimation of the reduced form equation are presented here. Table 7 presents the results for total manufacturing, while Table 8 presents those for the industry sub-groupings.

Only the reduced form results using the foreign output deflator over the period 1970-99 are presented for the sub-groups, as the results using US import prices are similar. All parameters are estimated using the DFE estimator.

(a) Relative prices and competitiveness of manufacturing

Foreign prices, domestic prices and the exchange rate have a strong impact on manufacturing export performance in South Africa. This is shown by the positive and significant coefficient on the relative price variable (the real effective exchange rate) in the

Table 8. Reduced form average coefficients for sector groupings, 1970-99 using foreign output deflators

	Beneficiated Coef.		Natural resource Coef.		Metal products Coef.		Labour-intensive Coef.	
Long run								
Relative price	2.33	***	1.51	***	0.79	ns	4.13	***
Foreign output	1.01	ns	1.48	*	−0.14	ns	2.27	***
ULC	−0.18	ns	−0.16	ns	0.03	ns	−1.00	ns
Output	0.28	ns	0.48	ns	0.62	*	0.57	ns
Output deviation	−0.47	ns	0.23	ns	−1.27	***	−0.63	***
Import penetration	0.46	ns	0.31	ns	0.90	ns	0.98	ns
Rail capacity	0.61	ns	0.92	ns	−0.79	ns	5.74	**
Fuel P	0.69	ns	−0.26	ns	−0.98	**	2.06	***
Adjustment term	−0.20	***	−0.24	***	−0.36	***	−0.36	***
Short run								
Relative price	0.99	***	0.66	***	0.24	ns	1.39	***
Foreign output	1.08	***	1.18	***	1.00	***	1.20	ns
ULC	−0.14	ns	−0.12	ns	0.00	ns	−0.63	*
Output	0.70	ns	0.45	ns	1.42	**	−0.19	ns
Import penetration	0.32	***	0.27	***	0.79	***	0.61	***
Output deviation	−0.54	*	−0.51	ns	−0.79	**	0.08	ns
Rail capacity	1.81	***	1.59	***	1.36	***	1.87	**
Fuel P	−0.10	ns	−0.09	ns	−0.01	ns	0.22	ns
Other								
K/L	−0.82	**	−0.71	*	−3.35	ns	−23.62	ns
Skill share	2.98	**	2.58	**	5.39	***	10.25	*
Sanctions	−0.03	ns	−0.04	ns	0.02	ns	−0.08	ns
Adj. R2	0.32		0.20		0.42		0.38	
F-statistic	4.21	***	3.38	***	5.82	***	4.33	***
Obs	196		308		196		140	

Notes: *, ** and *** reflect significance at the 10%, 5% and 1% significance level, respectively. ns reflects lack of significance at the 10% level.

reduced form results presented in Table 7.[20] A 1% increase in the relative price of exports is estimated to raise average manufacturing export volumes by 1.8% to 2.5% in the long-run. The very elastic response of export volumes to changes in relative prices found in these estimates is much larger than the estimate (0.63) by Fallon and da Silva (1994), but is similar to the results (1.6 to 2.8) of Edwards and Golub (2004). The estimate also falls within the range of estimates the international literature surveyed by Goldstein and Khan (1985). The results are also consistent with firm level studies showing that a high percentage of firms raised exports in response to the Rand crisis of 1998 (Chandra *et al.*, 2001). These results suggest that much of the improvement in export performance during the 1990s can be attributed to the real depreciation of the currency during this period.

Support for the vent-for-surplus hypothesis is also found, but its importance in determining export growth is diminishing. Declines in output from the long-run trend are found to positively affect aggregate manufacturing exports, at least in the short run. As shown in Table 7, the short-run coefficients on the output deviations variable range from −0.47 to −0.68. The vent-for-surplus relationship helps to explain why export growth continued during the late 1980s, despite the real appreciation of the currency. The growth in exports from the early 1990s in a period of improved domestic demand, reflects

[20] Note that in this specification, price homogeneity is imposed and foreign prices (P*), domestic prices (P) and the exchange rate (e) are combined into a single relative price variable (eP*/P). In many cases, but not all, the restriction of homogeneity could not be rejected.

a diminished importance of vent-for-surplus exports, as well as a once-off adjustment to the ending of sanctions.[21]

The highly elastic response to relative prices for aggregate manufacturing is also found within all sub-groups apart from metal products.[22] The long-run coefficient on relative prices in the reduced form results for beneficiated and natural-resource based products range from 1.5 to 2.3 (Table 8). Much of this appears to be driven by the positive impact of exchange rate depreciations on exports of these products. Labour-intensive products appear to be particularly sensitive to relative prices in the long-run (4.13).

In contrast, exports of metal products are not sensitive to changes in relative prices. Exports within this sector appear to be very sensitive to domestic demand conditions rather than price. The level of exports is weakly correlated with the level of output (the long-run coefficient of 0.67 is significant at the 10% level) and is very strongly affected by business cycles. A decline in output below its long-run trend raises exports by 1.3% in the long-run.

Exports of metal products are also strongly biased towards the regional market and reflect advantages arising from regional proximity and the ability to offer after sale service (repair, operator training and engineering support) rather than cost competitiveness in production.[23] Finally, export performance within the motor vehicle industry during the 1990s has largely been driven by industrial policies such as the MIDP, rather than adjustments in response to international price movements.

These results thus provide considerable support for the importance of a stable and competitive real effective exchange rate in driving export performance. Although the real depreciation of the Rand during the 1990s has contributed extensively towards growth in manufacturing exports during this period, the volatility of exchange rate fluctuations has potentially deterred new entrants and given rise to a more muted response than otherwise would have been the case. This may have contributed to the poor export response relative to other developing economies.

(b) Variable costs of production

The profitability of export supply is dependent both on output prices as well as the variable costs of production. In the econometric analysis of the determinants of export supply, variable production costs are captured by unit labour costs (ULC) and producer prices.

The negative impact of domestic price inflation on export performance has already been shown in the analysis of real exchange rates. Domestic price inflation causes a real appreciation of the currency and hence a decline in export performance. An implication drawn from this is that nominal depreciations of the currency do not lead to long-term increases in export performance if the gains in competitiveness are eroded by domestic inflation and wage increases (Edwards and Wilcox, 2003).

---

[21] The coefficient on the sanctions dummy (1986-92) is significant and negative for aggregate manufacturing when the period is restricted to the 1980s and 1990s (Table 9).

[22] We also find strong evidence that the sectoral composition of exports is determined by relative prices across sectors. This provides support for the argument of Bell *et al.* (1999) that commodity price booms raise the share of natural resource-based products in total exports.

[23] Africa accounts for 31% of total exports of these products, but only 18% of total SA manufacturing exports.

ULC is found to be insignificant in all but labour-intensive sectors where a long-run coefficient of −1.2 is estimated in the export supply function (not shown). This is consistent with expectations as natural-resource based products and metal products are less dependent on labour costs as a determinant of the profitability of export supply. Edwards and Wilcox (2003) also find a significant negative coefficient on ULC in their estimates of the export supply function. The results are also consistent with Edwards and Golub (2004) who analyse South Africa's unit labour costs relative to a range of developed and developing economies. They find that relative unit labour costs, relative productivity and relative wages are important determinants of South African manufacturing export performance, particularly within labour intensive sectors.[24]

(c) Infrastructure

Economic infrastructure such as transport, communication, power, water and sanitation systems provide the foundation for economic activity within an economy. The provision of infrastructure also has important consequences for an economy's export performance by lowering the transaction costs associated with exporting, facilitating the diversification of export production (Elbadawi, 1999; Collier, 2002), giving rise to powerful forces for agglomeration (Redding and Venables, 2004) and contributing towards the development of international production networks in world trade (Mayer, 2003).

To evaluate the importance of infrastructure on exports, the reduced form equations are re-estimated using eight different infrastructure variables. These variables are rail carrying capacity (tonnes), public-sector infrastructure fixed capital stock (R million, 1995 prices),[25] roads paved (km), the share of total roads paved, electricity generated (gigawatts), electricity, water and gas fixed capital stock, communication fixed capital stock and telephone mainlines per 1,000 people.[26] Table 9 presents the level of these variables for 1980, 1990 and 2000, as well as the estimated short and long run coefficients. Many of the infrastructure variables are expressed as a ratio to real manufacturing GDP.

Public sector capital stock rose strongly from the 1960s to the early 1980s, but subsequently collapsed from the mid-1980s (Perkins, 2003). As a consequence public sector infrastructure fixed capital stock has failed to keep pace with the recovery in manufacturing output growth, particularly during the 1990s (Table 9). Similarly, the collapse in railway infrastructure investment from the 1980s led to a decline in the number of locomotives, coaching stock and goods stock and an eventual decline in goods stock carrying capacity from the late 1980s. The paving of national and provisional roads, however, roughly kept pace with manufacturing GDP growth.

The strongest growth in infrastructure capital stock has occurred in communications infrastructure. Telephone mainlines have grown consistently from the early 1900's, rising from 41 telephones per 1000 people in 1970 to 112 in 2001. Despite the rapid growth

[24] They estimate a long-run coefficient on Relative Unit Labour Costs of −1.9 for natural resource intensive, −2.8 for labour-intensive and −1.78 for chemical products.

[25] Public-sector investment consists of investment by the government and public corporations such as Transnet (rail and air transport services), Eskom (electricity) and Telkom.

[26] The data are sourced from Perkins (2003), Quantec (2004) and the World Development Indicators. Paved roads and share roads paved are updated using data obtained from World Development Indicators.

Table 9. Impact of various infrastructure variables on export performance, reduced form results

Infrastructure variables	Level			Coefficient	
	1980	1990	2000		
Rail carrying capacity (tonnes)	67.7	65.1	52.1		
Long-run				1.95	*
Short-run				1.78	**
Public-sector infrastructure fixed capital stock/GDP (1995 prices)	3.8	4.1	3.9		
Long-run				2.37	**
Short-run				1.89	***
Roads paved (km)/GDP (1995 prices)	0.5	0.5	0.5		
Long-run				1.62	ns
Short-run				1.70	***
Roads paved, share (%)	0.2	0.3	0.3		
Long-run				−0.70	ns
Short-run				−1.62	*
Electricity generated (gigawatt hours)/GDP (1995 prices)	1.1	1.6	1.9		
Long-run				0.66	ns
Short-run				2.07	***
Electricity, gas and steam capital stock/GDP (1995 prices)	0.6	0.9	0.6		
Long-run				0.75	*
Short-run				1.27	***
Communication capital stock/GDP (1995 prices)	0.2	0.4	1		
Long-run				0.03	ns
Short-run				0.16	ns
Telephone mainlines (Unit: per 1,000 people)	55.2	93.4	113.6		
Long-run				0.12	ns
Short-run				0.36	ns

Source: Infrastructure data obtained from Perkins (2003), Quantec (2004) and World Development Indicators.

Notes: All variables, except telephone mainlines, are expressed relative to total manufacturing GDP. All infrastructure variables are in natural logarithms. The coefficients are obtained from the reduced form specification using foreign output deflators over the period 1970-99. As shown in Table 7, the long-run coefficient on rail carrying capacity is significant at the 5% level when the sample is restricted to the 1980s and 1990s. The coefficient on electricity capital stock (1.77) is also significant in the long-run during the period 1980-99. *, ** and *** reflect significance at the 10%, 5% and 1% significance level, respectively.

in communication infrastructure, South Africa still lags many middle-income countries in terms of the number of fixed lines per 1000 people (139 for lower middle income and 208 for upper middle income countries in 2001) and the number of telephone faults per fixed lines (40 faults per 100 fixed lines in 2000) (Perkins, 2003). Further, South Africa's telecommunications prices compare very poorly with international best practice (Truen, 2005).

The results of the econometric analysis show that access to good rail infrastructure is an important determinant of manufacturing export performance. The short-run coefficient on rail carrying capacity is positive and significant for all the reduced form regression results shown in Table 7and Table 8. The long-run coefficients are positive and significant for aggregate manufacturing and range from 2 to 4.7, suggesting a high responsiveness in manufacturing exports to rail carrying capacity.

Drawing on Table 9, public-sector infrastructure fixed capital stock, paved roads, electricity generated and electricity, gas and water fixed capital stock also positively affect export performance, but primarily in the short run. A 1% increase in public-sector infrastructure capital relative to manufacturing GDP is shown to raise average manufacturing exports by 2.4% in the long-run. An increase in the price of fuel relative to producer prices is also found to negatively affect export performance, particularly during the 1980s. This relationship, however, is not consistent across the industry groupings. No significant results are found for communication related infrastructure.

The importance of infrastructure for export performance is consistent with manufacturing firm-level data. Data from the National Enterprise Survey conducted in late 1999 (Gelb, 2002),[27] shows that a significantly (at 5% level) higher percentage of exporters relative to domestic-oriented firms find that the cost, reliability and speed of communication, postal and transport services are an obstacle to their operations. This is particularly evident in relation to freight handling in harbours, airports, airlines and railways where up to 44% of exporters found the cost and reliability of these services problematic.

These results provide strong evidence that poor infrastructure investment from the mid-1980s has curtailed the growth of manufacturing exports. Improved infrastructure is therefore an important avenue through which to raise manufacturing export growth.

(d) Human capital

Human capital formation is an additional determinant of export performance. Improvements in human capital raise productivity and also facilitate diversification into manufacturing from primary products (Wood and Mayer, 2001) and into high technology sectors within manufacturing. Unfortunately, we do not have access to data on the stock of human capital in South Africa from the 1970s. In our analysis we therefore use the ratio of highly skilled (managerial and professional occupations) to less-skilled labour (all other occupations) within each sector as a measure of human capital. Alternative specifications of the ratio do not affect the results substantially. This measure of human capital has a number of limitations as the ratio is not exogenous and may reflect, amongst others, skill biased technological change, within-sector shifts to high skilled products and labour market policies. The variable therefore also serves as a control for these factors. Some caution is required in interpreting the results.

Our estimations suggest that the availability of skilled labour is an important determinant of diversification into manufacturing. The econometric estimates in Table 7 and Table 8 show a strong positive relationship between the skill-intensity of production and export performance, with coefficients for aggregate manufacturing in excess of 2. The coefficient on the skill-unskilled ratio for metal products, which fall in the high technology group of products, is a high 5.4. The ability to diversify into high technology sectors therefore appears strongly influenced by the availability of well educated labour. Alternatively, the results may also reflect the importance of productivity improvements in enhancing growth of relatively high technology products. More research on this area is clearly required.

(e) Tariffs and export support measures

Tariff liberalisation is also expected to have improved export performance by lowering the cost of imported intermediate and capital goods used in export production, and reducing the incentive to produce for the domestic market relative to the export market.

To assess the impact of changes in protection and the anti-export bias on export performance over time, we re-estimate a reduced form export functions using a random

[27] The NE survey is national in coverage and consists of 941 manufacturing firms, 39 % of which are large firms consisting of more than 50 employees.

Table 10. Determinants of export orientation, 1990-2002

	Coeff	Prob	Coeff	Prob
Tariff	−1.549	***		
ERP			−0.212	***
Surcharge	0.489	ns		
Share *ad valorem*	−0.148	ns	−0.091	ns
Ln NEER/PPI	0.938	**	1.040	***
Ln import penetration	0.476	***	0.470	***
K/L	0.001	***	0.001	***
Skill share	−1.272	*	−1.093	ns
Obs	504		504	
Wald chi2	833.6	***	812.35	***
Random/Fixed effects	RE		RE	
Hausman	6.37	ns	1.66	ns

Notes: ERP are inclusive of surcharges. Tariffs, surcharges and ERP are measured as $(1 + t)$ where t is the protection rate. The trend variable and the time fixed effects are not presented. Glass products and non-ferrous metals are excluded due to data irregularities. *, ** and *** reflect significance at the 10%, 5% and 1% significance level, respectively.

effects model over the period 1990-2002. To estimate this function, we use an alternative data set consisting of 42 industrial sectors, classified at the 3-digit Standard Industrial Classification (SIC) level.[28]

The dependent variable is the natural logarithm of export orientation (exports/ domestic production), calculated using nominal data. The export data were sourced from Customs & Excise and the sales data were obtained from Statistics South Africa (P3041.2). As independent variables we include the share of skilled labour in employment, the capital/labour ratio (using machinery and equipment capital stock), import penetration (in natural logs) and the nominal effective exchange rate divided by the sector's producer price index (ln NEER/PPI). This data were sourced from Statistics South Africa, Quantec (2004) and the Reserve Bank. Some of this data were only available at the 2-digit (SIC) level.

Various measures of tariff protection at the sector level are used. These include the simple average tariff rate (Tariff), the effective rate of protection (ERP), the share of 8-digit Harmonised System tariff lines with *ad valorem* rates (Share *ad valorem*) and the average surcharge rate (Surcharge). These variables are obtained from the database used in Edwards (2005). Finally, time dummies are included to account for missing variables including international prices.

The regression results are presented in Table 10. The regression function appears to be well specified and the Hausman test indicates that the Random Effects estimator is appropriate. Nominal and effective protection rates are found to significantly reduce export orientation, with coefficients of −1.55 and −0.21, respectively.[29]

Import penetration, which can be interpreted as a proxy for the impact of tariff liberalisation on export performance, is also found to positively affect manufacturing exports. Import penetration affects exports by *(a)* improving access to imported

[28] The SIC is not to be confused with the International Standard Industrial Classification (ISIC), on which it is based.

[29] When using the original data base of 28 industrial sectors, we find that tariffs on intermediate inputs and ERP have a significant (at 5% level) negative impact on export volumes.

intermediate inputs, *(b)* enhancing productivity growth (Jonsson and Subramanian, 2001; Harding and Rattsø, 2005) and lowering mark-ups and hence the relative incentive to produce for the domestic market (Fedderke *et al.*, 2003; Edwards and van de Winkel, 2005). The econometric estimates show that a 1% rise in import penetration is associated with an average rise in export orientation of 0.47% within manufacturing.[30]

These results provide strong evidence that liberalisation during the 1990s has raised export performance by reducing intermediate input costs as well as lowering the incentive to produce for the domestic market. However, as shown in Edwards (2005) and Tsikata (1999), some of the gains to exporters arising from lower tariffs on intermediate inputs, has been eroded by the ending in 1997 of export subsidies provided under the General Export Incentive Scheme. This may explain why we have seen a more muted response in manufacturing export growth than expected.

6. CONCLUSIONS AND POLICY RECOMMENDATIONS

This study yields a number of insights regarding the composition and determinants of manufacturing export growth in South Africa

South African export growth during the 1990s is shown to be mediocre compared to many middle-income economies and other similar natural resource abundant economies. Exports also remain concentrated in natural resource-based products and products with a declining share of world markets. In contrast, East Asian economies have successfully restructured production towards dynamic high technology products. The inability to re-structure exports towards these dynamic high technology products is one explanation for the relatively poor export performance of South Africa during the 1990s.

The relatively poor manufacturing export growth can, in part, be attributed to South Africa's comparative advantage in natural resource-based products that have declined as a share of world trade. However, South African manufacturing export performance has been poor even relative to other similar resource-based economies. This suggests that South Africa has not fully exploited all opportunities to expand exports.

This study finds that foreign export demand in terms of market access is not a constraint to export growth. South African manufacturing exporters are predominantly price-takers in the international market and face an infinite demand for their products. Changes in foreign demand, however, impact upon export supply through changes in the international price.

The constraint to growth lies on the side of export supply. Manufacturing exporters have responded positively to the real depreciation of the currency during the 1990s. However, the real depreciation has been volatile, which may have dampened the response by exporters.

Declining infrastructure investment, particularly in transport infrastructure (ports, railways and roads), have also dampened the response of manufacturing exports to the

[30] This result is consistent with that of Khan and Knight (1988) who find a negative relationship between the cost of imported intermediate inputs and export performance in a pooled sample of 34 developing countries (including South Africa).

more favourable trade environment in the 1990s. While tariff liberalisation during the 1990s is shown to have a positive impact on export performance, some of the gains to exporters in the form of lower intermediate input prices have been eroded by the ending of exports subsidies under GEIS.

Other factors such as the availability of skills also appear to be important determinants of export growth, particularly within the high technology metal products sectors. However, more research on this relationship using exogenous measures of human capital is required.

Overall, the results of this analysis suggest exporters are responsive to policies and economic environments that raise the profitability of export supply. There is therefore considerable scope for policy makers to substantially enhance South Africa's manufacturing export performance.

APPENDIX

(a) The "Resource Group" of Countries

To construct the Resource Group, countries with populations over one million and consistently recorded export data were ranked according to average share of primary products and resource based manufactures in total exports between 1988 and 1990. 10% of the sample on either side of South Africa's mean value were then selected as the comparator group. Alternative approaches have been followed in the international literature. UNIDO (2004) classify economies as resource rich if natural resource based exports as a percentage of GDP exceeds 20%. Wood and Berge (1997), Mayer, (1997) and Wood and Mayer (2001) all use land area (km^2) per capita and classify economies as resource rich if their ratio is above the sample median.

The process followed in this study yielded the list of countries in Table A. It is worth mentioning that these countries were not the most resource intensive exporters in 1988-1990 (by this measure). Twenty-six countries, mainly from Africa, had ratios higher than that of Malawi, the most resource intensive exporter in the selected group.

Table A. Similar export structures, 1988-1990

	(RB + PP)/TX		(RB + PP)/TX
Malawi	0.95	Peru	0.81
Senegal	0.94	Guatemala	0.79
Paraguay	0.94	Nigeria	0.78
Chile	0.94	Indonesia	0.76
Algeria	0.91	Argentina	0.72
Tanzania	0.91	Colombia	0.71
Kenya	0.89	Costa Rica	0.71
Benin	0.88	Zimbabwe	0.71
Madagascar	0.88	El Salvador	0.68
Australia	0.86	Uruguay	0.65
Ethiopia	0.84	Venezuela	0.61
New Zealand	0.83	Morocco	0.61
South Africa	**0.83**	Norway	0.58

Source: as before.
Notes: 'PP' = primary products; 'RB' = resource based manufactures; TX = total exports. All data represent 1988-1990 averages.

(b) Industrial sectors, variable descriptions and data sources

Table B. Industrial classification

	Industry		Industry
1	Food [301-304]	15	Plastic products [338]
2	Beverages [305]	16	Glass and glass products [341]
3	Tobacco [306]	17	Non-metallic minerals [342]
4	Textiles [311-312]	18	Basic iron and steel [351]
5	Wearing apparel [313-315]	19	Basic non-ferrous metals [352]
6	Leather and leather products [316]	20	Metal products excluding machinery [353-355]
7	Footwear [317]	21	Machinery and equipment [356-359]
8	Wood and wood products [321-322]	22	Electrical machinery and apparatus [361-366]
9	Paper and paper products [323]	23	Television, radio and communication equipment [371-373]
10	Printing, publishing and recorded media [324-326]	24	Professional and scientific equipment [374-376]
11	Coke and refined petroleum products [331-333]	25	Motor vehicles, parts and accessories [381-383]
12	Basic chemicals [334]	26	Other transport equipment [384-387]
13	Other chemicals and man-made fibers [335-336]	27	Furniture [391]
14	Rubber products [337]	28	Other manufacturing [392-393]

Table C. Variables descriptions and sources

Variable	Description	Source
Output	output, R mill, 1,995 prices	QUANTEC
Export	exports, R mill, 1,995 prices	QUANTEC
Export price	export price, 1,995 = 100	QUANTEC
Relative price	Calculated as foreign price*nominal effective exchange rate/domestic PPI	
Foreign price	Weighted output price deflator (1,995 = 100) of developed economies (US, UK, Spain, Netherlands, Japan, Canada). Uses total weights in Walter & De Beer (1999).	UNIDO INSTAT 2001
US import price	US import price index, constructed from SITC classified data	BLS
Foreign output	Weighted real output index (1,995 = 100) of developed economies (as above).	UNIDO INSTAT 2001
Fuel price	PPI: Petrol, 93 octane – Witwatersrand (Unit: Index: 2,000 = 100) divided by domestic PPI.	SSA [P0142.1: Table 16]
Exchange rate	Nominal effective exchange rate. Calculated using Walter and De Beer (1999) weights	IMF IFS
Domestic PPI	PPI: Consumption in SA (Unit: Index: 2,000 = 100), includes domestic produced and imported goods	SSA [P0142.1: Table 10].
ULC	Unit labour costs (nominal wage /labour productivity) divided by domestic PPI	QUANTEC data
Skill share	Highly skilled/(skilled + semi + unsk)	QUANTEC
K/L	Machinery & equipment capital stock R mill in 1,995 prices per worker	QUANTEC
LNoutputHP	Hodrick Prescott filter of log(output), lambda = 7	
Output deviation	Difference between output and trend output, measured in natural logarithms. Trend output is calculated using Hodrick Prescott filter (lambda = 7)	
Tariff	Scheduled tariff rates, calculated as (1 + tariff rate)	Edwards (2005)
ERP	Effective rates of protection, calculated using scheduled tariff rates plus surcharges. Estimates and 2,000 Supply Use table	
Share *ad valorem*	Share of HS8 lines under *ad valorem* rates	Edwards (2005)
Surcharges	Surcharges calculated using collection duties. Measured as (1 + surcharge rate)	Edwards (2005)

REFERENCES

ABBOT, T., MCGUCKIN, R., HERRICK, P. and NORFOLK, L. (1989). Measuring the trade balance in advanced technology products. US Bureau of the Census Discussion paper, CES 89-1.

ALVES, P. and KAPLAN, D. (2004). South Africa's declining export shares: The developing country challenge. *Trade and Industry Monitor*, 30: 2-4.

ARELLANO, M. and BOND, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58: 277-297.

BEHAR, A. and EDWARDS, L. (2004). Estimating elasticities of demand and supply for South African manufactured exports using a vector error correction model. Centre for the Study of African Economies Working Paper Series, WPS/2004-04.

BELL, T., FARRELL, G. and CASSIM, R. (1999). Competitiveness, International Trade and Finance in a Minerals-rich Economy: The case of South Africa. Paper presented at 1999 Trade and Industry Policy Strategies conference.

BLUNDELL, R. and BOND, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87: 115-143.

CHANDRA, V., MOORTY, L., RAJARATNAM, B. and SCHAEFER, K. (2001). Constraints to growth and employment in South Africa: Statistics from the large manufacturing firm survey. World Bank Informal Discussion

Papers on Aspects of the South African Economy no. 14. The World Bank Southern Africa Department: Washington DC.
COLLIER, P. (2002). *Primary Commodity Dependence and Africa's Future*. World Bank, Washington.
EDWARDS, L. (2005). Has South Africa liberalised its trade? *South African Journal of Economics*, 73, 4.
EDWARDS, L. and GOLUB, S. (2004). South Africa's International Cost Competitiveness and Productivity in Manufacturing. *World Development*, 32, 8: 1323-1339.
EDWARDS, L. and SCHOËR, V. (2002). Measures of competitiveness: A dynamic approach to South Africa's trade performance in the 1990s. *South African Journal of Economics*, 70, 1008-1046.
EDWARDS, L. and VAN DE WINKEL, T. (2005). The Market Disciplining Effects of Trade Liberalisation and Regional Import Penetration on Manufacturing in South Africa. Paper prepared for Trade and Industry Policy Strategies.
EDWARDS, L. and WILCOX, O. (2003). Exchange rate depreciation and the trade balance in South Africa. Paper prepared for the National Treasury, 2003.
ELBADAWI, I. (1999). Can Africa Export Manufactures? The Role of Endowment, Exchange Rates and Transaction Costs. Development Research Group and Africa Region, World Bank, Washington.
FALLON, P. and PEREIRA DA SILVA, L. (1994). South Africa: Economic performance and policies, World Bank Informal Discussion Papers on Aspects of the South African Economy no. 7, The Southern Africa department, The World Bank.
FEDDERKE, J., KULARATNE, C. and MARIOTTI, M. (2003). Mark-up Pricing in South African Industry, ERSA, University of the Witwatersrand.
GELB, S. (2002). Foreign companies in South Africa: Entry, performance and impact. Report by the Edge Institute, South Africa.
GOLDSTEIN, M. and KHAN, M. S. (1985). Income and price effects in foreign trade. Iin R. Jones and P. Kenen (eds), *Handbook of International Economics*, vol. II, North-Holland, Amsterdam.
GOLUB, S. S. (2000). South Africa's international cost competitiveness. Paper presented at the TIPS annual forum, 18-20 September, 2000.
GOLUB, S. S. and CEGLOWSKI, J. (2001). South African real exchange rates and manufacturing competitiveness. *South African Journal of Economics*, 70, 6: 1047-1075.
HARDING, T. and RATTSØ, J. (2005). The barrier model of productivity growth: South Africa. Trade and Industry Policy Strategies Working Paper 5 – 2005.
HSIAO, C. (2003). *Analysis of Panel Data*, 2nd Edition. Cambridge University Press, Cambridge.
IMF. (1998). Country report – South Africa. International Monetary Fund, Washington, D.C.
JONSSON, G. and SUBRAMANIAN, A. (2001). Dynamic gains from trade: Evidence from South Africa. *IMF Staff Papers*, 48, 1: 197-224.
KAHN, B. (1998). Assessing South Africa's competitiveness: Is the Reserve Bank's real exchange rate measure misleading? London School of Economics Centre for Research and Finance in Southern Africa Quarterly Review, number 4, 1998.
KHAN, M. and KNIGHT, M. (1988). Import compression and export performance in developing countries. *The Review of Economics and Statistics*, 70 (2): 315-321.
LALL, S. (2000). The Technological Structure and Performance of Developing Country Exports, 1985-1998. QEH Working Paper 44, Queen Elizabeth House, Oxford University.
MAYER, J. (1997). Is having a rich natural-resource endowment detrimental to export diversification? UNCTAD Discussion Paper, No. 124 (Geneva: UNCTAD), March.
——— (2003). Export dynamism and market access. WIDER Discussion paper No. 2003/42.
NORDAS, H. (1996). South African manufacturing industries – Catching up or falling behind? *The Journal of Development Studies*, 32, 5: 715-733.
PERKINS, P. (2003). An analysis of economic infrastructure investment in South Africa. Unpublished Masters thesis, University of the Witwatersrand.
PESARAN, M. H. and SMITH, R. P. (1995). Estimating long run relationships from dynamic heterogeneous panels. *Journal of Econometrics*, 68, 79-113.
PESARAN, M. H., SHIN, Y. and SMITH, R. J. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the America Statistical Association*, 94: 621-634.
REDDING, S. and VENABLES, V. (2004). Economic Geography and International Inequality. *Journal of International Economics*, 62(1), pp. 53-82
REPUBLIC OF SOUTH AFRICA. (1996). *Growth, Employment and Redistribution: A Macroeconomic Strategy*. South African government printers, Pretoria.
QUANTEC. (2004). *South African Standardised Industry Database*, Quantech Research. Available from http://www.tips.org.za/data/
RIEDEL, J. (1988). The demand for LDC exports of manufactures: Estimates from Hong Kong. *The Economic Journal*, 98, March: 138-148.
SENHADJI, A. and MONTENEGRO, C. (1998). Time Series Analysis of Export Demand Equations: A Cross-Country Analysis. IMF Working Paper, WP/98/149.
SMAL, M. M. (1996). Exchange Rate Adjustments as an Element of a Development Strategy for South Africa. *South African Reserve Bank Quarterly Bulletin*, 200, 30-39.
TRUEN, S. (2005). Price complaints ring true. Web posting on Business Day (www.businessday.co.za), 22 April 2005.
TSIKATA, Y. (1999). Liberalisation and trade performance in South Africa, World Bank Informal Discussion Papers on Aspects of the South African Economy no. 13, The Southern Africa department, The World Bank.

UNCTAD. (2002). *Trade and Development Report*. United Nations Conference on Trade and Development, Geneva.

UNIDO. (2004). *Industrial Development Report: Industrialisation, Environment, and the Millenium Development Goals in Sub-Saharan Africa*. United Nations Industrial Development Organisation, Vienna.

VALENTINE, N. and KRASNIK, G. (2000). SADC trade with the rest of the world: Winning export sectors and revealed comparative advantage ratios. *South African Journal of Economics*, Vol. 68, 2: 266-285.

VAN SEVENTER, D. and GIBSON, K. (2004). SA's Absence from Global Trade in Dynamic Products. Trade and Industry Monitor, volume 29, Trade and Industrial Policy Strategies, Johannesburg.

WALTERS, S. and DE BEER, B. (1999). An indicator of South Africa's external competitiveness. *South African Reserve Bank Quarterly Bulletin*, September 1999, pp. 54-65.

WOOD, A. and BERGE, K. (1997). Exporing manufactures: Human resources, natural resources, and trade policy. *Journal of Development Studies*, Vol. 34, pp. 35-59.

WOOD, A. and MAYER, J. (2001). Africa's Export Structure in a Comparative Perspective. *Cambridge Journal of Economics*, Vol. 5, No. 3: 369-394.