Trade and Poverty Project
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# Trade and Poverty in South Africa: Exploring the trade-labour linkages

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# Executive Summary

## Introduction

Changes in trade flows have been major factors in the structural changes taking place in developing economies and have important implications for economic performance. This paper provides a comprehensive analysis of the impact of trade on employment and poverty in South Africa. South Africa provides a particularly useful case study because it liberalised its trade regime during the 1990s, with average nominal protection in manufacturing falling from 23% in 1994 to 8.2% in 2004. At the same time trade became more important and there were significant changes in the level and composition of employment. Aggregate employment grew, but not fast enough to reduce unemployment and there were important differences across sectors, with employment in the primary and secondary sectors stagnant or falling, but service sector employment rising.

## Key Results

- The degree of liberalisation in trade varied across sectors. In particular, tariffs declines were particularly large in labour intensive sectors, although these sectors remain heavily protected. This suggested that further liberalisation would reduce the demand for labour in manufacturing, particularly lower skilled, relative to capital.
- A decomposition analysis shows structural change following the usual pattern for liberalising economies with a shift away from import substitution being accompanied by a loss of output in import competing sectors and a rise in output in export sectors. Employment created through export growth was, however, matched by employment lost through import penetration, with the net effect of trade on employment between 1994 and 2003 close to zero. The evidence also pointed to the majority of employment being attributable to skill-biased technological change.
- Evidence was found of strong export growth in capital intensive, resource based and chemical products sectors that may have had positive employment effects through their backward linkages. This may reflect the relative abundance in natural resource endowments, the relatively low declines in protection on these products and the past history of state support.
- In contrast, labour intensive products would appear to have been negatively affected by relatively large declines in protection as well as rapid import penetration, particularly from China and India.
- An econometric analysis the impact of trade on employment through technology showed a strong trend effect of exogenous technological progress, and limited evidence that increased trade flows and trade liberalisation induced improvements in labour productivity.

## Policy Conclusions

- Any further trade liberalisation is likely to continue and to remain biased towards reducing labour demand in lower skilled and labour intensive industries, suggesting it is unlikely to increase employment for the poorer members of South African society and so will have little direct effect on poverty.
- At the same time the growth in trade is likely to have little net impact on employment, with labour intensive products being negatively affected by relatively large declines in protection as well as rapid import penetration, particularly from China and India.
- On the other hand, there is some evidence that backward linkages from export growth are providing positive employment growth and the study has not analysed the effect of increased trade on employment within the wholesale and retail industries. Growth in these and other service sectors may alleviate the decline in the relative demand for labour within the manufacturing sector.
- What is clear is that the South African Government cannot rely only upon the growth in trade to produce significant increase in employment, particularly for lower skilled workers, and so reduce poverty.

## Proposals for ongoing and future work

- Extend the analysis to cover other sources of technological change, such as skill biased technological change arising from use of computers and possibly military spending.
- Use tariff data directly as a measure of liberalisation.
- Undertake further work using firm level data to look deeper at the detailed intra industry trends.
- Explore the effect on trade liberalisation on economic growth. The current analysis fails to account for the possible growth effects arising from liberalisation.

# TRADE AND POVERTY IN SOUTH AFRICA: EXPLORING THE TRADE-LABOUR LINKAGES

**By: Paul Dunne & Lawrence Edwards***

## 1. Introduction

Changes in trade flows have been major factors in the structural changes taking place in developing economies and have important implications for economic performance. When trade is liberalised there is a direct reallocation of resources, including labour and capital, across sectors of the economy and indirect dynamic effects, through the resulting changes in productivity, which again will vary across sectors. While these static and dynamic adjustments impact on the levels and distribution of employment and wages and so have important implications for the development of the economy and the distribution of income, the relationship between them is not fully understood. An expanding literature has explored the links between trade liberalisation, structural change and employment growth, but while advancing our understanding there are still areas that require investigation. In particular, the specific nature of the trade labour relationship and its implications for poverty is yet to be adequately explored.

This paper provides a comprehensive analysis of the impact of trade on employment in South Africa, building upon the work of Bell and Cattaneo (1997), Nattrass (1998), Bhorat (1999), Fedderke *et al*. (2003), Birdi *et al*. (2001) and Edwards (2001a, 2001b, 2003) [1]. We therefore explore one of the central linkages between trade and poverty, as identified by McCulloch et al (2001).

South Africa provides a particularly useful case study because of the changes it has seen over the last decade or so. Since the early 1990s South Africa has made good progress in liberalising its trade regime in accordance with its offer to the World Trade Organisation (WTO), with average nominal protection in manufacturing falling from 23% in 1994 to 8.2% in 2004 (Edwards, 2005a). Furthermore, trade became more important over the period, with trade flows as a share of GDP rising, firstly in response to the ending of sanctions in the early 1990s and then stimulated by the reduction in tariffs (Edwards, 2005a). At the same time, the South African economy experienced significant changes in the level and composition of employment. Aggregate employment grew, but not fast enough to reduce unemployment and there were important differences across sectors, with employment in the primary and secondary sectors stagnant or falling, but service sector employment rising.

The structure of the paper is as follows. Section 2 considers the correlation between trade liberalisation and factor demand in South African manufacturing during the 1990s. Section 3 investigates the impact of trade on labour demand using a Chenery (1979) style decomposition technique, following Edwards (2001a, 2001b, 2005b) and Jenkins (2002). It develops the earlier work by exploring both the direct and the indirect effects and investigates variations in the regional impact of trade on factor demand during the 1990s. This analysis suggests that technological change accounts for the bulk of jobs lost in manufacturing during the 1990s. To investigate, whether this reflects exogenous technological change or trade-induced technological change requires undertaking an econometric analysis and Section 4 therefore explores the impact of trade on technological change through an induced labour demand model. Finally, Section 5 presents some conclusions.

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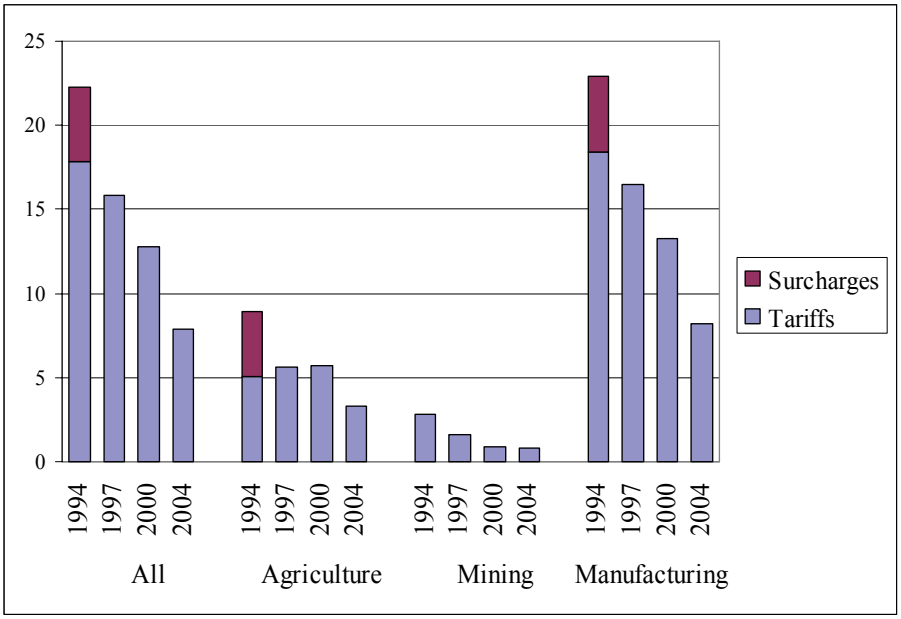
[1] An overview of many of these studies and an application of the various methodologies used in the debate is presented in Edwards (2005b).

## 2. Trade, trade liberalisation and employment in South Africa in the 1990s[2]

South Africa made considerable progress in liberalising its trade regime during the 1990s, as shown in Figure 1. Between 1994 and 2004 the simple average tariff rate fell from 22.9% to 8.2% in manufacturing, from 9% to 3.3% in agriculture and from 2.8% to 0.8% in mining. Average effective rates of protection (ERP) also fell from a high of over 50% in 1993 to 13.8%. This pattern of reductions in nominal and effective protection occurred in most sectors, with the largest reductions in the beverages, textiles, footwear, wearing apparel and communication equipment sectors and the lowest in the wood products, paper products, basic chemicals and basic iron & steel sectors. Despite these reductions in overall protection, tariff protection, when measured using scheduled rates, remains high in the wearing apparel, tobacco and footwear sectors, with average nominal and effective protection exceeding 20% and 50%, respectively (Table A1). Progress was also made in simplifying the tariff structure, with the number of HS8-digit tariff lines falling from over 11,200 in 1994 to 6,707 in 2004. The number of HS8-digit lines bearing formula, mixed or specific duties also declined from 3,524 in 1994 (30% of total) to 205 in 2004 (3% of total), although almost half of this reduction took place between 2003 and 2004.

**Figure 1: Evolution of nominal tariff protection, inclusive of surcharges in 1994 (Per Cent)**




*Note*: The tariff rate for 2004 reflects the weighted average (using import values) of MFN, EU and SADC rates. Average tariffs are calculated using scheduled tariff rates at the 8-digit Harmonised System level.

Associated with this decline in protection was a rise in openness, as reflected in an increase in export orientation (exports as a share of gross output) from 15.5% to 29.5% and import penetration (imports as a share of absorption), from 23.2% to 35.8% between 1994 and 2002 (Table A1). This was pervasive across industrial sectors, with particularly large increases in import penetration in the labour intensive sectors of textiles, wearing apparel and footwear and rises in export orientation concentrated in many of the chemical and metal product sectors. The particularly large increase in export orientation within the motor vehicle industry, from12.4% to 44.8%, was largely a result of the Motor Industry Development Programme (MIDP), which effectively subsidises exports (Flatters, 2005). Despite some diversification, exports remain concentrated in the resource intensive sectors, as reflected in the high export orientation within the iron & steel and basic chemical industries. It is also worth noting that while export growth during the 1990s was positive, it was not particularly impressive relative to other middle-income economies (Alves and Edwards, 2005).

[2] This section draws heavily from Edwards (2005a).

Over the same period employment growth within manufacturing and the primary sectors stagnated, with total employment within manufacturing declining by 10%. Falls in employment appear to be particularly strong in agriculture, mining and the resource based sectors.[3] There is also evidence of a rise in the skill intensity of production in all sectors, indicating the effect of skill-biased technological change (Bhorat and Hodge, 1999; Bhorat and Oosthuizen, 2005; Edwards 2002).

Having identified this pattern of tariff reductions, increased openness and changes in employment the question arises as to whether they are correlated across industries, for example whether large reductions in tariffs were associated with large increases or decreases in employment across industries. The first column of Table 1 presents pairwise correlation coefficients for the change in various measure of trade and protection and the change in employment for the period 1993-2002, for 44 manufacturing sectors, classified according to the 3-digit Standard Industrial Classification (SIC) system. There are few significant correlations. Growth in openness, as measured by trade (exports plus imports) divided by total sales, is negatively correlated with growth in employment, indicating that sectors that have had relatively large increases in openness have also experience relatively large decreases in employment. There is, however, no evidence that this is related to import penetration or export orientation, as while these variables have negative coefficients they are not significant.

**Table 1: Correlation between changes in openness and protection and changes in employment and for manufacturing 1993-02**

| % change in | Employment (1) | Share labour in costs (2) | Share semi- & unskilled labour in costs (3) |
|---|---|---|---|
| Import penetration | -0.19 | -0.10 | 0.06 |
| Export orientation | -0.14 | -0.21 | -0.21* |
| Openness | -0.22* | -0.08 | -0.002 |
| Scheduled tariff | 0.08 | -0.28** | -0.48** |
| Collection duty | 0.10 | -0.41** | -0.32** |
| Surcharge | 0.08 | -0.17 | -0.25* |
| Scheduled tariff incl. surcharge | 0.11 | -0.29** | -0.48** |
| Collection duty incl. surcharge | 0.10 | -0.40** | -0.38** |
| Share ad valorem rates | -0.26** | -0.08 | 0.06 |
| ERP using scheduled rates | 0.06 | -0.28** | -0.28** |
| ERP using collection rates | 0.10 | -0.34* | -0.19 |
| Observations | 44 | 44 | 44 |

*Source*: Employment data and Sales data are drawn from Statistics South Africa (P0271 and P3041.2, respectively). Trade data are obtained from Customs & Excise and is based on HS8-digit data. Tariff measures are sourced from Edwards (2005a).
*Note*: ** and * represents significance at 10% and 20% level, respectively. [4]

There are positive correlations between changes in employment and the various measures of tariff protection, which suggests that the biggest falls in employment tended to be in the industries experiencing the largest reductions in tariffs, but the relationship is not significant. However, we find some evidence that employment falls were highest in industries experiencing the greatest simplification of the tariff structure, as measured by the increase in the proportion of tariff lines at the 8-digit Harmonised System (HS) level under *ad valorem* tariffs. These sectors include Textiles, Wearing apparel, Beverages and Iron and steel, most of which experienced large reductions in employment.

[3] These estimate use Quantech (2004). There is, however, some concerns over the reliability of South African statistical series (Bhorat and Oosthuizen, 2005). They use household survey data and estimate a rise in employment of 200 000 individuals within manufacturing from 1995-2002. The change in employment for Wearing apparel is biased upwards by the inclusion of the TBVC states in the data from 1996.

[4] Effective rates of protection are based on a 95 sector Supply Use table for 2000 (SSA, 2003). Openness is calculated as (exports+imports)/sales. Import penetration and export orientation are calculated using nominal trade and sales values. Changes in protection using tariffs and effective rates of protection are calculated as $(t_1-t_0)/(1+t_0)$ where t is the measure of protection. When using ERP, the change is a measure of the change in value added (Edwards, 2005a). The share of labour and the share of semi- & unskilled labour in total costs are calculated using a 1997 Social Accounting Matrix.

In addition to these direct links, there are also possible indirect ones through the effect of tariff liberalisation on product prices. The Stolper-Samuelson theorem states that declining prices in a sector will lead to a reduction in the relative demand for, and hence the relative return to, the factor used intensively in that sector. This implies that rapidly declining tariffs in labour intensive sectors would lead to a fall in demand for labour relative to capital and so too a reduction in the ratio of wages relative to the rental price of capital. To investigate this Column 2 and 3 of Table 2 present the correlation coefficients for the various measures of changes in trade and protection and the factor intensity of production, as measured by the share of labour remuneration in total costs and the share of semi- and unskilled remuneration in total costs.[5] These are mostly negative and significant, suggesting that large reductions in protection are associated with industries with high shares of labour in costs and particularly semi- and unskilled labour in total costs. According to the Stolper-Samuelson relationship, this sector bias of liberalisation will have reduced the demand for labour relative to capital as well as reduced the demand for semi- and unskilled labour relative to skilled labour. Consistent results are found by Edwards (2005b) and Edwards and Behar (2005) using different data sets[6]. There was also a strong positive correlation between the current level of tariffs and the labour intensity of production, as well as the share of semi- and unskilled labour in total costs. Further liberalisation is thus expected to reinforce shifts in relative demand away from unskilled and semi-skilled labour relative to capital.

Overall, the results suggest weak evidence of a negative relationship between changes in employment and changes in protection measures or trade flows. The relationship, however, is not consistent across the various measures, suggesting that other demand and supply factors dominate. It does, however show that reductions in protection were biased towards labour intensive sectors, and particularly sectors with a high share of semi- and unskilled labour in total costs According to standard trade theory, this implies that liberalisation has reduced the demand for labour, particularly unskilled labour, relative to capital. In addition, tariff protection was found to remain high in the relatively labour intensive and unskilled intensive sectors. Taken together the results suggest that further liberalisation is likely to reduce the demand for labour, particularly semi- and unskilled labour, relative to capital.

## 3. Sources of demand for labour in South Africa

A useful way to analyse the impact of trade, technology and domestic demand on factor demand is the factor content approach. Tariff liberalisation alters the relative incentive to produce for the domestic and export market. This means that import competing sectors will contract, while export-oriented sectors expand, which changes the composition of production and so of employment and factor payments. To investigate the sources structural change in factor demand in South Africa, the gross value of manufacturing production is disaggregated into demand effects arising from changes in final demand, exports, import penetration and technology using a Chenery (1979) style decomposition technique[7]. This starts from the simple accounting identity for gross output X:

$$X = D + E - M \qquad (1)$$

where *E*, *D* and *M* are vectors of exports, demand (final plus intermediate demand) and imports, respectively. Imposing the assumption that exports do not include re-exports, this can be re-formulated as:

$$X = dD + E \qquad (2)$$

[5] This is not a direct application of the Stolper Samuelson theorem (see Feenstra and Hanson, 1999) but rather a 'consistency check' similar to that used internationally by Lawrence and Slaughter (1993) and locally by Fedderke *et al.* (2003), Behar and Edwards (2005) and Edwards (2005b). The data on factor shares are obtained from a 1997 Social Accounting Matrix.

[6] Edwards (2005b), for example, estimates that bias of liberalization against labour intensive sectors mandated a decline in real wages of 19% to 17% and a real increase in the return to capital of 5% to 20% between 1994 and 2003. Liberalisation also mandated a 40%-47% decline in wages of semi- and unskilled labour between 1994 and 2003, although Edwards and Behar (2005) use firm level data to show that the mandated decline in wages is concentrated amongst semi-skilled labour.

[7] Similar methodologies have already been applied to South Africa by Edwards (2001a, 2001b, 2005b) and Jenkins (2002), but the analysis here updates and extends these studies by considering the labour impact of regional variations in the composition of trade.

where *d* is the proportion of total demand that is produced domestically. Total factor usage (*N*) is then given by *nX* where *n* is the row vector of factor requirements (capital, high skilled labour, skilled labour and low skilled labour) per unit of output and the change in total factor usage can be decomposed into:

$$\Delta N = n\Delta X + \Delta nX = nd\Delta D + n\Delta dD + n\Delta E + \Delta nX \quad (3)$$

where factor usage is affected by improvements in labour productivity ($\Delta nX$) in addition to changes in demand ($\Delta D$), export expansion ($\Delta E$) and import penetration ($\Delta dD$).

Applying equation 3 to the Quantech (2004)[8] data gave the results in Table 2, which presents the sources of change in employment for manufacturing, mining and agriculture (indirect effects are excluded), for the periods 1970-79, 1980-89 and 1990-2002. The last period corresponds with increased trade liberalisation[9]. The results for some broadly defined manufacturing sub-sectors, those that were natural resource based, labour intensive, chemical intensive and metal products intensive are also presented. In all cases, tobacco is excluded given its volatile output and trade trends.

**Table 2: Sources of change in the structure of employment**

| | Final Demand (1) | Exports (2) | Imports (3) | Net Trade (4) | Technology (5) | Total (6) | Δ Factor Share (7) | Factor (8) |
|---|---|---|---|---|---|---|---|---|
| **1970s** | | | | | | | | |
| Total traded sectors | 3.4% | -0.1% | 0.4% | 0.3% | -2.4% | 1.2% | 354048 | 100.0% |
| Agriculture | 4.0% | -0.2% | 0.4% | 0.2% | -4.9% | -0.6% | -66400 | -19% |
| Mining | 1.6% | -0.4% | -1.0% | -1.3% | 0.5% | 0.7% | 49041 | 14% |
| Manufacturing | 3.8% | 0.1% | 1.2% | 1.3% | -1.7% | 3.4% | 371407 | 105% |
| *Natural resource* | *3.9%* | *0.4%* | *1.0%* | *1.4%* | *-2.4%* | *2.9%* | *118159* | *32%* |
| *Labour* | *2.2%* | *0.2%* | *1.7%* | *1.9%* | *-1.6%* | *2.6%* | *61610* | *17%* |
| *Chemical* | *6.3%* | *-0.4%* | *2.2%* | *1.8%* | *-3.3%* | *4.8%* | *47662* | *13%* |
| *Metal products* | *4.2%* | *-0.2%* | *1.0%* | *0.8%* | *-1.0%* | *4.0%* | *136683* | *37%* |
| **1980s** | | | | | | | | |
| Total traded sectors | 1.1% | 0.1% | 0.1% | 0.2% | -1.5% | -0.2% | -54712 | 100.0% |
| Agriculture | 1.7% | 0.6% | 0.0% | 0.5% | -3.4% | -1.2% | -117300 | 214% |
| Mining | 0.1% | -1.3% | 0.3% | -0.9% | 0.5% | -0.3% | -21611 | 40% |
| Manufacturing | 1.2% | 0.5% | 0.0% | 0.5% | -1.1% | 0.6% | 84199 | -154% |
| *Natural resource* | *1.1%* | *0.5%* | *-0.1%* | *0.4%* | *-1.0%* | *0.5%* | *27804* | *33%* |
| *Labour* | *1.3%* | *0.4%* | *0.1%* | *0.5%* | *-1.5%* | *0.2%* | *6475* | *8%* |
| *Chemical* | *5.2%* | *0.5%* | *-0.3%* | *0.2%* | *-2.5%* | *2.8%* | *41611* | *49%* |
| *Metal products* | *-0.4%* | *0.4%* | *-0.1%* | *0.3%* | *0.2%* | *0.1%* | *4682* | *6%* |
| **1990-02** | | | | | | | | |
| Total traded sectors | 0.9% | 0.6% | -0.5% | 0.1% | -3.0% | -1.9% | -716483 | 100.0% |
| Agriculture | 1.1% | 1.3% | -0.3% | 1.0% | -3.6% | -1.5% | -158277 | 22% |
| Mining | -0.3% | -0.6% | 0.0% | -0.7% | -2.4% | -3.4% | -276221 | 39% |
| Manufacturing | 1.4% | 0.8% | -0.8% | 0.0% | -2.9% | -1.5% | -281985 | 39% |
| *Natural resource* | *1.3%* | *0.4%* | *-0.2%* | *0.3%* | *-3.9%* | *-2.4%* | *-157971* | *56%* |
| *Labour* | *0.2%* | *0.5%* | *-0.8%* | *-0.3%* | *-1.3%* | *-1.4%* | *-51963* | *18%* |
| *Chemical* | *3.1%* | *1.1%* | *-0.6%* | *0.5%* | *-3.9%* | *-0.3%* | *-6380* | *2%* |
| *Metal products* | *1.7%* | *1.3%* | *-1.6%* | *-0.3%* | *-2.4%* | *-1.0%* | *-60023* | *21%* |

*Note*: Percentage values reflect the average annual change in employment within each aggregated sector due to the various sources of demand. Net trade is calculated as exports – imports.

[8] Much controversy surrounds the reliability of South African statistical series, particularly those dealing with employment numbers. The Quantech 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 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 1996, when the last official manufacturing Census was conducted.

[9] There were of course other changes in the global and domestic environment that will have affected trade flows, so in the empirical analysis we can only assess the consistency of the results with those expected under liberalisation and are not able to test the relationship directly

Looking at column 6, the relatively poor employment growth in the traded sectors from the 1980s is clear, with total employment falling on average 0.2% per annum during the 1980s and then almost 2% per annum between the years 1990 and 2002. More that 60% of this fall was in the agriculture and mining sectors, although manufacturing, particularly the resource-based sectors, contributed significantly during the 1990s.

It is clear from the decomposition results, that domestic demand and technology have been the dominant sources of demand for labour. During the 1970s increasing domestic demand raised employment by 3.4% per annum, although this declined to 1.1% per annum during the recession years of the 1980s. During the latter part of the 1990s, a recovery in domestic demand for manufacturing raised employment, but this was offset by lower growth in demand for agricultural and mining products. Technology, as reflected in reductions in the labour required per unit output, was particularly significant in the 1990s, where it reduced employment by 3% per annum. This labour shedding was strongest in agriculture (3.6%), but also very strong in mining (2.4%) and manufacturing (2.9%). The coincidence of improved labour productivity and a more open economy during the 1990s suggests some causal relationship, but it is important to remember that the period also saw the election of a new government and the implementation of new macroeconomic policies and labour legislation, so it is difficult to draw any such conclusion.

The effect of trade on employment is given in columns 2 to 4, for exports, imports and net trade (calculated as the sum of exports and imports). There was a small and declining contribution of net trade, raising employment growth by 0.3% per annum during the 1970s, 0.2% in the 1980s, and 0.1% per annum in the 1990s. In all periods, trade in mining had a negative effect, largely a result of the decline in gold exports. The contribution of exports and import penetration towards employment growth also changed over time closely following the changes in South Africa's industrial policy. During the 1970s import substitution was an important source of growth in employment (0.4% per annum) and exceeded the contribution of export expansion (-0.1% per annum). Its influence declined absolutely and relative to exports during the 1980s and 1990s in response to the liberalisation of the economy and the expansion of manufacturing exports from the mid-1980s. During the 1990s firms were unable to retain market share in the face of cheaper imports, and rising import penetration reduced employment growth (-0.5% per annum). The net trade effect, however, remained positive, but small.

These structural shifts correspond closely with other economies that have liberalised their trade. In almost all countries surveyed in Edwards (2001b), the shift away from an import substitution regime towards a more open regime is accompanied by both a loss in output growth due to import penetration and a rise in output growth due to exports. South Africa is no exception to this pattern.

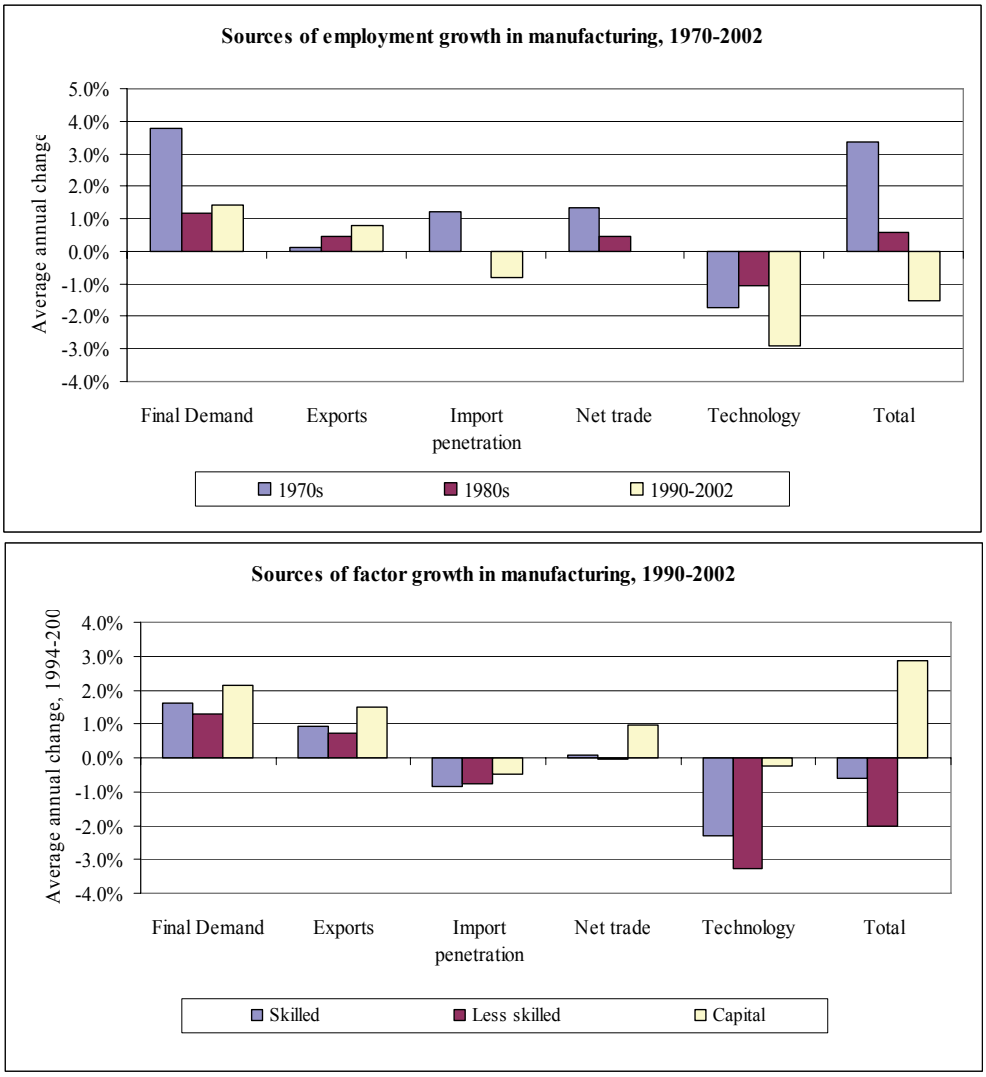
Considering the results for manufacturing more closely, Table 3 shows the decomposition results for total labour, skilled labour, less skilled labour and capital stock (machinery & equipment) [10]. They show clearly the decline in manufacturing employment growth and the rising capital intensity of production over time. While formal sector employment growth declined, growth in capital stock was positive in all periods and employment growth was also strongly biased towards high skilled labour. As figure 2 clearly illustrates, the dominant source of the decline in employment growth is technological change, with skill-biased technological change pervasive across manufacturing (all but 2 of the 27 sectors experienced rising skill intensities of production). These results are not only consistent with other studies of South Africa[11], but also studies of other developed and developing economies, for example Berman *et al*. (1994) and Berman and Machin (2000). This suggests that the changes in South Africa are partly driven by global skill-biased technological change.

A similar pattern is apparent for the effect of manufacturing trade on factor demand, with liberalisation concurrent with a decline in factor growth, through import substitution and an increase through export expansion, as shown in Figure 2. The net effect was a decline in employment growth associated with net trade from 1.3% per annum in the 1970s to no growth in the 1990s. This result is partly biased by the recession years prior to 1993 and taking the period 1994-2002 net trade did raise manufacturing employment growth by 0.3% per annum. Nevertheless, neither export growth, nor growth in net trade

[10] See also Edwards (2005b).
[11] See Bhorat and Hodge (1999) and Edwards (2002)

within manufacturing, has been sufficient to have a substantial impact on unemployment during the 1990s. One reason for this has been the relatively poor manufacturing export growth during this period (Alves and Edwards, 2005).

**Figure 2: Sources of factor growth in manufacturing, 1970-2002**




There was also substantial variation across factors and sectors. Figure 2 shows a slight bias of net trade in favour of skilled labour during the 1980s and the 1990s. The relationship is stronger if we focus on the period from 1994, when net trade raised skilled employment growth by 0.5% per annum compared to 0.2% per annum for less skilled labour. Edwards (2001a; 2005b) shows that this bias has been driven by relatively high export growth within skill intensive sectors, rather than high import penetration in less skill intensive sectors. Net trade also had a very large positive impact on the demand for capital in all decades from 1970, raising the demand for capital by 1.2% per annum between 1990 and 2002, mainly the result of positive net trade effects in natural resource-based and chemical products intensive sectors and negative net trade effects in labour intensive sectors (see Tables A2 and A3 in the Appendix). As was found in earlier research (Bell and Cattaneo, 1997; Edwards, 2001b), the structure of net trade has shifted towards more capital intensive sectors.

**Table 3: Sources of factor growth in manufacturing, average annual change**

| | Final Demand | Exports | Imports | Net Trade | Technology | Total | Δ Factor |
|---|---|---|---|---|---|---|---|
| **1970s** | | | | | | | |
| Total employment | 3.8% | 0.1% | 1.2% | 1.3% | -1.7% | **3.4%** | 371,407 |
| Skilled | 4.1% | 0.1% | 1.3% | 1.4% | -0.1% | **5.4%** | 151,428 |
| Less skilled | 3.7% | 0.1% | 1.2% | 1.3% | -2.3% | **2.7%** | 219,979 |
| Capital | 5.5% | -0.2% | 3.0% | 2.8% | 3.6% | **11.9%** | 63,472 |
| **1980s** | | | | | | | |
| Total employment | 1.2% | 0.5% | 0.0% | 0.5% | -1.1% | **0.6%** | 84,199 |
| Skilled | 1.4% | 0.5% | 0.0% | 0.5% | 1.0% | **2.9%** | 126,700 |
| Less skilled | 1.1% | 0.4% | 0.0% | 0.4% | -1.9% | **-0.4%** | -42,501 |
| Capital | 2.3% | 0.7% | 0.0% | 0.7% | -0.6% | **2.4%** | 28,535 |
| **1990-2002** | | | | | | | |
| Total employment | 1.4% | 0.8% | -0.8% | 0.0% | -2.9% | **-1.5%** | -281,985 |
| Skilled | 1.6% | 0.9% | -0.8% | 0.1% | -2.3% | **-0.6%** | -40,106 |
| Less skilled | 1.3% | 0.7% | -0.8% | 0.0% | -3.3% | **-2.0%** | -241,880 |
| Capital | 2.1% | 1.5% | -0.5% | 1.0% | -0.2% | **2.9%** | 50,371 |

Note: Skilled labour consists of managers, professionals, technicians, clerks, skilled service workers, skilled agricultural workers and artisans. Less skilled labour consists of all remaining occupations.

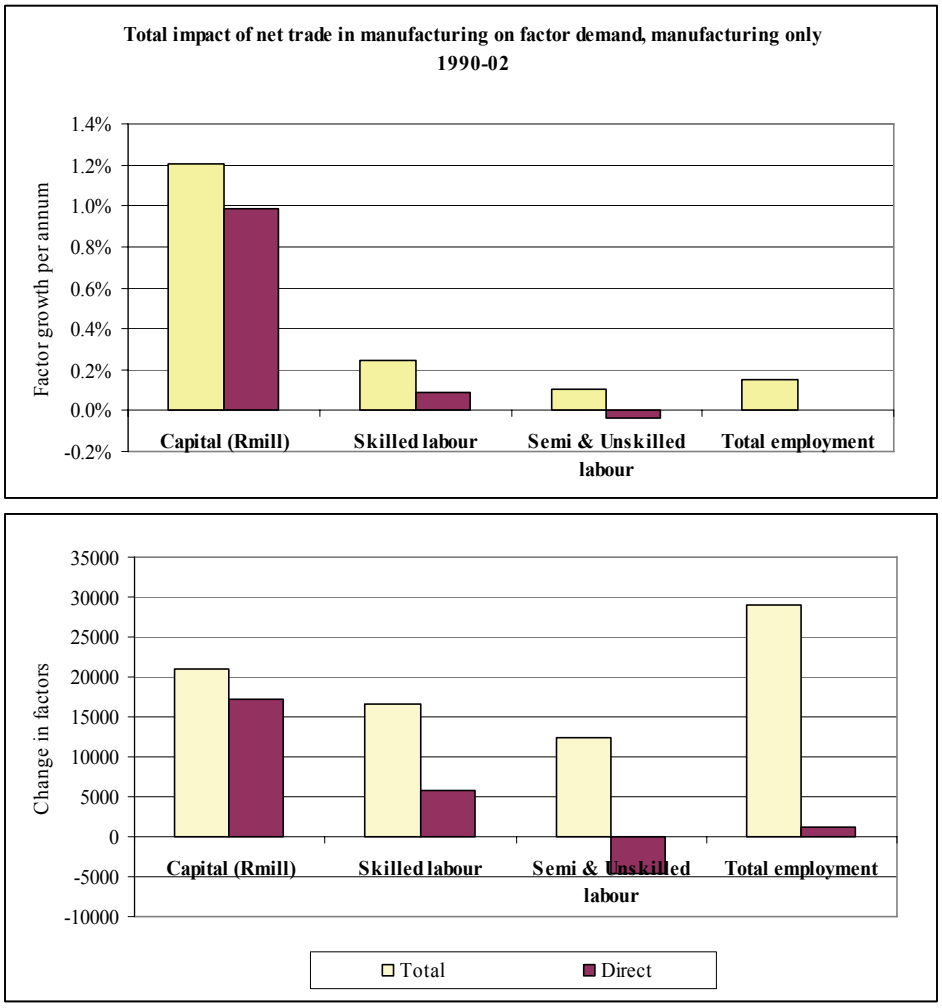
## Indirect effects

So far the analysis has been based entirely on the direct effects of trade, technology and domestic demand on factor demand. Changes in final demand do, however, affect the demand for intermediate inputs, which in turn has spill-over effects on other sectors. Indirect effects are, however, often ignored as the direct effects tend to dominate and the relative impact across the various sources of growth is largely unaffected Edwards (2001a, b). In addition, the estimation of indirect effects using input-output tables often requires strong assumptions of excess capacity and fixed production coefficients (Jenkins, 2002)[12]. Nevertheless, some insight into the total effects of net trade on factor demand can be obtained by multiplying the trade variables by the Leontief inverse for a particular year, using the Supply-Use table for 2000, provided by Statistics South Africa (2003). The results are presented in Figure 3 for the period 1990 to 2002.

This shows that including the indirect effect raises demand for all factors. The total employment impact, which is zero for the direct effect, becomes positive once indirect effects are included (0.2% per annum) and is equivalent to 29, 000 jobs being created during this period. The skill bias of net trade, however, remains with relatively more skilled jobs created than semi- and unskilled jobs. The indirect effect on demand for capital is also positive, but is proportionately smaller than that of labour. Once indirect effects are included, net trade raises demand for capital from 1% per annum to 1.2% per annum.

[12] Input-output tables, valued in real prices, for the end-points of the various sub-periods are required to estimate the direct and indirect effects on employment from final demand, trade and technological change. See Edwards (2001a, b).

**Figure 3: Total and direct effect of net trade on factor demand in manufacturing, 1990-2002**

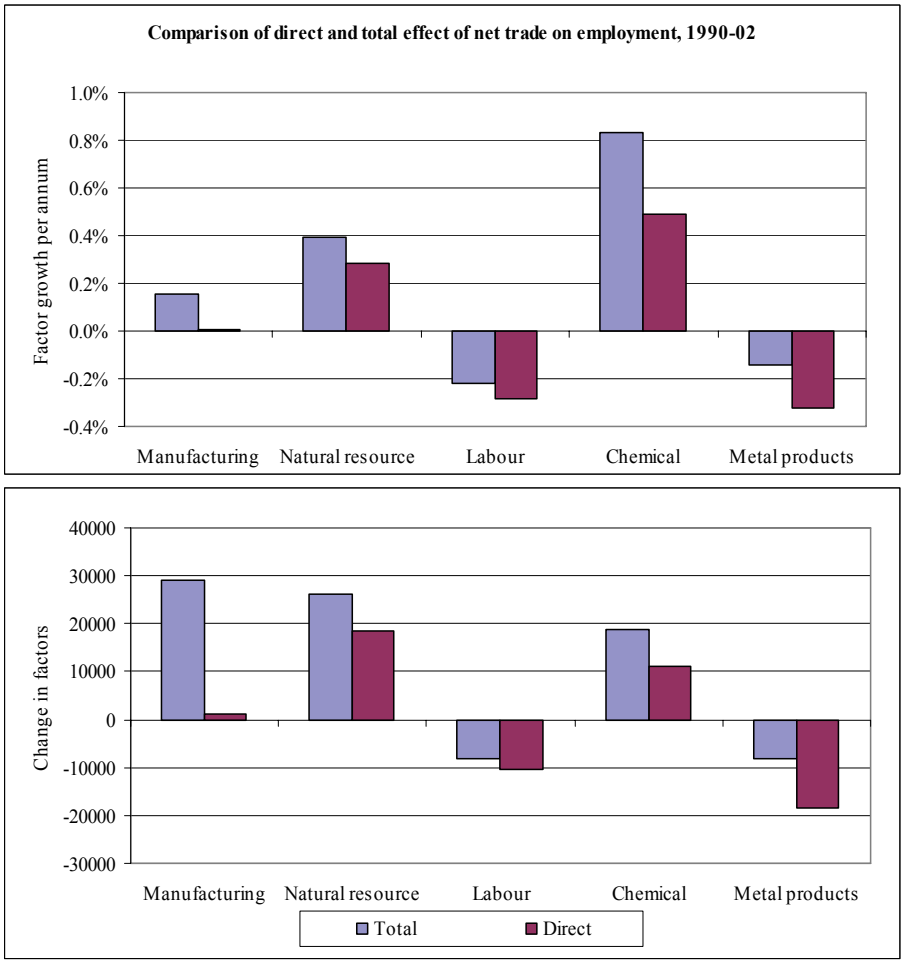



*Note*: The total for each sector reflects the direct effect plus the effect all other sectors have on output in that sector, i.e. manufacturing effect includes the impact from changes in primary sectors.

Figure 4 shows the total effects of net trade on the broadly classified manufacturing sub-sectors.[13] Accounting for the indirect effect reduces the negative impact of net trade on labour demand in labour intensive and metal products sectors, and raises the positive impact in chemical and natural resource-based products. The positive indirect effects on employment arise from the important backward linkages between chemical and resource-based products and the rest of the economy. In the case of metal products, the positive indirect effects reflect the relatively high proportion of these products used in machinery & equipment, iron & steel and motor-vehicles, all of which experienced positive growth in net trade. Other than the metal products sector itself, these sectors are the 3 most important downstream industries for metal products[14]. In the case of labour intensive sectors, we find that the large negative direct effect on textiles is partially offset by a large improvement in the net exports of vehicles, basic chemicals and furniture[15]. Overall, these results suggest that strong export growth in the capital-intensive resource-based and chemical products sectors may nevertheless have positive employment effects through their backward linkages.

[13] A2 in the Appendix provides further details.
[14] Based on the Leontief inverse
[15] These sectors are the 2, 7th and 4th most important downstream industries for textiles, the 1st and 3rd being clothing and footwear.

**Figure 4: Comparison of direct and total effect of net trade on employment in manufacturing sub-sectors, 1990-2002**




## Regional trade effects

Another important issue is the impact of regional trade flows on factor demand. South Africa is a middle-income economy and its pattern of trade differs significantly across regions. Standard tests of comparative advantage reveal South Africa to be abundant in unskilled labour relative to high- and middle-income economies, but skill abundant relative to low-income economies. In most cases, South Africa is also seen to be capital abundant, which largely reflects its abundance in natural resources (Alleyne and Subramanian, 2001; Edwards, 2005b).

Data on regional trade flows were obtained at the HS8-digit level from Customs & Excise. The data were then aggregated to the SIC based sectors presented in Table A1 and deflated to give real values using the implicit export and import price deflators derived from Quantech (2004). This dataset shows trends in total exports and imports that differ marginally from the previous analysis. Export growth during the 1990s is stronger, while import growth is more moderate.

Using this data the direct effects of net trade on employment by region from 1994-2002 were estimated and are shown in Table 4 according to broad manufacturing sub-sector. Wide variations in the impact of regional trade are evident. Net trade with developed economies raised manufacturing employment by 0.66% per annum (75 000 jobs), with a relatively large contribution by the metal products sector (mainly motor vehicles), while net trade with China and India and South America reduced manufacturing employment by around 23 400 and 3 000, respectively. The decline in employment from trade with China and India is concentrated in labour intensive sectors, particularly textiles, wearing apparel and footwear. Trade with Africa has also been an important source of growth of manufacturing employment (0.16% per annum) and is concentrated in the natural resource-based

and chemical products. This is consistent with South Africa's comparative advantage in these products.

**Table 4: Employment impact of regional trade by manufacturing sub-sector, 1994-2002**

| | Africa | Asia excl. Japan | South America | Developed | China & India |
|---|---|---|---|---|---|
| **Change in employment** | | | | | |
| Manufacturing | 18,422 | 3,051 | -3,034 | 74,925 | -23,440 |
| *Natural resource* | 4,004 | 101 | -863 | 18,758 | 78 |
| *Labour* | 368 | 1,569 | -159 | 13,593 | -11,935 |
| *Chemical* | 3,539 | -1,064 | 299 | 8,713 | -855 |
| *Metal products* | 10,315 | 1,908 | -2,280 | 33,027 | -10,535 |
| **Average annual growth** | | | | | |
| Manufacturing | 0.16% | 0.03% | -0.03% | 0.66% | -0.21% |
| *Natural resource* | 0.10% | 0.00% | -0.02% | 0.47% | 0.00% |
| *Labour* | 0.02% | 0.07% | -0.01% | 0.62% | -0.54% |
| *Chemical* | 0.25% | -0.07% | 0.02% | 0.61% | -0.06% |
| *Metal products* | 0.29% | 0.05% | -0.06% | 0.92% | -0.29% |

*Note*: The total impact of net trade on employment is 69 924 jobs created (0.61% growth per annum). This is roughly double the employment impact using Quantech (2004) over the same period.

Thus regional trade has a non-uniform impact on total employment as well as employment across sectors. Trade with large labour abundant economies such as China and India negatively affect employment within labour intensive sectors, while trade with developed economies appears to have a large positive impact on employment in most sectors.

Overall, the decomposition analysis indicates that employment lost due to import penetration is counteracted by employment gained through export expansion. The dominant source of the decline in employment appears to be skill-biased technological change. However, important structural shift in trade towards natural resource-based and chemical products are evident. These structural shifts reflect the effect of a relative abundance in natural resource endowments and relatively low declines in protection on these products. Further, the continued dominance of these products in total trade may reflect the past history of state support as well as continued support into the 1990s (Roberts, 2005). In contrast, labour intensive products have been negatively affected by relative large declines in protection as well as rapid import penetration, particularly from China & India.

A serious limitation of these decomposition studies is that they fail to account for the interaction between the various sources of demand (Baldwin, 1995) and the impact of supply side factors including the labour market[16]. A more important limitation for the purpose of this study is that they do not allow for the fact that trade liberalisation and import penetration can indirectly affect employment and factor remuneration via technological change.[17] The next section explores the impact of trade-induced technological change on labour using an induced-labour demand model.

[16] For example, the negative impact of technology on employment during the 1990s may reflect labour shedding in response to real wage changes and the enactment of new labour legislation since 1994. The very strong growth in capital combined with improvements in labour productivity driven largely through labour-shedding also suggests that much of the productivity improvement is due to capital/labour substitution (Edwards and Golub, 2003). See Edwards (2005b) for a discussion of some of these limitations.

[17] Wood (1994), for example, argues that competition causes firms to shed labour and upgrade their capital stock to improve labour productivity. Further, he argues that many of the imported products may be noncompeting products and domestic employment coefficients will understate the labour content of these imports. Hence he concludes that "*The conventional method of calculation, using domestic input coefficients, is bound to* ***understate*** *the impact of trade on factor markets*" (Wood, 1994: 73). There are numerous other problems with the methodology. Estimates are based on average labour coefficients of broad industrial sectors composed of many different firms. Shifts in demand affect entry and exit of low productivity firms or products which may affect measures of productivity. The approach also lacks theoretical foundations and is not a strict application of the Stolper-Samuelson theorem that draws a relationship between product prices and factor payments (Leamer, 2000). In addition, the methodology does not capture the employment created around the retail of imported products.
There is some evidence that trade induces technological change in South Africa (Belli *et al.*, 1993; Fallon and Pereira de Silva, 1994; Hayter *et al.*, 1999; Jonsson and Subramanian, 2000), but the magnitude of the effect on the level and

## 4. Labour demand and trade-induced technological change

In analysing the impact of trade on employment there are a number of theoretical starting points, depending on the nature of this technology. In the standard Heckscher-Ohlin model, which is commonly used to assess the impact of trade on labour, technological change is simply considered to be exogenous. This means that its effect, whether Hicks neutral or skill biased, will dependent on how different its impact is across industries or sectors (Findlay and Grubert; 1959; Leamer, 1996; Haskel and Slaughter, 1998)[18]. A number of papers have moved beyond assuming exogeneity. Wood (1994) argued that in order to compete against cheaper imports, firms raise productivity through unskilled labour saving technical progress, or "*defensive innovation*" as he refers to it. Thoenig and Verdier (2003) formalised this view and argued that openness triggers predation, meaning that firms will invest in skill-intensive techniques to limit the threat of imitation by foreign competitors. A model of endogenous skill biased technological change was developed by Acemoglu (2002), where openness raises the relative price of skill-intensive products and hence the return to investment in skill-biased technology. Other studies have suggested that trade can affect technological change by disciplining oligopolistic firms, diffusing technology through the transmission of blueprints and proprietary knowledge to exporters, learning from observation and the imitation of foreign technology, the transfer of skill-biased technology imbedded in imported intermediate and capital goods and the availability to domestic firms of a wider range of intermediate inputs.[19]

Given such a range of possible impacts that trade can have on technological change, it is important to start any empirical analysis from a relatively simple theoretical model. This will provide a consistent framework that makes the choice of variables clear and the relations between them explicit, with a clear identification of paths of causation. Variables that reflect different hypotheses of the impact of trade on technology can then be introduced in a consistent manner.

Starting from the simple Cobb-Douglas production function:

$$Q_{st} = A^{\chi} K_{st}^{\alpha} L_{st}^{\beta} \qquad (6)$$

where *Q* is real output; *K* is capital stock; *L* is labour; *S* is sector $\alpha$ , $\beta$ and $\chi$ are coefficients a labour demand function can be derived. Following Greenaway *et al.* (1999) technical efficiency is considered be dependent on trade[20] giving a long run model of the form:

$$\ln L_{st} = \delta_o^* - \mu_0 T - \mu_1 \ln M_{st} - \mu_2 \ln X_{st} + \delta_1 \ln\left(w_s / c\right) + \delta_2 \ln Q_{st} \quad (\mu_i, \delta_i > 0) \qquad (9)$$

Thus labour is determined by output and relative factor process, a trend to pick up exogenous technical progress and imports, exports, which affect labour demand through their impact on technology. To introduce short run dynamics the model is written in the form of changes and lagged levels giving:

$$\begin{aligned} \Delta \ln L_{st} = {} & \alpha_0 - \alpha_1 T - \alpha_2 \Delta \ln M_{st} - \alpha_3 \Delta \ln X_{st} + \alpha_4 \Delta \ln\left(w_s / c\right) + \alpha_2 \Delta Q_{st} \\ & + \alpha_5 \ln M_{st-1} - \alpha_6 \ln X_{st-1} + \alpha_7 \ln\left(w_s / c\right)_{t-1} + \alpha_8 Q_{st-1} \end{aligned} \qquad (12)$$

composition of employment has not been fully ascertained. Jenkins (2002), for example, estimates that rising import penetration led firms to rationalise their use of labour leading to an estimated reduction in total employment in manufacturing of 100 000 between 1990 and 2001. Edwards (2003) uses firm level data and finds some evidence that trade-induced technological change reduced employment, but the effect was small.

[18] See Berman, Bound and Griliches (1994) and Berman and Machin (2000) who analyse the impact of global skill-biased technological change. Pervasive skill-biased technological change raises the relative price of skill intensive products and thus raises the relative wage of skilled labour, while still allowing for a rise in the skill-intensity of production.

[19] See Tybout (2001) for a review of these and evidence at the firm level.

[20] Where A is a log linear function of M and X

where *s* is the industry subscript and *t* the time subscript. We can interpret the lagged levels as representing long run effects and the changes as giving the short run dynamics. Finding negative coefficients on the trade variables, would indicate that trade has induced a reduction in the amount of labour per unit of output (improved labour productivity) through its impact on technological change.

To use the data in a way that considers the variations across industries as well as over time, we use panel data techniques to estimate the labour demand equations. Estimating the model for 28 industrial sectors 1970-2002, using the South African Standardised Industrial Database (Quantech, 2004)[21], the starting point is the commonly used one way fixed effects method, which takes account of individual industry effects and is equivalent to introducing a separate dummy variable for each industry.[22]

When estimating the model we are attempting to measure the impact of four types of technological change:

1. Exogenous technological change, which is represented by the time trend.
2. Defensive innovation, as described by Wood (1994), which arises from companies competing with imported commodities and having to introduce new technologies. It is captured by the inclusion of a variable for import penetration or a direct measure of tariff protection (nominal protection, effective protection and anti-export bias).
3. Trade induced technology transfers, which arises from firms imitating foreign technology and using capital goods that contain foreign technology (Pissarides, 1997). It is captured by the level of imported intermediate inputs.
4. Export orientated technological change, where firms adjust in response to gaining access to foreign markets through exports and having to compete with more technologically advance products. This is captured by the export orientation variable.

There are, of course, other forms of technological change, such as skill biased technological change arising from use of computers, etc. While some of these effects are captured by the time trend, lack of adequate data (computer usage, R&D expenditure and patents by industry) prevents a closer interrogation of these effects and further exploration is left for a later study. We do, however introduce a variable to capture the composition of the capital stock, namely machinery and equipment capital stock as share of total capital stock.

Table 5 provides the estimation results for 1970-2002. Initial estimation results indicated a number of outliers/extreme values that had to be dealt with. This led to the introduction of a number of dummy variables for Basic Chemicals and Non Ferrous metals in 1998 (Dbchem98 and Dnmet98), for Coke for the years 1998-2002 (Dcoke9802) and for the years 2000, 2001 and 2002 (d00, d01 and d02). With these included the results show the estimated labour demand function to be well defined, with the coefficients having the expected signs. The variables are all in logs and if preceded by a $\Delta$ have been differenced.

Looking at the results, log output has a positive growth (short run) and levels (long run) effect, log relative wages a negative short run and long run effect (elasticity = -0.81) and the coefficient on the lagged log employment, the adjustment term is significant and negative.[23]

[21] Values are measured in 1995 prices. The limitations regarding this data, as discussed in footnote 8, remain valid and some caution is required in analysing the results.

[22] The fixed effects model was developed for static models and we are estimating a dynamic model. In fact this is only a problem if we have a short time series as the lagged dependent variable will introduce bias, but this will get smaller as T, the number of time periods, gets larger. So for this study the fixed effects results should be reasonable.

[23] Dunne and Edwards (2006) provide more details on the derivation of the model and the long run coefficients. It is interesting to note that the returns to scale, which can be computed from the coefficients is close to 1.

**Table 5: Estimation Results 1970-2002 Fixed Effects**

| | Coef. | t | Coef. | t | Coef. | t |
|---|---|---|---|---|---|---|
| Employment(t-1) | **-0.031** | -2.4 | **-0.036** | -2.8 | **-0.045** | -3.3 |
| Output(t-1) | **0.031** | 2.9 | **0.041** | 3.6 | **0.046** | 4.0 |
| Relative wage(t-1) | **-0.032** | -3.4 | **-0.035** | -3.7 | **-0.036** | -3.6 |
| Import penetration(t-1) | | | -0.007 | -1.1 | -0.008 | -1.0 |
| Export orientation(t-1) | | | **0.009** | 2.9 | **0.009** | 2.8 |
| ∆Output | **0.297** | 14.0 | **0.296** | 13.7 | **0.296** | 13.5 |
| ∆Relative wage | **-0.115** | -8.3 | **-0.118** | -8.6 | **-0.113** | -7.9 |
| ∆Import penetration | | | **0.029** | 2.7 | **0.028** | 2.6 |
| ∆Export orientation | | | 0.001 | 0.1 | 0.001 | 0.2 |
| M&E K(t-1) | | | | | **-0.021** | -2.8 |
| Intermediate import(t-1) | | | | | **0.036** | 2.6 |
| ∆M&E K | | | | | -0.013 | -0.6 |
| ∆Intermediate import | | | | | 0.016 | 0.9 |
| Trend | **-0.002** | -6.5 | **-0.002** | -7.1 | **-0.002** | -7.2 |
| Dbchem98 | **0.187** | 3.6 | **0.189** | 3.7 | **0.197** | 3.8 |
| Dnmet98 | **-0.145** | -2.5 | **-0.149** | -2.6 | **-0.143** | -2.5 |
| Dcoke9802 | **-0.058** | -2.1 | -0.052 | -1.8 | -0.050 | -1.8 |
| d00 | -0.009 | -0.9 | -0.010 | -0.9 | -0.010 | -0.9 |
| d01 | **-0.034** | -3.0 | **-0.034** | -3.1 | **-0.034** | -3.0 |
| d02 | 0.006 | 0.6 | 0.007 | 0.6 | 0.005 | 0.5 |
| Constant | 0.044 | 0.4 | 0.035 | 0.4 | 0.120 | 1.2 |
| **Long run** | | | | | | |
| Output | **0.99** | | **1.12** | | **1.03** | |
| Relative wage | **-1.01** | | **-0.95** | | **-0.81** | |
| Import penetration | | | -0.20 | | -0.17 | |
| Export orientation | | | **0.26** | | **0.21** | |
| M&E K | | | | | **-0.48** | |
| Intermediate import | | | | | **0.82** | |
| Trend | **-0.06** | | **-0.07** | | **-0.06** | |
| **Return to scale** | 1.011 | | 0.892 | | 0.970 | |

*Notes*: All variables in logs. M&E K is log of machinery and equipment capital stock as share of total capital stock.

Exploring the impact of trade on technological change, we find a significant negative impact of exogenous technological change on labour demand per unit output, as represented by the time trend, across all specifications. Exogenous technological change has therefore raised labour productivity. Rising shares of machinery & equipment in total capital stock are also found to reduce labour per unit output (improve productivity) in the short run and long run.

The results using trade flows are less satisfactory. There is evidence of a positive short run effect of import penetration, but the long run effect is insignificant, although of the correct sign (negative). We therefore find no evidence of defensive innovation in response to increased import competition. We also find no evidence of trade-induced technological transfers through imported intermediate inputs. In contrast, rising import penetration in intermediate inputs appears to raise labour demand per unit output (i.e. a decline in labour productivity) in the long run. Similarly, the coefficient on export orientation is positive in the long run, suggesting that exports have reduced technological change. This is in contrast to the results for the UK by Greenaway *et al*. (1999). These results also contrast those found by Jonsson and Subramanian (2001) and Harding and Rattsø (2005) who find strong positive relationships between tariff reductions, trade flows and improved total factor productivity growth in South African manufacturing sectors.

There are a number of estimation issues that are dealt with in detail in Dunne and Edwards (2006). Dealing with possible endogeneity problem, gave some evidence of significant negative impact on labour demand of imports, as found by Jenkins (2002), but the results were sensitive to

specification[24]. Allowing for heterogeneity of results across industries by estimating the equation on each industry and taking the mean of the coefficients, did indeed show a considerable variation across industries and a sensitivity to 'outliers'[25]. While the results show some variation, they still offer evidence of a strong trend effect of exogenous technological progress, reducing labour demand given levels of output and so improving in labour productivity. There is also limited evidence that increased trade flows and trade liberalisation induced improvements in labour productivity.

# 5. Conclusion

Understanding the impact of trade on the South African is an important task for researchers, given its history, present path of development and its problems of unemployment, inequality and poverty. The government has made considerable progress in liberalising its trade regime, in negotiations with the WTO, since the early 1990s and trade became increasingly important over the period. At the same time, the South African economy experienced significant changes in the level and composition of employment, with employment growth unable to reduce unemployment. There is also evidence of a rise in the skill intensity of production in all sectors, suggesting that technological change was skill-biased. This paper has contributed to the literature on the links between trade liberalisation, structural change and employment growth in South Africa, by providing an updated and comprehensive analysis with a particular focus upon the relationship between trade, technology and employment.

Firstly, the paper provided an analysis of the degree of liberalisation in trade, illustrating the variations across sectors. In particular, it was clear that there were particularly large decreases in tariffs in labour intensive sectors, although these sectors do still remained heavily protected. A simple investigation of the correlations between tariff reductions and changes and employment across manufacturing industries found little evidence of association, but did further illustrate the bias of tariff reductions to labour intensive sectors, particularly those with a high share of semi- and unskilled labour. This suggested that further liberalisation would reduce the demand for labour in manufacturing, particularly lower skilled, relative to capital.
Secondly, to investigate the sources of the demand for employment a decomposition analysis was undertaken, which showed domestic demand and technology to have been the dominant sources of the demand for labour, with variation across sectors. The pattern of structural change followed the usual pattern for liberalising economies with a shift away from import substitution being accompanied by a loss of output in import competing sectors and a rise in output in export sectors. Employment created through export growth was, however, matched by employment lost through import penetration, with the net effect of trade on employment, between 1994 and 2003, close to zero. The evidence also pointed to the majority of employment change being attributable to skill-biased technological change.

An attempt was made to consider the indirect effects of trade on employment and there was evidence that strong export growth in capital intensive, resource based and chemical products sectors may have had positive employment effects through their backward linkages. These evident structural shifts in trade towards natural resource-based and chemical products reflect the effect of a relative abundance in natural resource endowments and relatively low declines in protection on these products. Further, the continued dominance of these products in total trade may reflect the past history of state support. In contrast, labour intensive products would appear to have been negatively affected by relatively large declines in protection as well as rapid import penetration, particularly from China and India.

Finally an induced labour demand model was estimated to analyses the impact of trade on employment through trade. This was necessary to overcome the limitation of the decomposition analysis, that it cannot account for the interaction between the various sources of demand and the impact of supply side factors. While the results show some variation, there is a strong trend effect of exogenous technological progress reducing labour demand given levels of output, i.e. improvements in labour productivity. There is limited evidence that increased trade flows and trade liberalisation induced improvements in labour productivity. Future work could extend the analysis to cover other

[24] This entailed re-estimate the dynamic model using the Arellano and Bond (1991) estimation procedure to deal with potential problems associated with lagged dependent variable and endogeneity biases.
[25] This is the Mean Group Estimator (MGE) of Pesaran and Smith (1995).

sources of technological change, such as skill biased technological change arising from use of computers and possibly military spending. It would also be worthwhile using tariff data directly as a measure of liberalisation[26]. Using aggregated industry data may obscure compositional changes over time, within the industries/sectors, both in terms of companies and products.[27] Further work using firm level data would, therefore, be extremely valuable.

Overall, the findings of the paper are of concern because of their likely impact on poverty. Any further trade liberalisation is likely to continue and to remain biased towards reducing labour demand in lower skilled and labour intensive industries, suggesting it is unlikely to increase employment for the poorer members of South African society and so will have little direct effect on poverty via the employment linkage. At the same time the growth in trade in trade is likely to have little net impact on employment, with labour intensive products being negatively affected by relatively large declines in protection as well as rapid import penetration, particularly from China and India. On the other hand, there is some evidence that backward linkages from export growth are providing positive employment growth and the study has not analysed the effect of increased trade on employment within the wholesale and retail industries. Growth in these and other service sectors may alleviate the decline in the relative demand for labour within the manufacturing sector. What is clear is that the South African Government cannot rely upon the growth in trade to produce significant increase in employment, particularly for lower skilled workers, and so reduce poverty via employment creation.

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[26] This was not possible with this data set.

[27] Productivity could improve from trade if low productive firms exit (in face of import competition), productive firms enter (in terms of exports) and or large firms that tend to be more productive grow relative to small firms (or small firms close relative to large firms). Pavcnik (2002) for example finds that in Chile (1973-79) most of the productivity gains came from market share re-allocation and entry/exit of firms, not improved productivity within firms. Tybout and Westbrook (1995) find that the market share reallocation effects were relatively small in Mexico (1984-89).

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## Table A1: Indicators of protection, employment and openness

| Sectors [SIC classification] | Average scheduled tariff rate | | Effective Protection Rates | | employment | Export orientation | | Import penetration | |
|---|---|---|---|---|---|---|---|---|---|
| | 1994 (1) | 2004 (2) | 1993 (3) | 2004 (4) | 1994-2002 (5) | 1994 (6) | 2002 (7) | 1994 (8) | 2002 (9) |
| **Agriculture, forestry & fishing [1]** | **9** | **3.3** | **9.9** | **1.7** | **-14.7** | **16.0** | **18.6** | 5.7 | 9.1 |
| **Mining [2]** | **2.8** | **0.8** | **2.3** | **0.2** | **-23.3** | **62.6** | **68.0** | **51.5** | **60.9** |
| Coal mining [21] | 0 | 0 | -4.7 | -2.2 | -17.6 | 54.9 | 76.6 | 2.0 | 13.2 |
| Gold & uranium [23] | 10 | 0 | 11.5 | -2.1 | -50.0 | 98.3 | 102.1 | 0.0 | 0.0 |
| Other mining [22/24/25/29] | 2.9 | 0.9 | 2.4 | 0.3 | 7.1 | 62.8 | 67.8 | 52.6 | 61.9 |
| **Manufacturing [3]** | **22.9** | **8.2** | **52.2** | **13.8** | **-10.8** | **15.5** | **29.5** | **23.2** | **35.8** |
| *Natural resource* | *16.8* | *7.4* | *54.3* | *21* | *-18.3* | *34.0* | *43.3* | *11.1* | *14.7* |
| *- Agricultural resource based* | *23.4* | *11.1* | *90* | *36.3* | *-11.3* | *8.3* | *13.1* | *7.6* | *10.0* |
| *- Other resource based* | *11.2* | *4.3* | *24.5* | *8.3* | *-31.7* | *41.0* | *51.4* | *14.0* | *18.6* |
| *Labour* | *48* | *20.6* | *214.8* | *61* | *-1.9* | *18.0* | *34.9* | *18.1* | *32.0* |
| *Chemical* | *13.1* | *3.8* | *32.9* | *7.6* | *6.8* | *27.3* | *38.8* | *26.7* | *37.2* |
| *Metal products* | *17.9* | *6.8* | *46.6* | *11.9* | *-4.6* | *13.4* | *43.7* | *44.0* | *66.8* |
| Food [301-304] | 22.8 | 11.2 | 94.9 | 40.7 | -19.0 | 6.7 | 9.1 | 7.6 | 9.8 |
| Beverages [305] | 36.4 | 12.3 | 86.2 | 21.8 | -28.7 | 6.8 | 13.2 | 3.7 | 5.9 |
| Tobacco [306] | 46.1 | 29.7 | 683.6 | 263.6 | -33.0 | 3.5 | 7.3 | 1.9 | 1.0 |
| Textiles [311-312] | 41.2 | 16.5 | 240.5 | 60.8 | -20.4 | 13.6 | 19.1 | 24.2 | 31.8 |
| Wearing apparel [313-315] | 75.1 | 31 | 325.9 | 91 | 11.0 | 9.7 | 25.1 | 8.4 | 19.7 |
| Leather & leather products [316] | 25.9 | 11.4 | 76.8 | 19.9 | -29.7 | 37.9 | 39.4 | 35.8 | 38.2 |
| Footwear [317] | 47.9 | 22.4 | 163.7 | 50.9 | -54.4 | 4.6 | 4.9 | 17.9 | 46.6 |
| Wood & wood products [321-322] | 14.8 | 8.7 | 42.2 | 15.3 | 10.1 | 14.0 | 22.8 | 10.9 | 15.0 |
| Paper & paper products [323] | 11.4 | 6.5 | 21 | 11.5 | -14.9 | 19.9 | 19.6 | 14.2 | 9.5 |
| Printing & publishing [324-326] | 16.1 | 4.7 | 36 | 4.5 | 15.7 | 2.3 | 2.8 | 17.9 | 23.5 |
| Coke & refined petrol [331-333] | 12.6 | 3.4 | 35.2 | 8.5 | -34.6 | 14.1 | 33.9 | 12.6 | 28.0 |
| Basic chemicals [334] | 8.3 | 1.7 | 16.8 | 1.5 | -8.4 | 40.4 | 51.7 | 45.2 | 52.1 |
| Other chemicals [335-336] | 16.4 | 4.3 | 39.8 | 7.2 | 6.3 | 5.3 | 15.3 | 22.1 | 32.3 |
| Rubber products [337] | 19 | 10.6 | 51.1 | 31.4 | -22.8 | 9.7 | 25.4 | 21.8 | 34.8 |
| Plastic products [338] | 19.9 | 9.6 | 65.6 | 20.1 | 31.4 | 4.6 | 12.2 | 9.9 | 18.8 |
| Glass & glass products [341] | 17.2 | 7.3 | 40.7 | 13.6 | -31.1 | 9.7 | 15.0 | 18.2 | 26.7 |
| Non-metallic minerals [342] | 15.5 | 5.6 | 38.6 | 10.9 | -49.8 | 7.8 | 11.6 | 10.3 | 20.7 |
| Basic iron & steel [351] | 9 | 3.9 | 19.9 | 9.7 | -35.8 | 45.3 | 63.6 | 11.2 | 17.6 |
| Basic non-ferrous metals [352] | 8.8 | 2 | 16.6 | 2.7 | -26.1 | 44.6 | 27.6 | 17.5 | 20.1 |
| Metal products [353-355] | 18.5 | 7.8 | 62 | 16.4 | -11.7 | 10.9 | 17.7 | 10.6 | 18.6 |
| Machinery & equipment [356-359] | 10.5 | 3.4 | 20.8 | 2.8 | 3.1 | 16.8 | 54.6 | 56.3 | 77.7 |
| Electrical machinery [361-366] | 18.5 | 7.2 | 47.2 | 14.1 | -17.5 | 7.7 | 15.4 | 31.9 | 38.1 |
| Communication equip [371-373] | 24.1 | 2.7 | 60 | 0.9 | -18.8 | 9.6 | 44.2 | 59.4 | 88.1 |
| Professional & scientific [374-376] | 12.4 | 0.3 | 14.7 | -5.8 | -23.2 | 23.7 | 62.5 | 72.8 | 91.7 |
| Motor vehicles [381-383] | 26.1 | 14.6 | 81.8 | 31.8 | 0.3 | 12.4 | 44.8 | 30.1 | 54.8 |
| Other transport [384-387] | 12.3 | 0.8 | 18.4 | -3 | -11.1 | 15.8 | 51.2 | 43.5 | 82.2 |
| Furniture [391] | 32.2 | 17.4 | 89.7 | 47.2 | 7.4 | 21.8 | 52.1 | 5.3 | 29.2 |
| Other manufacturing [392-393] | 26.9 | 5.8 | 49.9 | 17.4 | -14.1 | 26.0 | 40.0 | 22.9 | 33.5 |

*Source*: Edwards (2005a) for tariff data and Quantech (2004) for trade and employment data.

*Notes*: Protection rates include surcharges. The tariff rate for 2004 is the weighted average (using 2003 import values) of MFN, EU and SADC rates. The change in nominal and effective protection is between 1994 and 2004 (using the weighted average) and is calculated as (t1-t0)/(1+t0), where t represents the level of protection.

Export orientation is calculated as share of exports in domestic production, while import penetration is calculated as the share of imports in domestic consumption (output+imports-exports). Both measures use data valued in current prices.

Natural-resource based includes wood, iron & steel, non-ferrous metals, paper products, non-metallic minerals and food products (food, beverages & tobacco). Chemicals include coke, basic chemicals, rubber products & plastic products. 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. Other manufacturing is excluded from the sub-sectors. The weighted average tariffs for these sectors are based on 2003 import or export values.

**Table A2: Sectors experiencing rising or falling employment from net trade**

| **1990-02** | | **1994-02** | |
|---|---|---|---|
| **Decline** | **Rise** | **Decline** | **Rise** |
| Communication equipment | Printing & publishing | Communication equipment | Glass products |
| Other transport | Non-ferrous metals | Other transport | Food |
| Footwear | Plastic products | Footwear | Plastic products |
| Professional & scientific | Other chemicals | Professional & scientific | Beverages |
| Machinery & equipment | Other manufacturing | Wearing apparel | Printing & publishing |
| Textiles | Wood products | Metal products | Leather products |
| Rubber products | Beverages | Textiles | Wood products |
| Wearing apparel | Paper products | Non-metallic minerals | Non-ferrous metals |
| Metal products | Electrical machinery | Rubber products | Other manufacturing |
| Glass products | Leather products | | Paper products |
| Non-metallic minerals | Motor vehicles | | Other chemicals |
| Food | Coke & petroleum | | Furniture |
| | Basic iron & steel | | Coke & petroleum |
| | Furniture | | Machinery & equipment |
| | Basic chemicals | | Electrical machinery |
| | | | Basic iron & steel |
| | | | Motor vehicles |
| | | | Basic chemicals |
| **Employment in 1994** | | | |
| 728174 | 696072 | 461668 | 962578 |
| **Share employment in 1994** | | | |
| 51% | 49% | 32% | 68% |
| **Δ employment** | | | |
| -210963 | -71022 | -76782 | -75788 |
| **Share Δ employment** | | | |
| 75% | 25% | 50% | 50% |

*Notes*: Sectors ranked in ascending order. The first industry is that with the largest negative or lowest positive percentage change in employment.

**Table A3: Comparison of direct and total effects of trade on factor demand, 1990-02**

| | Total Exports | Import penetration | Net trade | D factor | Direct Exports | Import penetration | Net trade | D factor |
|---|---|---|---|---|---|---|---|---|
| **Capital** | | | | | | | | |
| Total incl. services | 0.7% | -0.4% | 0.3% | 33540 | | | | |
| Total traded sectors | 1.5% | -0.7% | 0.7% | 25552 | 0.8% | -0.3% | 0.5% | 16398 |
| Agriculture | 1.8% | -0.6% | 1.2% | 6739 | 1.4% | -0.3% | 1.0% | 5960 |
| Mining | 0.1% | -0.3% | -0.2% | -2284 | -0.5% | -0.1% | -0.5% | -6840 |
| Manufacturing | 2.3% | -1.1% | 1.2% | 21097 | 1.5% | -0.5% | 1.0% | 17277 |
| *Natural resource* | 1.5% | -0.7% | 0.8% | 5447 | 0.8% | -0.1% | 0.7% | 4722 |
| *Labour* | 1.0% | -1.2% | -0.2% | -145 | 0.3% | -0.7% | -0.4% | -236 |
| *Chemical* | 3.0% | -0.9% | 2.1% | 15842 | 2.0% | -0.2% | 1.7% | 13454 |
| *Metal products* | 2.9% | -2.9% | 0.0% | -83 | 2.1% | -2.4% | -0.3% | -697 |
| Services excl. gov | 0.3% | -0.2% | 0.1% | 7988 | | | | |
| **Skilled labour** | | | | | | | | |
| Total incl. services | 0.5% | -0.4% | 0.1% | 33832 | | | | |
| Total traded sectors | 1.3% | -1.1% | 0.3% | 22125 | 0.8% | -0.7% | 0.1% | 6756 |
| Agriculture | 2.1% | -0.7% | 1.4% | 6508 | 1.6% | -0.4% | 1.3% | 5756 |
| Mining | 0.2% | -0.3% | -0.1% | -905 | -0.3% | -0.1% | -0.4% | -4727 |
| Manufacturing | 1.5% | -1.2% | 0.2% | 16522 | 0.9% | -0.8% | 0.1% | 5728 |
| *Natural resource* | 0.9% | -0.5% | 0.5% | 10768 | 0.5% | -0.1% | 0.3% | 7923 |
| *Labour* | 1.2% | -1.1% | 0.0% | 300 | 0.8% | -0.8% | 0.0% | -194 |
| *Chemical* | 2.1% | -1.2% | 0.9% | 8509 | 1.2% | -0.6% | 0.6% | 5464 |
| *Metal products* | 2.0% | -2.1% | -0.1% | -3282 | 1.3% | -1.6% | -0.3% | -7688 |
| Services excl. gov | 0.1% | -0.1% | 0.1% | 11707 | | | | |
| **Semi- & Unskilled labour** | | | | | | | | |
| Total incl. services | 0.8% | -0.5% | 0.2% | 93784 | | | | |
| Total traded sectors | 1.0% | -0.7% | 0.3% | 89712 | 0.6% | -0.4% | 0.2% | 45160 |
| Agriculture | 1.7% | -0.5% | 1.1% | 114262 | 1.3% | -0.3% | 1.0% | 101059 |
| Mining | -0.4% | -0.1% | -0.5% | -36954 | -0.7% | 0.0% | -0.7% | -51300 |
| Manufacturing | 1.2% | -1.1% | 0.1% | 12405 | 0.7% | -0.8% | 0.0% | -4598 |
| *Natural resource* | 0.8% | -0.4% | 0.4% | 15279 | 0.4% | -0.2% | 0.3% | 10711 |
| *Labour* | 0.8% | -1.1% | -0.3% | -8396 | 0.5% | -0.8% | -0.3% | -10284 |
| *Chemical* | 2.1% | -1.3% | 0.8% | 10286 | 1.1% | -0.6% | 0.4% | 5637 |
| *Metal products* | 1.9% | -2.1% | -0.2% | -5004 | 1.2% | -1.5% | -0.3% | -10897 |
| Services excl. gov | 0.1% | -0.1% | 0.0% | 4072 | | | | |
| **Total employment** | | | | | | | | |
| Total incl. services | 0.6% | -0.5% | 0.2% | 127616 | | | | 51916 |
| Total traded sectors | 1.1% | -0.8% | 0.3% | 111837 | 0.6% | -0.5% | 0.1% | 51916 |
| Agriculture | 1.7% | -0.6% | 1.1% | 120769 | 1.3% | -0.3% | 1.0% | 106814 |
| Mining | -0.3% | -0.2% | -0.5% | -37859 | -0.6% | 0.0% | -0.7% | -56028 |
| Manufacturing | 1.3% | -1.2% | 0.2% | 28927 | 0.8% | -0.8% | 0.0% | 1130 |
| *Natural resource* | 0.8% | -0.4% | 0.4% | 26046 | 0.4% | -0.2% | 0.3% | 18635 |
| *Labour* | 0.9% | -1.1% | -0.2% | -8096 | 0.5% | -0.8% | -0.3% | -10478 |
| *Chemical* | 2.1% | -1.3% | 0.8% | 18795 | 1.1% | -0.6% | 0.5% | 11101 |
| *Metal products* | 1.9% | -2.1% | -0.1% | -8286 | 1.3% | -1.6% | -0.3% | -18585 |
| Services excl. gov | 0.1% | -0.1% | 0.1% | 15779 | | | | |

**TableA3: Direct employment impact of net trade by region**

| | 1990-94 | | | | 1994-02 | | | |
|---|---|---|---|---|---|---|---|---|
| | Exports | Imports | Net trade | Net Δ employment | Exports | Imports | Net trade | Net Δ employment |
| **Highly skilled** | | | | | | | | |
| Africa | 1.4% | -0.2% | 1.2% | 6,920 | 1.5% | 0.0% | 1.5% | 7,856 |
| Asia excl. Japan | 0.9% | -0.9% | 0.0% | -227 | 0.2% | 0.1% | 0.3% | 1,549 |
| South America | 0.1% | -0.2% | 0.0% | -271 | 0.0% | -0.2% | -0.2% | -1,299 |
| Developed | 1.6% | -2.3% | -0.6% | -3,492 | 5.9% | 0.1% | 6.0% | 32,025 |
| China & India | 0.2% | -0.3% | -0.2% | -1,062 | 0.2% | -1.5% | -1.3% | -6,781 |
| European Union | 0.9% | -1.6% | -0.8% | -4,252 | 3.5% | 0.0% | 3.5% | 18,725 |
| **Less skilled** | | | | | | | | |
| Africa | 1.2% | -0.3% | 0.9% | 8,908 | 1.2% | 0.0% | 1.2% | 10,614 |
| Asia excl. Japan | 0.7% | -0.9% | -0.2% | -1,861 | 0.0% | 0.3% | 0.3% | 2,821 |
| South America | 0.1% | -0.1% | 0.0% | -381 | 0.0% | -0.2% | -0.2% | -1,651 |
| Developed | 1.8% | -1.4% | 0.3% | 3,422 | 4.9% | 0.0% | 4.9% | 43,893 |
| China & India | 0.1% | -0.6% | -0.4% | -4,371 | 0.2% | -2.1% | -1.9% | -16,437 |
| European Union | 1.0% | -1.1% | -0.1% | -1,192 | 2.8% | 0.1% | 2.9% | 26,004 |
| **Total employment** | | | | | | | | |
| Africa | 1.3% | -0.3% | 1.0% | 15,828 | 1.3% | 0.0% | 1.3% | 18,470 |
| Asia excl. Japan | 0.8% | -0.9% | -0.1% | -2,088 | 0.1% | 0.2% | 0.3% | 4,370 |
| South America | 0.1% | -0.2% | 0.0% | -652 | 0.0% | -0.2% | -0.2% | -2,950 |
| Developed | 1.7% | -1.7% | 0.0% | -70 | 5.3% | 0.0% | 5.3% | 75,919 |
| China & India | 0.1% | -0.5% | -0.3% | -5,434 | 0.2% | -1.9% | -1.6% | -23,219 |
| European Union | 0.9% | -1.3% | -0.4% | -5,444 | 3.1% | 0.1% | 3.1% | 44,729 |

# The Southern Africa Labour and Development Research Unit

The Southern Africa Labour and Development Research Unit (SALDRU) was established in 1975 as part of the School of Economics. SALDRU conducted the first national household survey in 1993 (the Project for Statistics on Living Standards and Development). More recently, SALDRU ran the Langeberg Integrated Family survey (1999) and the Khayelitsha/Mitchell's Plain Survey (2000). Current projects include research on public works programmes, poverty and inequality.

## The Trade and Poverty Project

South Africa is currently engaged in various trade negotiations at the multilateral, regional and bilateral level. The net impact of the resulting trade reforms should be to contribute to growth, employment and raising average incomes. But this net impact conceals a range of differential effects: the benefits of reform do not accrue automatically and equally to all households or communities, and in some cases poverty and unemployment may rise. Policy makers need to be aware of these different effects and implement trade reforms in a way that maximizes the benefits for the poor.

The objective of the South Africa Trade and Poverty Research Project is to analyse the impact of specific trade reforms on poverty in South Africa. The project includes a number studies that explores various linkages through which trade reform affects prices, consumption, production, and employment. These studies fall under 5 broad sections:

1. Review of trade and poverty in South Africa
2. Industry level analysis of trade, enterprise production and employment
3. Household level analysis of trade and poverty
4. Sector specific analysis and case studies
5. Policy simulations

The project is funded by the Department for International Development (through the Trade and Industrial Policy Strategies and the RTFP), USAID and the Department of Trade and Industry. All papers can be accessed via the project home page:

http://www.saldru.uct.ac.za/saldru_trade&poverty.html.