



Munich Personal RePEc Archive

The export behaviour of South African manufacturing firms

Rankin, Neil A.

Trade and Industrial Policy Strategies

September 2001

Online at <https://mpra.ub.uni-muenchen.de/16904/>
MPRA Paper No. 16904, posted 22 Aug 2009 14:06 UTC



2001 Annual Forum

at Misty Hills, Muldersdrift

The Export Behaviour of South African Manufacturing Firms

Neil Rankin

Centre for the Study of African Economies

University of Oxford

The Export Behaviour of South African Manufacturing Firms

Neil Rankin

Centre for the Study of African Economies

University of Oxford

neil.rankin@economics.ox.ac.uk

To be presented at the Trade and Industrial Policy Strategies Forum 2001
“New Directions in the South African Economy”, 10-12 September 2001,
Johannesburg.

The financial assistance of the National Research Foundation towards this research is hereby acknowledged. Opinions expressed in this paper and conclusions arrived at, are those of the author and are not necessarily to be attributed to the National Research Foundation. I am grateful for financial assistance from the Trade and Industrial Policy Strategies which has enabled me to attend this conference. I thank Christopher Adam, Rashad Cassim, Måns Söderbom and Francis Teal for useful comments, discussion and advice. The errors are mine.

Executive summary

This paper presents results based on a recent South African firm-level survey. It examines the export behaviour of South African manufacturing firms, it attempts to characterise the decision to export and it also considers the destination of exports. We find the following:

- 71% of South African firms export. These firms export on average 18% of their output.
- The proportion of firms exporting is one of the highest for a number of African countries. However, given that a firm exports, the percentage of output exported is amongst the lowest.
- There are very few specialist exporters. Less than half the firms in the sample export more than 10% of their output.
- More than a quarter of exporters export only to countries in the SADC region.
- SADC is the major market for all sectors and for more than 50% of firms in all sectors except the iron and steel sector and the textiles and garments sector.
- Other major markets include the rest of Africa, Western Europe, Asia and North America, although there are noticeable differences in major markets between sectors.
- For those firms that export, about 55% of exports go to SADC and 45% to the rest of the world. Less than 6% of total output for all firms is exported to the rest of the world. However, these figures mask important differences between sectors.
- Exporters produce more output per employee and have higher average labour costs.
- Estimates of production functions for firms suggest that firms with some foreign ownership produce more output than identical firms with none. This suggests that foreign ownership may be an important channel for technological transfer.
- Production function estimates suggest that returns to scale are constant.
- Exporting in general does not make a difference to efficiency but exporting out of SADC does. Firms that export outside of SADC produce more output with the same amount of inputs than those that do not.

- Larger firms are more likely to export suggesting that fixed costs may be important for exporting.
- Larger, more efficient firms are more likely to export outside of SADC. It is argued that there may be some efficiency threshold which firms need to overcome in order to enter global markets.
- Further research on factors determining the amount exported is needed. It seems as though if a firm is exporting, its size is not an important factor in determining the amount exported.
- If an increase in manufactured exports is a policy goal (we suggest that it should be), policy should focus on encouraging firms to export more rather than persuading more firms to export.
- In order to provide better insight into the dynamic evolution of South African manufacturing firms it would be very valuable to add a time dimension to the survey data. Expanding the human capital and skills section would also be useful.

Very little is known about the specific relationship between South African manufacturing firms and their exports. Recent empirical work has focused mainly on the sectoral, macro-economic or regional dimensions of South African trade. These recent studies suggest a number of stylised facts for the South African manufacturing sector. First, they suggest that comparative advantage for South African manufacturing lies in the mineral related sub-sectors – although there is a suggestion that non-traditional sub-sectors are becoming more important (Valentine and Krasnick, 2000, Roberts 2000). Second, that trade patterns in the manufacturing sector are changing – with more industry specialisation and more intra-industry trade (Roberts, 2000, Parr, 2000). Third, that macro-economic variables cannot explain the time-series behaviour of South African exports (Naudé, 2000). Together these results suggest that in order to better understand the nature and determinants of South African exports there is a need to examine firm-specific factors.

Globally, a number of studies have examined firm-level behaviour and exports in the manufacturing sector. Roberts and Tybout (1996) examine industrial evolution in Chile, Colombia, Morocco and Turkey, Caves (1992) contains studies on industrial efficiency in six industrialised nations, Bernard and Jensen (1995) analyse the relationship between exports, wages jobs and efficiency for the US, and Bigsten *et al* (1999) conduct a similar study for four sub-Saharan African countries. These studies all suggest that there are important firm-level factors, most notably efficiency, that need to be examined to understand industrial dynamics and consequently exports. A firm-level study examining similar issues in South Africa, has until now been constrained by the paucity of data. Fortunately, a recent firm-level survey administrated by the World Bank and the Greater Johannesburg Regional Council provides an opportunity to investigate these issues in a South African context. This paper examines the characteristics of South African manufacturing firms and the relationships between these characteristics and their export behaviour. It is divided into 6 sections. The first examines recent trends in macroeconomic aggregates in South Africa. The second section provides a summary of the survey methodology and its limitations. The third section examines some of the data from the survey. The fourth estimates production functions using the survey data. The fifth section attempts to isolate important factors in the decision to export. The sixth section concludes and suggests some policy implications.

Section I: Recent Macroeconomic trends

This section compares recent trends in South African GDP growth, exports and manufacturing production with countries that have experienced recent rapid economic growth. South Africa is compared to three of the Newly Industrialised Countries (NICs) of East Asia – Indonesia, Malaysia and Thailand, and an African success story – Mauritius. As Table 1 illustrates, the growth rates of real per capita GDP in these countries are positively associated with positive trends in real exports. Although, this association says little about the direction of causality between exports and growth, it is widely acknowledged that a link does exist. Greenaway, Morgan and Wright (1999) survey some of the extensive empirical literature on the relationship between exports and growth. They find that there does seem to be a fair amount of evidence pointing to some kind of correlation between the growth of exports and the growth of GDP, although there is some ambiguity with regard to causality. Fosu (1990) finds that it is the manufacturing rather than the primary export sector which has a positive impact on GDP growth in less developed countries.

The trend growth rate for South Africa GDP has been, since 1994, less than 1%. However, over this time real exports have increased by about 5%. Although this is poor in comparison with the other countries considered, it is at least an improvement on the previous period.

Table 1: Trend rates of growth (%pa) of Real GDP per Capita and Real Exports per Capita: 1980-1989 and 1990-1998.						
	Real GDP per Capita			Real Exports per Capita		
	80-89	90-98	94-98	80-89	90-98	94-98
Indonesia	0.038	0.040		0.005	0.072	
Malaysia	0.020	0.047		0.069	0.092	
Mauritius	0.050	0.038		0.091	0.051	
Thailand	0.051	0.043		0.108	0.081	
South Africa	-0.016	-0.002	0.007	-0.009	0.034	0.047

Source: World Development Indicators 2000.
Real GDP and Real Exports are constant price series.
The figures reported in the table are the coefficients of a regression of the log of the series on time

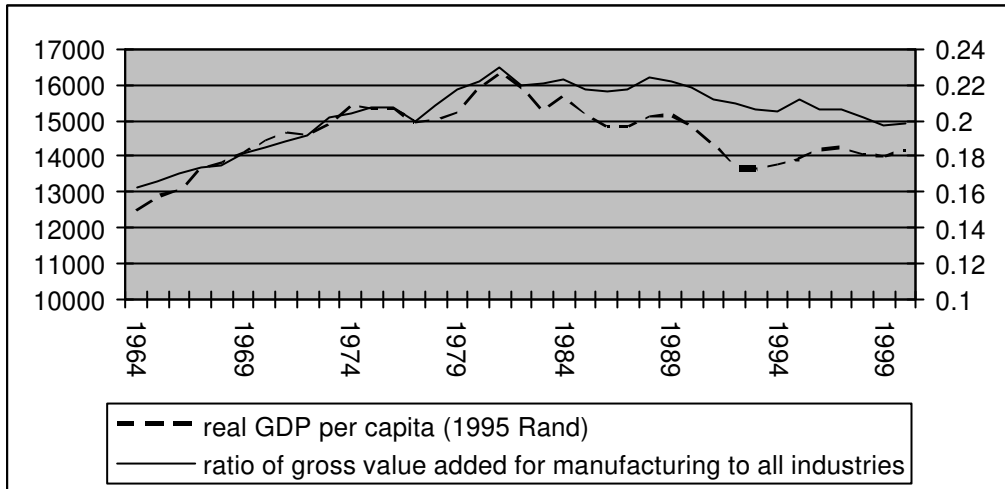
Table 2 provides a closer analysis of manufacturing exports. In the 1990 to 1998 period South Africa had the lowest ratio of manufactured exports to merchandise exports of all the countries considered. This was about 57% of the ratio for Malaysia, Mauritius and Thailand but only fractionally smaller than Indonesia. The mean value of South African manufactured exports for this period was smaller than all the East Asian countries but not Mauritius. However, in per capita terms Mauritius produced more than three times the value of South African manufactured exports.

Table 2: Manufactured exports: 1980-1998						
	Manufactures exports (% of merchandise exports)		Manufacturing exports (means US\$ mil current prices)		Manufactured exports/capita (mean US\$ current)	
	80-89	90-98	80-89	90-98	80-89	90-98
Indonesia	16 ^a	46	3058 ^a	19354	18 ^a	100
Malaysia	31	70	5302	40573	328	1971
Mauritius	43	69	290	1021	282	917
Thailand	39	69 ^b	4177	28963 ^b	80	493 ^b
South Africa	18 ^c	41	3711 ^c	11513	123 ^c	296

Source: World Development Indicators 2000.
^a 1981-1989
^b 1990-1997
^c 1985-1987 excluded.

Figure 1 charts real per capita GDP and the share of manufacturing in gross value added since 1964. These series both peaked in 1979 and since then both have declined.

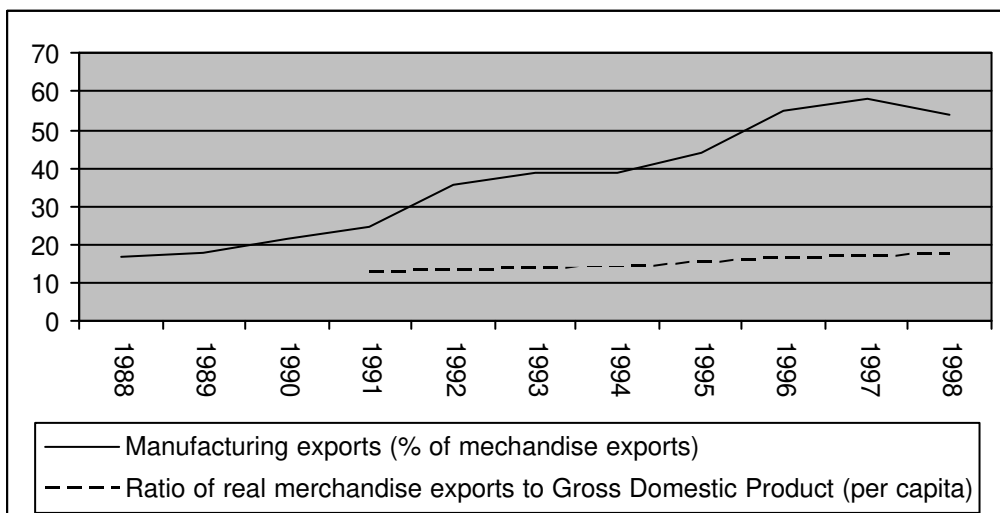
Figure 1 Real per capita GDP and the share of manufacturing in gross value added since 1964.



Source: South African Reserve Bank

Figure 2 provides a more optimistic picture. The ratio of merchandise exports to GDP has increased since 1991. Moreover, manufacturing exports as a share of these exports have increased dramatically from 17% in 1988 to 54% in 1998. Since 1991 the ratio of manufactured exports to GDP has increased by more than 3 times from 3.1% to 9.6%. This suggests that manufacturing exports are an increasingly important component of GDP.

Figure 2: Manufacturing exports as a share of merchandise exports and merchandise exports as a share of GDP.



Source: South African Reserve Bank

This section has provided a macroeconomic overview of manufactured exports both in an international context and over time. It is argued that manufacturing is an important component of exports and that export growth is an important part of GDP growth. Some reasons for this may be that exports generate foreign exchange, allow firms to benefit from economies of scale, provide a mechanism for the transfer of know-how and technology, and encourage efficiency. The importance of manufactured exports has increased dramatically in South Africa in recent years. It is important to understand what is driving this, specifically at the firm level. The next section examines the results and data from a recent firm-level survey in order to begin tackling these issues.

Section II: The Survey¹

The data used in this paper comes mostly from a survey coordinated by the Greater Johannesburg Metropolitan Council and the World Bank. This survey was initiated firstly, so as to better understand the basic nature of economic activity in the Greater Johannesburg Metropolitan Council (GJMC) area and secondly, to use the nationally representative data set from Greater Johannesburg to draw implications for other metropolitan areas within South Africa. Although, there is some available data on firms in South Africa most of it is either sectoral or macroeconomic in nature. This data set is, to our knowledge, the most current and comprehensive one that publicly exists. Because it is based on firm level responses it can be used to analyse firm level behaviour and decision making. It is thus an important tool in examining issues such as export behaviour (as in this paper) and investment. Although, it is not strictly comparable to surveys in other countries, useful comparisons can be made between the results obtained in this survey and those obtained from other African countries. Comparable data of varying quality exists for, at least, Cameroon, Ghana, Kenya, Zambia and Zimbabwe.

The South African survey was undertaken in 1999 and covers the years 1997 and 1998. It was administered in the Johannesburg area and its immediate surrounds

¹ This description of the survey and sampling methodology is based on Annex A1 of the Greater Johannesburg – World Bank Partnership Report (2000).

(hereafter referred to as the Greater Johannesburg Metropolitan Area – GJMA).

These surrounds did not include the Pretoria Metropolitan area. The large firm survey (LFS) was one part of a larger study. This larger study also surveyed: large formal service firms; small, medium and micro enterprises; informal sector firms; households in Soweto; training and credit providers and recently hired production workers. At the moment, the data and report for the LFS is the only part publicly available.

Approximately 42% of large formal sector manufacturing firms (50 employees or more) in South Africa are located in the GJMA. The survey covered approximately one in every fifth large manufacturing firm. Thus the survey can, with some caveats be claimed to be nationally representative. The survey covered the following eight sectors:

1. chemical products;
2. electrical and electronic machinery;
3. food and beverages;
4. iron and steel;
5. metals and machinery;
6. paper and furniture;
7. textiles and garments; and
8. vehicles and automotive components.

Within these sectors, firms were divided into three size classes²: size 1 or medium (50-99 employees)³; size 2 or large (100-199 employees); and size 3 or very large (200 or more employees).

Manufacturing firms were stratified by sector and then by size class. Within these strata random sampling was performed. Table 3 provides a summary of the number of firms sampled and the proportion of firms sampled in each group relative to the national total. The iron and steel sector is proportionately over sampled whereas the textile and garment sector and the food processing and beverages sectors are under sampled. This is the case because the iron and steel sector has a smaller number of firms nationally than the other sectors. Both the

² Note these class size names differ from the GJMC report. The small category in their report has been renamed medium in this paper.

³ It turned out that some respondents had less than 50 employees. This was only the case with a few firms and the smallest firm size was 43 employees.

textile and the food sectors are not as concentrated in Gauteng as other sectors are. These aspects of the sampling need to be borne in mind when analysing the results.

Table 3: Number of firms sampled and percentage of national total by sector and size

Size category	200+		100-199		50-99		total	
	N	% of national total	N	% of national total	N	% of national total	N	% of national total
Chemical products	11	3.75	16	5.39	21	4.86	48	4.70
electrical, electronic machinery	17	6.97	10	4.55	29	7.75	56	6.68
food processing and beverages	11	3.05	6	2.2	9	2.29	26	2.53
iron and steel	18	34.62	13	38.24	25	58.14	56	43.41
metal products	9	5.42	18	8.49	30	5.99	57	6.48
paper and furniture	10	3.44	12	4.43	12	2.96	34	3.52
Textiles	3	0.77	6	2.14	5	1.58	14	1.42
vehicles, automotive components	13	11.3	7	8.43	14	11.02	34	10.46
Total	92	4.81	88	5.27	145	5.59	325	5.26

Source: GJMC – World Bank partnership, 2000.

There are a number of limitations with the data. These limitations fall into two main groups: aspects not covered by the data; and, limitations associated with the available data. There are two main limitations in the first group. Firstly, it is a cross-sectional survey. Whilst there is a lot of information to be gleaned from surveys of this nature, it would be very valuable to add a time dimension to the data. This would enable analysis of the dynamic behaviour of firms. We would be better able to understand how firms respond to the changing macroeconomic environment and to government policy. In the context of this paper it would allow for research on, amongst other things, why firms enter or exit the export market, whether export shares or destinations change, and the link between firm level efficiency and exports. We cannot understand any of this without a time dimension. The second limitation is that there is very little information on human capital from the employee perspective. The availability of skilled people is often cited as a constraint to business in South Africa (see for e.g. Abedian and Antonie,

2001). There is also a pressing need in South Africa to absorb many unskilled (or at least semi-skilled) workers into the workforce. Questioning workers and being able to link their characteristics with firms would be a valuable addition to the survey.

These comments cover aspects not included in the data. There are also some factors which need to be borne in mind when considering the data we have. The first is the sampling methodology. As mentioned above some sectors and size categories are proportionately over or under sampled. The results could be weighted so as to provide a national or regional picture. We have chosen not to weight the observations primarily because we will be using regression analysis on the data. It is important though that the sampling methodology be borne in mind when interpreting the results. Another comment that needs to be made with regards to the available data is that many of the firms do not have data for all the required variables or that the data may have been recorded incorrectly. We have attempted to use as many observations as possible and to check for doubtful values. Due to this, over a third of the firms in the sample are unusable. In much of the analysis the sample size used is 199 firms.

Bearing in mind these limitations we now consider some summary statistics of the firms in the sample and their export characteristics.

Section III: Exports, destinations and efficiency.

This section considers the general export characteristics of the firms in the sample. It examines the percentage of firms exporting and the amount exported by size and sector. It compares these results with other African countries. It also considers the major export markets for firms and the percentage of output exported to these markets. Finally, controlling only for size and sector, it examines whether exporting firms differ from non-exporting firms in terms of output per employee, capital per employee and average labour costs.

Sector	Very large (200+)		Large (100-199)		Medium (50+)		Total	
	% exporting	% exported	% exporting	% exported	% exporting	% exported	% exporting	% exported
chemical products	0.91	0.10	0.88	0.12	0.57	0.14	0.75	0.12
Electrical / electronic machinery	0.94	0.18	0.80	0.26	0.76	0.16	0.82	0.19
food processing	0.73	0.11	0.67	0.26	0.56	0.06	0.65	0.14
iron & steel	0.83	0.13	0.69	0.34	0.56	0.30	0.68	0.24
metal products	1.00	0.25	0.67	0.24	0.57	0.11	0.67	0.19
paper & furniture	0.90	0.09	0.67	0.06	0.25	0.10	0.59	0.08
Textiles	0.67	0.05	0.67	0.13	0.40	0.13	0.57	0.11
vehicles & automotive components	0.77	0.29	0.86	0.33	0.86	0.23	0.82	0.27
Total	0.86	0.16	0.74	0.21	0.60	0.17	0.71	0.18

Table 4 shows the percentage of firms that export and the percentage of sales exported by both sector and size category. In total 71% of firms in the sample export some of their sales. The sectors with the highest proportion of exporters are the electrical and electronic machinery sector and the vehicle and automotive components sector. The textiles and garments and paper and furniture sectors have the lowest proportion of exporters. By size category, the larger a firm is the more likely it is to export, suggesting that larger firms find it easier to enter the export market than smaller firms. One explanation for this may be fixed costs. Firms may need to invest in specific machinery to meet international standards, they may face costs in setting up a distributional network or they may need to undertake research into possible export markets. Larger firms which produce more output can more easily spread these fixed costs and thus not dramatically increase average costs. An alternative explanation may be that larger firms may have better links with foreign companies, they may be more efficient or they may have been around longer. These issues are examined later.

Given that a firm exports, larger firms do not export a higher percentage of their sales than other firms. In fact, on average, the large firm category exports a higher proportion of sales than either the very large category or the medium category. This result is consistent with a fixed cost argument that size matters only to enter the export market but thereafter does not determine the amount exported. The sectors which export the highest proportion of sales are the iron and steel, and vehicles and automotive components sectors (24% and 27% respectively). The paper and furniture sector exports the least (8%). Over all sectors the average proportion of sales exported is 18%. However, the median value is much lower than this. The histogram of the percentage of a firm's output exported given it exports (figure 3) shows that less than half the firms in the sample export more than 10% of their sales. Thus very few firms are substantial exporters or focus mainly on exporting. Within the sample, only 10% of firms export half or more than half of their sales. These firms are found mainly in the iron and steel, the metal products and machinery and vehicles and automotive components sectors.

Figure 3: Distribution of the percentage of output exported given a firm exports, by sector.

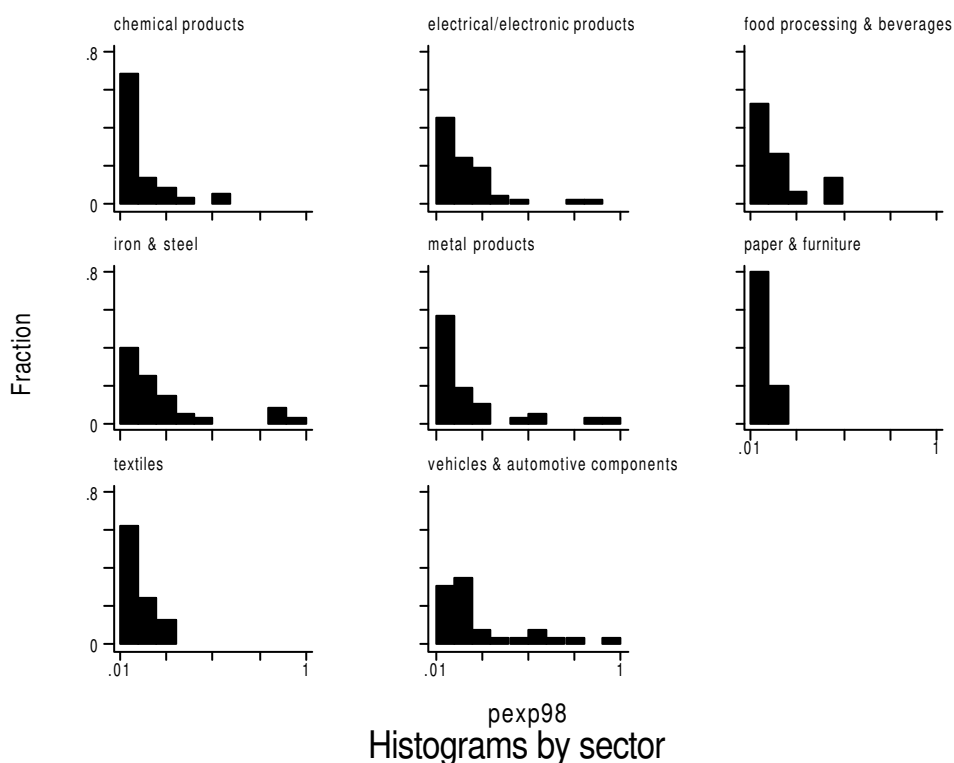
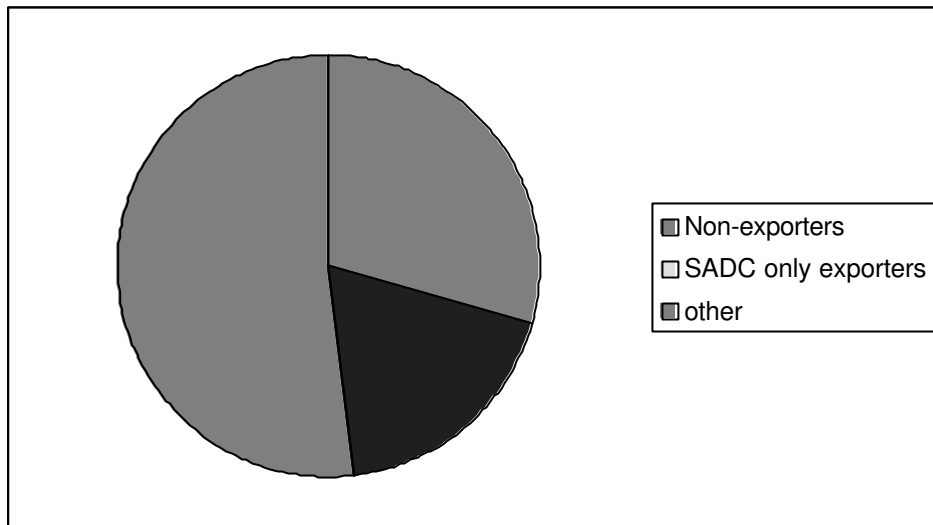


Table 5 provides a similar breakdown to table 4 but includes a number of other African countries. South Africa has one of the higher percentages of firms exporting yet the amount exported, given a firm exports, is one of the lowest.

Table 5: The percentage of firms exporting and the percentage exported for a number of African countries.						
	Cameroon	Ghana	Kenya	Zimbabwe	Cote d'Ivoire	South Africa
Time period	1993	1991	1992	1992	1995	1998
Large(>100)						
N	17	12	25	62	52	181
Percentage exporting	76	58	56	78	81	80
% exported if a firm exports	40	40	28	23	64	18
% exported (entire sample)	30	24	16	18	52	14
Medium(50-100)						
N	21	19	27	25	20	146
Percentage exporting	38	0	41	52	80	60
% exported if a firm exports	22	0	29	11	44	17
% exported (entire sample)	8	0	12	6	35	10
All						
N	38	31	52	87	72	327
Percentage exporting	55	22	48	71	80	71
% exported if a firm exports	30	15	29	20	58	18
% exported (entire sample)	18	9	14	15	47	13
Source: Bigsten et al (1999), Kimbrough (1999), and own calculations						

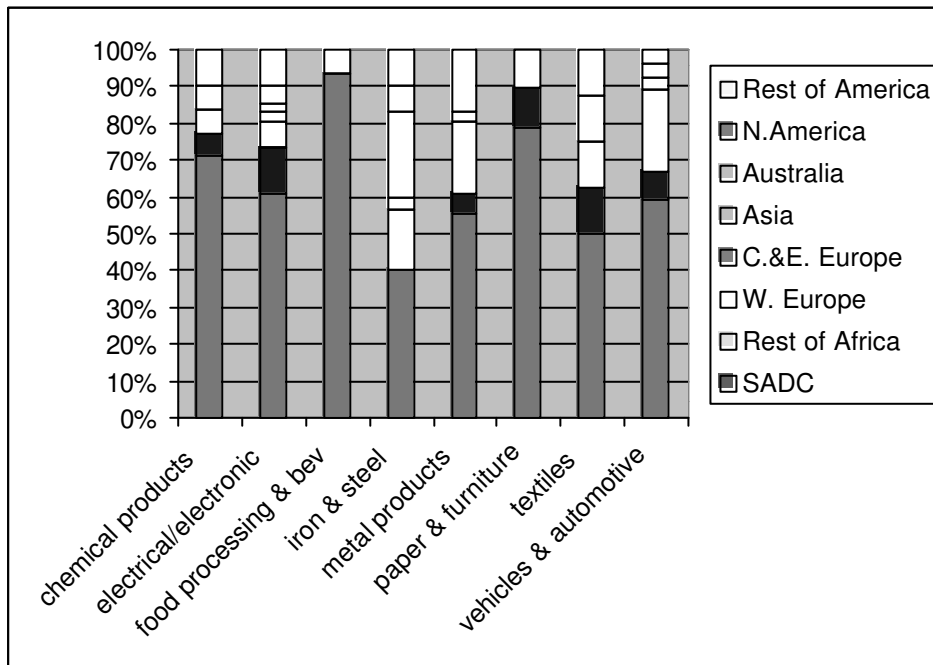
Figure 4 examines the breakdown of firms according to their export behaviour. 30% of the firms in the sample do not export, 19% export only to countries in the SADC region, and 51% export at least some of their exports outside of SADC.

Figure 4: Non-exporters, SADC only exporters and other exporters.



Next we consider the major export markets of firms. These are defined as the market to which a firm sends the majority of its exports. Figure 5 groups major markets by sector.

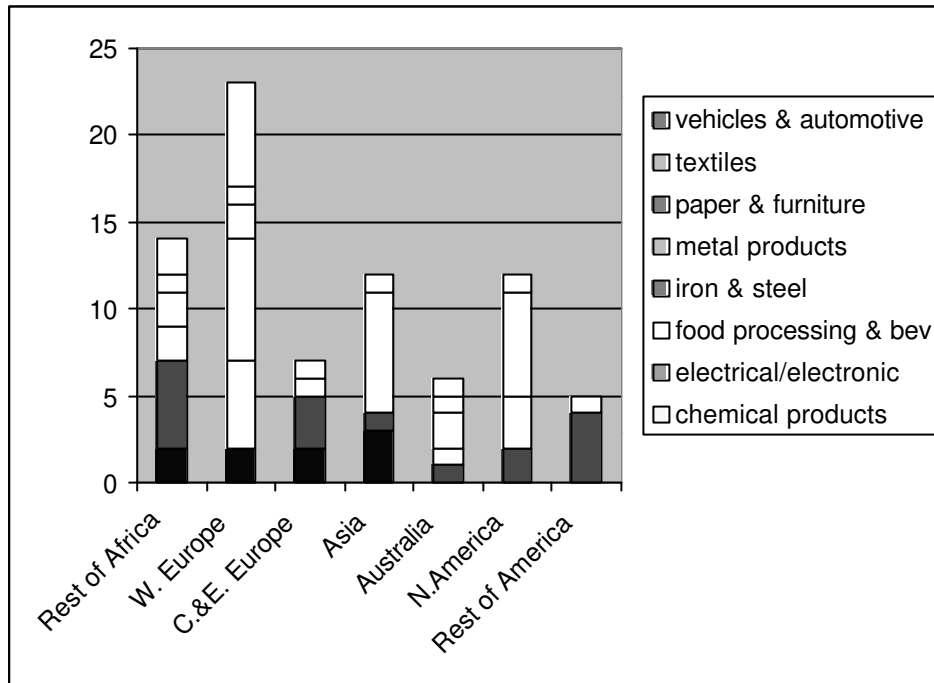
Figure 5: Major markets by sector.



For all sectors except the iron and steel, and textiles and garments sectors, the SADC region is the major market for more than half the exporting firms. In the

food processing and beverages sector SADC is the major market for more than 90% of the firms.

Figure 6: Major markets outside of SADC by market.



If we exclude SADC and group exports according to destination, figure 6 illustrates that Western Europe is the major market for the highest number of firms. In particular it is an important market for vehicles, metal products and iron and steel. The rest of Africa is the major market for the second highest number of firms. The electronic sector is dominant in this market. The rest of the Americas and Central and Eastern Europe are also important major markets for firms in this sector. Asia is the major market for a number of iron and steel firms and North America is an important major market for firms in the metal products and machinery sector.

The next table splits the percentage exported by destination – either to SADC or the rest of the world. The iron and steel sector has the highest percentage of exports going outside of SADC. The electrical, metal products and textiles sector have an almost even split between the percentage of exports to SADC and the percentage to the rest of the world. The chemical products, food processing, paper and furniture and vehicles and automotive components sectors all export on

average more of their output to the SADC region than the rest of the world.

Median values suggest that the majority of firms in these sectors see SADC as their major export market. These results suggest that although for many firms, and all sectors except iron and steel, SADC is the major market, on average about 45% of exports go to the rest of the world. However, as a percentage of total output for all firms in the sample, this is below 6%.

Table 6: Export behaviour by sector					
sector	% exporting	% exported (whole sample)	% exported (exporters only)	% of exports to SADC	% of exports to the rest of the world
chemical products					
Mean	0.75	0.09	0.12	0.62	0.38
Median	1	0.05	0.06	0.80	0.20
N	48	47	35	34	34
electrical/elect					
Mean	0.82	0.15	0.19	0.51	0.46
Median	1	0.10	0.125	0.50	0.46
N	56	56	46	46	46
food processing					
Mean	0.65	0.09	0.14	0.74	0.26
Median	1	0.02	0.07	1	0
N	26	24	15	16	16
iron & steel					
Mean	0.68	0.16	0.24	0.36	0.63
Median	1	0.05	0.15	0.12	0.88
N	56	53	35	34	34
metal products					
Mean	0.67	0.12	0.19	0.47	0.53
Median	1	0.05	0.10	0.50	0.50
N	57	56	37	37	37
paper & furniture					
Mean	0.59	0.05	0.08	0.74	0.25
Median	1	0.015	0.065	0.95	0.05
N	34	34	20	20	20
textiles					
Mean	0.57	0.06	0.11	0.51	0.49
Median	1	0.03	0.06	0.55	0.45
N	14	14	8	8	8
vehicles & automotive components					
Mean	0.82	0.22	0.27	0.60	0.40
Median	1	0.15	0.165	0.85	0.15
N	34	32	26	27	27
Total					
Mean	0.71	0.13	0.18	0.55	0.45
Median	1	0.05	0.10	0.60	0.40
N	325	316	222	222	222

The above tables have summarised the export behaviour and destinations of firms in the sample. We are also interested in whether firms that export are different from non-exporters in terms of output, labour costs and capital usage.

	Medium (50-99)	Large (100-199)	Very Large (200<)	all	Difference for exporters
Ln Output employment ratio	12.32	12.49	12.65	12.50	0.34
Std dev	0.16	0.17	0.16	0.15	0.11
N	108	74	77	259	258
Ln capital labour ratio	11.26	11.48	11.75	11.50	0.06
Std dev	0.23	0.25	0.23	0.22	0.16
N	136	83	89	308	307
Ln Average labour cost	10.50	10.70	10.81	10.68	0.20
std dev	0.14	0.16	0.14	0.13	0.10
N	123	77	87	287	286

Note: Means reported in this table are obtained by regressing the variables on sector and size dummies. The size effect is then obtained from the size dummies in the regression. This effect is for the base category (vehicles and automotive components).⁴

Table 7 gives the results of the differences between output per employee, capital per employee and average labour costs by firm size and between non-exporters and exporters. The last column suggests that output per employee is significantly larger for exporters than non-exporters. It is also found that conditional on sector and size effects that average labour costs are higher for exporters than non-exporters. There is no difference between exporters and non-exporters in the capital labour ratio. These findings are no different if we group SADC only exporters with non-exporters. These results suggest that exporters produce more and pay higher wages than non-exporters. This is investigated further in the next section.

⁴ This technique constrains the differences attributed to firm size to be the same across all sectors. This is not a problem as we are interested in the differences between firms of differing size rather than between sectors or the magnitude of the means.

Section IV: Production functions results

The next step in our analysis is to consider the production technology used by firms. To do this we attempt to fit a Cobb-Douglas production function⁵ to the data. The function takes the form:

$$Y_i = A_i K_i^{\hat{\alpha}} L_i^{\hat{\beta}} M_i^{\hat{\gamma}} I_i^{\hat{\delta}} \quad (1)$$

Where Y is output, K is capital, L is labour, M is material inputs, I is indirect inputs (in this case things like electricity, royalties and telephone bills) and A is a firm specific parameter. The subscript i denotes individual firms. The superscripts are traditionally interpreted as the share of the input in the production function. Their sum provides the returns to scale inherent in the production process. We estimate the production function by taking natural logarithms of both sides. This gives us:

$$\ln Y_i = \ln A_i + \hat{\alpha} \ln K_i + \hat{\beta} \ln L_i + \hat{\gamma} \ln M_i + \hat{\delta} \ln I_i + \hat{\epsilon} \quad (2)$$

where $\hat{\epsilon}$ is the error term.

We include in our specification dummy variables to take into account sector specific effects and a dummy variable for foreign ownership. We also include the age of the firm and the age of the firm squared because we hypothesise that this may play a role in determining output. To test whether exporting and exporting outside of SADC makes a difference to output for firms which are otherwise identical, we include dummy variables to take account of this. The results of three specifications are reported in table 8. The coefficients for capital, labour, material inputs and indirect inputs are all significant at the 1% level. These coefficients sum to 1.01 - suggesting constant returns to scale. This means that if each factor is increased by the same proportion, output will increase by a like proportion. The only other significant

⁵ The Cobb-Douglas production function owes its name and development to Charles W. Cobb, a mathematician, and Paul H. Douglas, an economist (1928). Whilst plotting a logarithmic graph of labour, capital and output in US manufacturing from 1899 to 1922, Douglas observed correlations among the series which Cobb helped formalise in the functional form known now as Cobb-Douglas. In their seminal paper, they suggested that there are laws of production that govern the proportions of productive factors (this account is taken from Chung, 1994, p. 94). The Cobb-Douglas function is now widely used in both aggregate and firm level studies.

variable is foreign ownership, which suggests that firms with some foreign ownership produce more output than those with only domestic owners.

Table 8: Ordinary least squares estimates of production functions									
	Coef.	t	P> t	Coef.	t	P> t	Coef.	t	P> t
Capital	0.056	2.820	0.005	0.056	2.820	0.005	0.056	2.810	0.005
Employment	0.231	4.690	0.000	0.231	4.670	0.000	0.233	4.670	0.000
Material inputs	0.572	19.540	0.000	0.572	19.170	0.000	0.560	18.700	0.000
Indirect inputs	0.151	4.910	0.000	0.151	4.890	0.000	0.155	5.000	0.000
Electrical	-0.019	-0.230	0.816	-0.019	-0.230	0.817	-0.019	-0.230	0.817
Food	-0.125	-1.120	0.266	-0.125	-1.110	0.268	-0.098	-0.870	0.386
Iron & steel	-0.032	-0.400	0.688	-0.032	-0.400	0.687	-0.014	-0.170	0.867
Metal products	-0.055	-0.700	0.486	-0.055	-0.700	0.486	-0.050	-0.620	0.537
Paper & furniture	-0.036	-0.400	0.691	-0.036	-0.400	0.690	-0.004	-0.040	0.969
Textiles	-0.201	-1.550	0.122	-0.201	-1.550	0.123	-0.184	-1.410	0.160
Vehicles	-0.018	-0.190	0.853	-0.018	-0.180	0.853	-0.006	-0.060	0.949
Age	0.002	0.510	0.609	0.002	0.510	0.610	0.002	0.470	0.638
Age ²	0.000	-0.690	0.490	0.000	-0.690	0.492	0.000	-0.770	0.443
Foreign ownership	0.244	4.410	0.000	0.244	4.400	0.000	0.245	4.380	0.000
Exporting				-0.002	-0.040	0.964			
Exporting out of SADC							0.093	1.930	0.055
Constant	3.621	9.740	0.000	3.619	9.590	0.000	3.687	9.730	0.000
Number of obs		199			199			195	
F(14, 184)		214.83			199.42			196.05	
Prob > F		0			0			0	
R-squared		0.9423			0.9423			0.9426	
Adj R-squared		0.938			0.9376			0.9378	
Root MSE		0.30904			0.30988			0.30848	

In the second specification we include a dummy variable for exporters. This is not significant indicating that merely exporting makes no difference to the amount of output produced. However, if we substitute a dummy for exporting outside of SADC, this is significant at the 10% level. This result is robust to various specification changes. Thus firms that export outside of SADC produce more output than identical firms that do not export or that export only to the SADC region. These two results suggest a number of things. Firstly, it suggests that firms that export outside of

SADC are more efficient (they produce more output with the same amount of inputs) than those that do not export or export only to SADC. This may be the case because either efficient firms self-select into exporting, or that by exporting outside of SADC firms become more efficient. These issues cannot be answered with only cross-sectional data. However, evidence from other semi-industrialised countries - Colombia, Mexico and Morocco (Clerides, Lach and Tybout, 1998) suggests that it is efficient firms that self-select into the export market. Secondly, it suggests that exporting only to SADC has no implications for efficiency and in conjunction with the evidence presented in section III it seems that many firms see SADC as an extension of their domestic market.

The results so far indicate that exporting – outside the SADC region – and efficiency are related. To examine this aspect further we need some measure of the efficiency of firms. We derive this measure from the residuals of our initial production function. If the residual is positive, it means that the firm, given its characteristics, produces more than the estimation suggests it should. It is thus relatively efficient. If the residual is negative, the firm produces less than the estimation suggests and it is thus relatively inefficient. The next section uses these measures of efficiency to analyse the factors that determine whether a firm exports or not.

Section V: The determinants of exports.

In this section we are interested in what factors make it more probable for a firm to be an exporter or not, or to export outside of SADC. We use logit estimation techniques to attempt to establish what makes a firm more likely to export. In these types of specifications the dependent variable is qualitative – it is either yes or no. Thus we set up a specification where no takes the value 0 and yes takes the value 1. We then estimate, using maximum likelihood techniques, the probability that the dependent variable takes a value of 0 or 1. We do this for whether a firm is an exporter or not and for whether a firm exports outside of SADC or not. We use the natural logarithm of the capital-labour ratio, the natural logarithm of employment, age and age-squared, a foreign ownership dummy, dummies for the sectors and the residuals from the Cobb-Douglas production function (a measure of efficiency) as independent variables. The results are presented in table 9.

Table 9: Logit estimates of the decision to export and to export outside of SADC						
	To export out of SADC			To export		
	Coef.	Z	P> z	Coef.	z	P> z
Capital/labour	0.040	0.300	0.765	0.069	0.470	0.641
Electrical	0.705	1.240	0.214	0.308	0.400	0.687
Food	-0.529	-0.670	0.501	-0.963	-1.090	0.277
Iron & steel	0.049	0.090	0.928	-1.199	-1.800	0.072
Metal products	0.190	0.350	0.726	-0.847	-1.260	0.209
Paper & furniture	-1.180	-1.790	0.073	-1.075	-1.450	0.146
Textiles	-0.624	-0.700	0.486	-0.475	-0.450	0.649
Vehicles	-0.006	-0.010	0.993	-0.124	-0.140	0.887
Age	0.017	0.660	0.511	0.011	0.360	0.717
Age ²	0.000	-0.240	0.808	0.000	-0.010	0.991
Foreign ownership	0.277	0.740	0.459	0.311	0.670	0.500
Employment	0.452	2.090	0.036	0.809	2.860	0.004
Efficiency	1.017	1.900	0.057	-0.033	-0.060	0.953
Constant	-2.891	-1.670	0.096	-3.307	-1.580	0.114
Number of obs	195			199		
LR chi2(13)	26.06			28.3		
Prob > chi2	0.0167			0.0082		
Pseudo R2	0.0966			0.1227		
Log likelihood	-121.823			-101.188		
The capital-labour ratio and employment are estimated in the natural logarithm form.						

In the export specification the only significant sector is the iron and steel sector. This suggests that firms in the iron and steel sector are less likely to export than identical firms in other sectors. This result may be driven by the fact that firms in the iron and steel sector do not export as much to SADC as firms in other sectors. The only other variable that is significant is the natural logarithm of employment. This is positive and like our previous results suggests that larger firms are more likely to export. We next consider which factors are important for exporting outside of SADC. In this specification only one sector is significant. Firms in the paper and furniture sector are less likely to export outside of SADC than identical firms in other sectors.

Employment is again significant indicating that larger firms are more likely to export

than smaller firms, however its magnitude is smaller than for exports in general. At first glance this seems counter-intuitive. With a fixed cost type argument we would expect size to be more important for out of SADC exports. We would assume that the costs associated with exporting outside of SADC would be larger than those associated with exporting merely to SADC. We would therefore expect larger firms to be better able to spread these costs. However, the explanation perhaps lies with the fact that efficiency is significant for out of SADC exports. More efficient firms are more likely to export outside of SADC than less efficient firms. Intuitively this makes sense - firms need to be efficient if competing in world markets. These results suggest that for firms to export outside of SADC, not only does size matter but efficiency matters too. There may be some threshold effect and firms have to exceed some efficiency threshold to be able to export globally.

Section VI: Conclusions and policy recommendations.

This paper has examined the export behaviour of South African manufacturing firms. Using data from a recent firm-level survey we examine the characteristics of the firms, their export behaviour and the decision to export. Firms that export have higher average wage costs and produce more output per worker. Controlling for a number of factors, our results suggest that firms that export outside of SADC are more efficient than firms that export only to SADC or that do not export at all. This may suggest that efficient firms self-select into this export market or that firms become efficient once they are exporting to this market. Without time-series data we cannot tell, although evidence from some other semi-industrialised countries suggest the former (Clerides, Lach and Tybout, 1998). Firms with some foreign ownership are more efficient than firms without any suggesting that foreign ownership is an important conduit for the transfer of technology. In general returns to scale are close to constant, indicating that an increase in inputs increases output by the same amount.

Within our sample many firms export, yet few firms export very much. It seems that the most important factor that determines whether a firm is an exporter or not is size. Size, together with efficiency is an important factor determining whether a firm exports outside of SADC. However, once a firm exports, size does not seem to matter. Firms in the middle size category exported more output than smaller or larger

firms if they exported at all. This seems to suggest that there are some fixed costs that need to be overcome in order for a firm to become an exporter but that these costs do not constrain a firm once it exports. There may also be some threshold efficiency level which a firm has to overcome in order to become an exporter.

For the majority of firms that export SADC is the major export market. Other major markets seem to differ by sector. For example the electronics and electrical machinery sector seems to have its major markets in the less developed regions of the rest of Africa, Central and Eastern Europe and the rest of the Americas whereas vehicles, iron and steel and metal products have major markets in the more developed regions of Western Europe, Asia and North America. About 45% of exports go to destinations outside of SADC. This figure however differs by sector. The iron and steel sector sends most of its exports outside of the region. The electrical, metal products and textiles sectors are about evenly split between the percentage exported regionally and the percentage exported globally. The chemical products, food processing, paper and furniture and vehicles sectors all export a higher percentage of their output regionally.

Many of the policy implications from this study depend on what determines the percentage of output exported. If increasing exports is the policy goal (as it should perhaps be given that exports and GDP growth seem to be related) then the focus should be on encouraging firms to export more rather than having more firms export. It is thus crucial to understand why so few firms export a significant portion of their output. There may be a number of explanations as to why firms export so little. Exporting may be risky and concentrating on the domestic market may be safer, firms may lack information about potential export markets or it may be unprofitable (and risky) to find out about them. They may face supply-side constraints such as a lack of skilled workers, outdated capital or a lack of access to credit. Alternatively, there may be a limited demand for South African products because they do not meet international standards, or are too expensive because of transport costs or high domestic costs. Furthermore, trade barriers may constrain South African manufactured exports. These are some of the issues that require further investigation.

Adding a time dimension to the data would help in answering some of these questions as would more information on human capital, but still significant progress can be made given the existing data. This paper provides an informative initial insight into firm-level export behaviour in South African manufacturing firms. It is hoped that subsequent work will build on this.

References.

- Abedian, I., and F. Antonie (2001) "Contemporary challenges facing South African Business in a globalising economy", Paper presented "Development Policy in Africa: Public and Private Perspectives", 29-31 March 2001, The Centre for the Study of African Economies, Oxford University.
- Bernard, A.B. and J.B. Jensen (1995) "Exporters, Jobs and Wages in US Manufacturing 1976-1987", *Brookings Papers on Economic Activity Microeconomics*, p67-119.
- Bigsten, A., Collier, P., Dercon, S., Fafchamps, M., Gauthier, B., Gunning, J.W., Habarurema, J., Isaksson, A., Oduro, A., Oostendorp, R., Patillo, C., Söderbom, M., Teal, F. and A. Zeufack (1999) "Exports of African manufactures: macro policy and firm behaviour", *The Journal of International Trade and Economic Development*, Vol. 8(1), p53-71.
- Caves, R.E. in association with Bailey, S.D, Baldwin, J., Fecher, F., Green, A., Harris, C.M., Mayes, D.G., Perelman, S., Torii, A., and S.M. Yoo (1992) *Industrial Efficiency in Six Nations*, The MIT Press, Cambridge and London.
- Chung, J.W. (1994) *Utility and Production Functions*, Blackwell Publishers, Oxford.
- Clerides, S., Lach, S. and J.R. Tybout (1998) "Is learning by exporting important? Micro-dynamic evidence from Colombia, Mexico and Morocco", *Quarterly Journal of Economic*, Vol. 113(3), p903-47, August.
- Cobb, C.W. and P.H. Douglas (1928) "A theory of production", *American Economic Review*, 18, p139-65.
- Fosu, A.K. (1990) "Export Composition and the Impact of Exports on Economic Growth of Developing Economies", *Economic Letters*, Vol. 34(1), p67-71, September.

Greater Johannesburg Metropolitan Council – World Bank Partnership (2000), *Constraints to Growth and Employment in South Africa – Report 1: Evidence from the Large Manufacturing Firm Survey*, <http://www.tips.org.za/lfs99/contents.asp>.

Greenaway, D., Morgan, W., and P. Wright (1999) “Exports, export composition and growth”, *The Journal of International Trade and Economic Development*, Vol. 8(1), p41-51.

Kimbrough, K.J. (1999) *Monetary union, real exchange rates and trade in the West African Economic and Monetary Union*, unpublished D.Phil. Thesis, University of Oxford.

Naudé, W. (2000) “The Determinants of South African Exports: An Econometric Analysis”, *South African Journal of Economics*, Vol. 68(2), p246-65, June.

Parr, R. (2000) “Specialisation in South African Manufactures Trade, 1993-1998”, *South African Journal of Economics*, Vol. 68(2), p.297-306, June.

Roberts, M.J. and J.R. Tybout (eds.) (1996) *Industrial Evolution in Developing Countries*, Oxford University Press for the World Bank, Oxford and New York.

Roberts, S. (2000) “Understanding the Effects of Trade Policy Reform: The Case of South Africa”, *South African Journal of Economics*, Vol. 68(4), p607-38, December.

Valentine, N. and G. Krasnick (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), p266-85, June.

World Bank (2000) *World Development Indicators 2000*, World Bank, Washington D.C.