


# Evidence-based Employment Scenarios

## Manufacturing Employment and Import Dependence

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innovative employment strategies

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# Executive summary

South Africa's manufacturing sector will have a role to play in any growth strategy that generates employment and reduces poverty. It is useful therefore to attempt to assess what its potential and limitations are.

Trends since 1997 suggest that with productivity rising and despite real wages remaining relatively constant, manufacturing employment growth has been a lot slower than manufacturing output growth. This implies that a high rate of manufacturing output growth would have to be achieved if the sector were to create the jobs needed to halve unemployment. If manufacturing were to absorb a quarter of the number required to halve *current* unemployment (about 500,000 jobs), its gross output would have to rise by 80%[1]. It seems implausible that the implied growth acceleration can be achieved and sustained.

However, such an argument ignores the indirect employment-creating effects of manufacturing growth. Its linkages to other sectors through input requirements mean that growth in manufacturing spills over into other sectors. Looking at various multipliers, the picture improves considerably. Although manufacturing's direct employment-output ratios are not as high as other sectors', its linkages are stronger than most, so that indirect job creation is higher. Taking these into account, the output growth required to create 500,000 jobs falls to 28%.

These estimates are based on current structures, characteristics and trends of the manufacturing sector. It is arguable that these do not give us the right information for tackling unemployment, since they arise from and reflect an economy with high unemployment. This particular research project will investigate possible ways that manufacturing might become an important direct and indirect employment generator. We envisage that this might be done in one of three ways: by reducing import dependence, by expanding labour absorbing exports, or by increasing labour absorption within existing activities. This paper focuses on the first question: how might employment be stimulated as a result of import replacement in SA manufacturing? The intention is not to say what causes changes in these aspects of manufacturing but rather to see how such changes impact on employment.

There is a common view that employment can be generated by reducing import dependence. This view manifests itself in many ways, ranging from campaigns such as 'Proudly South Africa' to calls for protection to prevent 'jobs being exported'. Given how widely this view is held, it is worth exploring.

There are two versions of the argument that we explore. The first, epitomised by the call for incentives to raise local content, suggests that it would be beneficial to reduce the imported component of inputs into manufacturing production. This would strengthen domestic linkages and raise multipliers.

But imported inputs into manufacturing *rose* from 13.0% of gross output in 1993 to 15.9% in 2005. We find that this was driven mainly by increases in the import intensity of manufacturing subsectors (in particular motor vehicles), rather than by shifts in production from low- to high-import intensity subsectors. This suggests the scope for *reducing* these intensities is limited.

The second version of the view, epitomised by 'Proudly South Africa', is that the economy will benefit if the balance between imports and domestic supplies is shifted towards the latter for all uses, not simply for intermediates. This seems to be common sense. However, the argument is typically applied to a single sector in isolation. We begin to explore it in an economy-wide setting by simulating reductions in imports of a particular good arising from different causes.

[1] There were about four million people unemployed in 2004. This paper asks what if there were changes in the economic environment that caused manufacturing employment to rise by 500,000. This would have resulted in unemployment falling by one-quarter.

There are three main causes of import replacement that we pursue in this paper: the world price of imported inputs rise; productivity rise in the domestic industry; and capacity in the domestic industry expands through capital investment

The lesson we draw is that − not unsurprisingly − the consequences of the reduction in imports depend on why it occurs. If it is because the world price has risen, the net effects on employment can be negative, even though employment rises in the competing domestic industry. This is primarily because of exchange rate appreciation. If, however, the reduction is because of productivity growth or increased capacity in the industry, leading to increased domestic production, the effects can be positive.

# 1. Introduction

The belief that 'development' and 'industrialisation' go hand in hand has long been a core tenet of most development thinking, within both academic and policy circles. A stylised sequence for development is that there is a shift from primary production into manufacturing as economies develop. Where services are a significant provider of employment, this is typically because of the under-developed nature of the economy – a reflection of surplus labour *a la* Lewis. People work in services largely because they are unable to get more productive ('proper'?) jobs in formal manufacturing. Only in high-income countries, where incomes are high enough for the high income elasticity of demand for services to kick in can they provide any self-sustaining impetus.

There are good reasons for this view. Many of the arguments in favour of policies that stimulate industrialisation are valid. However, evidence from fast-growing economies around the world shows that the manufacturing sector typically provides around 15% of total employment and seldom higher than 30% (see Berry, 2006). There is sufficient evidence to suggest that there may be exceptions to the rule, so that the actual role of manufacturing in any specific country might depend on specific characteristics of the local economy. Furthermore, the growth of services in the globalised economy suggests that services could possibly be more of an engine of growth than they have been in the past.

This paper, which complements Tregenna (2006), considers some aspects of South Africa's manufacturing sector that are relevant for assessing its employment-generating potential. We begin by considering how much employment is currently generated by the sector, directly and indirectly. However, since the structure and characteristics of the economy on which we base this analysis reflect an economy with high unemployment, they can provide only limited information as to how to tackle the problem. At best, they can tell us how far we might go by changing the sectoral composition of output and employment.

But it is likely that any successful policy will entail introducing new characteristics (technical change). The second part of the paper therefore considers aspects of this side of the story, exploring possible employment pay-off from particular kinds of technical change. We ask how many jobs could be created by a particular kind of change (say, reducing import dependence), but do not ask what might stimulate such a change.

We should emphasise that the focus on manufacturing is only one part of the story. The full story requires an examination of all possible engines of growth. The issue is not whether a particular sector is an engine or not, but how it compares to other sectors. More importantly, growth is not likely to be generated by a one-sided dependence on one or another sector to the exclusion of all others. Rather, we need to understand how the various sectors interact with each other and consider appropriate balances between them. Nonetheless, it is useful to explore the manufacturing sector explicitly. There is a widely held view that growth in the manufacturing sector is key to employment-generating, poverty-reducing growth in South Africa. This being so, it is useful to explore its possibilities and limits systematically.

The issues we will focus on have been selected because they reflect perceptions given currency by at least some influential opinion-makers in South Africa.

1. Import dependency: if South Africa could reduce its dependence on imports, producing more domestically, then more jobs could be created domestically.
2. Export expansion:

3. Labour intensity: if South Africa could raise labour intensity it could create more jobs.

This paper focuses on the first question. The potential impact on employment of expanding labour absorbing manufactured exports or of influencing labour intensity in manufacturing will be explored in subsequent papers.

# 2. Current employment potential of the manufacturing sector

Tregenna (2006) provides a detailed description of the manufacturing sector and its linkages with other sectors. Reliable empirical analysis is difficult, given South Africa's notoriously inconsistent employment data. Nonetheless, Table 1 provides some key statistics. The employment shares in columns [1] to [3]; drawn from the Labour Force Survey, show that the manufacturing sector provides about 14% of total employment and that this share has been relatively constant over the past 8 years. Manufacturing employment has grown at about 2.2% per year. Productivity has grown much faster than this though − gross output per head has grown at 5.0% p.a. and value added per head at 8.8% p.a.

Table 2 presents some relevant ratios and multiplier estimates at the 1 digit SIC level. The first column shows the average number of jobs associated directly with R1m worth of output in any sector.[2] We could use such ratios to do back of the envelope estimates of the amount by which output in the sector would have to grow to create a certain number of jobs. Thus, say our target was to employ 500,000 more people in manufacturing (approximately a quarter of the jobs needed ***now*** to halve ***current*** unemployment). Then manufacturing gross output would have to be R357bn greater than it is (about 50% of its 2003 level).[3]

This calculation uses only the 2003 information, assuming the employment output ratio for that year remains fixed. We could do a similar calculation using the growth rates referred to earlier. These give a crude employment/gross output elasticity of 0.4: a 1% rise in gross output will be associated with a 0.4% rise in employment. This is a very crude figure, since it does not control for other changes that might be taking place, for example, in wage rates. Ignoring this, it would suggest that the extra 500,000 jobs would require manufacturing gross output to be 80% higher than it currently is.

These figures may not seem to be too out of reach. Manufacturing output grew by 57% between 1997 and 2005, so 80% does not look infeasible. However, this makes the wrong comparison. Rather, the 80% gives us an idea of the *additional* output growth needed on top of 'normal growth' if manufacturing is to create a quarter of the additional jobs that will be needed to halve unemployment. 'Normal growth' would simply be growth that continues past trends. Alternatively, we could say there would have been 500,000 more jobs in manufacturing in 2003 if output had grown by 118% between 1997 and 2003 (13.0% p.a.), rather than by the 46% (6.3% p.a.) it did. This is a much harder target to reach.

[2] The inverse of this ratio is often used in popular discussions of employment. It shows how many rand of output it takes to create one job.

[3] The direct employment output ratio for manufacturing is 1.4 (column 1 Table 2). If 1.4 jobs are associated with R1m of output, then 500,000 jobs will be associated with 500,000/1.4 = R357bn.

**Table 1 – Manufacturing sector employment and productivity data**

| | Shares in employment (%) | | | Employment | Gross output | Gross output per employee | Value added | Value added per employee | Wage rates |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Formal | Informal | LFS | 2000P Rm | LFS | 2000P Rm | LFS | 2000P R p.a. |
| | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] |
| 1997 | 17.4 | 20.5 | 6.5 | 1 503 636 | 493 960 | 245 506 | 124 066 | 61 663 | 49 975 |
| 1998 | 14.9 | 17.7 | 9.1 | 1 359 141 | 525 229 | 302 877 | 129 693 | 74 788 | 59 134 |
| 1999 | 14.6 | 17.7 | 10.0 | 1 470 344 | 553 665 | 302 983 | 135 447 | 74 121 | 55 238 |
| 2000 | 13.3 | 16.9 | 7.6 | 1 546 256 | 633 517 | 336 941 | 157 204 | 83 610 | 53 674 |
| 2001 | 14.7 | 18.0 | 8.7 | 1 594 606 | 670 356 | 353 587 | 175 063 | 92 339 | 51 656 |
| 2002 | 14.8 | 18.1 | 8.0 | 1 623 835 | 709 292 | 365 333 | 207 479 | 106 866 | 48 159 |
| 2003 | 13.8 | 16.5 | 8.6 | 1 545 575 | 719 865 | 390 088 | 219 615 | 119 007 | 50 361 |
| 2004 | 15.0 | 17.9 | 9.3 | 1 706 296 | 753 154 | 369 309 | 234 301 | 114 889 | 47 544 |
| 2005 | 14.1 | 16.9 | 9.1 | 1 696 621 | 777 948 | 385 925 | 249 203 | 123 625 | 50 619 |

*Sources: [1]-[4]: LFS data provided by D. Lee; [5], [7]: Quantec SASID database, downloaded Sept 21 2006; [6], [8]: author's estimates; [9] author's estimates based on SASID compensation of employee data and LFS employment data*

However, both these calculations ignore the **indirect** impacts that work through the inter-industry linkages. These effects are shown in the multiplier estimates, two variants of which are shown in Table 2. Multipliers based on supply use tables (SUT) capture only interindustry effects, while those base on the social accounting matrix (SAM) go some way towards capturing feedbacks operating through higher incomes (hence they are bigger – see Appendix B for explanation). The output multipliers show the impact of a R1m rise in the final demand for the sector on total economy-wide output. Thus a R1m rise in, say, export demand for manufacturing would require output in the economy to rise by R1.8m in the SUT case and R3.9m in the SAM one. We are more interested in the employment multipliers in columns [4] and [5], which show how the rise in output translates into jobs. Thus the R1m rise in export demand would directly and indirectly create 7.5 jobs in the whole economy. The final columns give some idea of the relative importance of direct and indirect impacts.[4]

**Table 2 – Sector multipliers, 1-digit SIC, 2003**

| | Direct employment-output ratio (Jobs per Rm) | Multipliers | | | | Ratio of total to direct jobs | |
|---|---|---|---|---|---|---|---|
| | | Output | | Employment | | | |
| | | SUT | SAM | SUT | SAM | SUT | SAM |
| | [1] | [2] | [3] | [4] | [5] | [6] | [7] |
| Agriculture | 10.2 | 1.7 | 3.8 | 11.9 | 14.8 | 1.1 | 1.6 |
| Mining | 2.8 | 1.6 | 3.5 | 4.5 | 7.8 | 1.6 | 3.4 |
| Manufacturing | 1.4 | 1.8 | 3.9 | 4.2 | 7.5 | 2.1 | 4.0 |
| Electricity & Water | 0.8 | 1.9 | 4.0 | 2.5 | 7.3 | 2.6 | 7.6 |
| Construction | 3.1 | 2.4 | 4.5 | 6.1 | 10.9 | 1.6 | 3.0 |
| Trade & Hotel | 4.2 | 1.9 | 3.9 | 6.0 | 10.3 | 1.4 | 2.1 |
| Transport & Communications | 0.8 | 2.0 | 3.8 | 2.7 | 6.8 | 3.0 | 7.3 |
| Finance & Business | 2.9 | 1.8 | 3.7 | 4.7 | 8.9 | 1.3 | 2.1 |
| Other Services | 10.2 | 1.9 | 4.1 | 11.9 | 15.1 | 1.3 | 1.7 |
| Government | 5.5 | 1.7 | 4.4 | 7.0 | 13.6 | 1.2 | 2.3 |

*Source: author's estimates based on 2003 SAM*

*Note: SUT = multiplier based on supply use table; SAM = multipliers based on social accounting matrix.*

[4] The ratios in column 1 show employment per R1m of **gross output**, while the employment multipliers show the change in employment associated with a R1m change in **final demand**. We cannot directly compare the two. The ratios in [6] and [7] are based on increases in final demand that give rise to a R1m rise in the gross output of the sector concerned.

The full implications of these figures are discussed in Tregenna (2006). One way of using them is to ask what the increase in final demand for a sector would have to be to create, directly and indirectly, say 500,000 additional jobs. The results of some calculations are shown in Table 3.[5] To create 500,000 jobs directly and indirectly, *final demand* for manufacturing output would have to rise by 28.3%. The pattern of employment changes are shown in columns [2] and [3]. More than half the jobs are created outside the manufacturing sector, reflecting is strong linkages. In contrast, final demand for Finance and Business services (which include BPO) would have to grow by 86.8% if we tried to create the jobs by stimulating only this sector. Now 394,220 jobs (78% of the increase) are created directly in the stimulated sector. This reflects the poor backward linkages of this sector. The last two columns show what happens if we try to achieve the same goal by stimulating all four of the private service sectors uniformly.

The figures in Table 3 were calculated using the SUT multipliers. Although we do not show the results here, they change significantly if we use the SAM multipliers. The relatively higher proportion of value added in service sectors' outputs give rise to feedbacks via household income and demand. In effect, including value added and household demand in the picture strengthen service linkages much more than they do manufacturing.

**Table 3 – Creating 500,000 jobs by increases in final demand for certain sectors**

| | Initial formal employment | Simulated increase in final demand for: | | | | | |
|---|---|---|---|---|---|---|---|
| | | Manufacturing | | Finance & business | | Private services[1] | |
| | No. | No. | % | No. | % | No. | % |
| | [1] | [2] | [3] | [4] | [5] | [6] | [7] |
| Agriculture | 830,800 | 107,763 | 13.0 | 13,761 | 1.7 | 16,144 | 1.9 |
| Mining | 428,643 | 37,367 | 8.7 | 5,723 | 1.3 | 5,880 | 1.4 |
| Manufacturing | 1,250,265 | 242,179 | 19.4 | 29,596 | 2.4 | 32,507 | 2.6 |
| Electricity & Water | 44,304 | 2,843 | 6.4 | 1,284 | 2.9 | 1,491 | 3.4 |
| Construction | 342,647 | 2,797 | 0.8 | 10,602 | 3.1 | 5,928 | 1.7 |
| Trade & Hotel | 1,285,215 | 5,285 | 0.4 | 10,586 | 0.8 | 162,033 | 12.6 |
| Transport & Communications | 205,689 | 6,086 | 3.0 | 6,558 | 3.2 | 20,863 | 10.1 |
| Finance & Business | 1,172,495 | 46,191 | 3.9 | 394,220 | 33.6 | 112,175 | 9.6 |
| Other Services | 1,378,467 | 48,919 | 3.5 | 26,556 | 1.9 | 141,376 | 10.3 |
| Government | 1,438,126 | 568 | 0.0 | 1,115 | 0.1 | 1,602 | 0.1 |
| Total | 8,376,651 | 500,000 | 6.0 | 500,000 | 6.0 | 500,000 | 6.0 |
| % Change in Final Demand | | | 28.3 | | 86.8 | | 13.0[1] |

*Source: estimates by author using the SUT multipliers*

[5] The estimates in Table 3 were done using the SUT multipliers. These multipliers show the change in gross outputs of every sector associated with a given change in final demand for a particular sector. These are then combined with employment-output ratios to estimate the change in employment. For Table 3 we worked backwards to ask, given the multipliers and the employment-output ratios, what will the rise in final demand for a particular sector have to be to create 500,000 jobs across the whole economy?

*Notes: [1] Privates services = trade, transport, finance and other. It is assumed that there was a uniform percentage increase in final demand for all four.*

# 3. Implications of changing manufacturing's characteristics

One of Tregenna's findings is that the employment multipliers of private services taken as a group are much higher than those of manufacturing (Tregenna, 2006: Table 4). This finding would suggest that employment generating growth strategies should focus on developing service sectors. However, it could be countered that it is based on characteristics of manufacturing now and in the recent past, and ignores the possibility of changing them. Doing so might restore manufacturing as an engine of employment generating growth. This paper is concerned with these kinds of arguments.

There are three main ways that manufacturing might become a more important source of employment. These include:

1. reduce import dependence
2. expand labour absorbing exports
3. increase labour absorption per Rand of output

In this paper we examine only the first of these ways, leaving the other two for subsequent studies.

For our purposes there are two related but different meanings we can attach to 'import dependence'. The first is a narrow concept that focuses on the import content of production. The second meaning reflects a broader concern and looks at the share of imports in the total domestic market for a good. In the first part of this section we concentrate on import dependent production. Common sense tells us that replacing imported by domestic inputs strengthens inter-industry linkages and raises multiplier effects. This should be beneficial for employment creation. We will call the ratio of imported intermediate inputs to gross output the "import intensity of production" or simply "import intensity". [6]

There are two ways in which production in the economy can become less import dependent. Either production can shift from sectors with higher import intensities to ones with lower, leaving the intensities within sectors unchanged, or intensities within sectors can be changed. In most practical situations actual changes will be the outcome of some combination of these two. However, it is useful to think of them separately, and is worth taking a little trouble to think this through carefully.

Say we have an economy that has only two sectors. The economy wide demand for intermediate imported inputs will depend on the demand within each sector. At any point in time we can measure the import intensity of each sector by the ratio of imported intermediate imports to total output[7]. The economy-wide import intensity will then be the average of the two sector intensities, weighted by their respective shares in total output. Any change will, by definition, be because of a change in the intensity of one or more sectors or because of a change in the shares of the sectors, or because of some combination of the two. We can use this to decompose

[6] Although the literature tends to focus on quantitative import dependence, it is possible for actual dependence to be worse in sectors with lower intensities. For example, there may be some input which, although only a small proportion of costs, is vital to production. Inability to secure it may lead to production halting completely. This qualitative dependence is not captured by our measure of intensity.

[7] We could us the ratio to all intermediates, but in practice the difference is minimal.

changes to the economy-wide intensity into an 'intensity effect' and a 'composition effect'. The algebra is set out in Appendix A.

It is clear that composition effects arise because of the host of factors that cause changes to the structure of output in an economy – essentially resource allocation effects caused by changing relative prices of goods and factors. Intensity effects can arise because of similar influences or because of technical changes within sectors. Changes in relative prices of imported and domestic intermediate goods induce firms to change their input composition. This may be relatively easy – where the two are relatively close substitutes for each other, so that all that matters is their relative cost to the producer. Where they are not close substitutes, changes will come about either because the users innovate to change the input composition or because a new industry is established producing a South African version of what was previously available only from abroad.

This separation of changes into sectoral intensity and compositional effects provides a convenient framework for thinking about the possibilities of reducing import dependence in South Africa. We begin with the compositional effects.

We can see some hypothetical limit to the impact that can be achieved through compositional changes by looking at existing import intensities and thinking what the possibilities of changing are. Table 4 shows relevant figures for the three major economic divisions in 1993 and 2005. Hypothetically we could reduce this economy's import intensity to 4.8% by producing everything in the tertiary sector. Clearly this is not a practical limit. The question is how to decide what is practical within these limits. There are two sources of information: relevant past trends in South Africa and international experiences.

South Africa's economy-wide imported intermediate intensity ratio has shown a slight upward trend since 1993, rising from 7.4% to 8.7% in 2005. The figures in Table 4 show that import intensities in manufacturing rose over the period, but that the effect of this on the economy-wide intensity was somewhat off-set by the growth in the output share of tertiary activities (services). The economy-wide trend was thus driven by changes to the sectoral import intensities not by changes in the structure of output. If the structure of output in 2005 had been the same as in 1993, the economy-wide import intensity would have risen from 7.4% to 8.9%, driven by changes in the intensities. On the other hand, if the intensities had remained fixed, but the structure had changed to its 2005 pattern, the economy-wide intensity would have *fallen* to 7.2%. In other words, while output tended to shift towards sectors with lower import intensities between 1993 and 2005, average intensities rose.

Since our concern is with the manufacturing sector, it is instructive to take this decomposition one stage further. In Table 4 we see that the import intensity of secondary industries (manufacturing, electricity and water, and construction) rose over the period. This has largely been driven by the manufacturing sector. Its import intensity rose from 13.0% to 15.9%, electricity's from 2.4% to 3.4%, while construction's fell from 8.6% to 7.7%.

**Table 4 – Import intensities and output shares, major economic divisions, 1993 and 2005**

| | Import intensity (%) | | Output share (%) | |
|---|---|---|---|---|
| | **1993** | **2005** | **1993** | **2005** |
| Primary | 7.8 | 8.3 | 12.3 | 8.2 |
| Secondary | 11.7 | 14.3 | 39.3 | 38.5 |
| Tertiary | 3.8 | 4.8 | 48.5 | 53.3 |
| Economy-wide | 7.4 | 8.7 | 100.0 | 100.0 |

*Source: QUANTEC SASID database, downloaded 22 Sep 2006*

*Note: Import intensity is measured as the ratio of imported intermediate inputs to total inputs, both measured in constant 2000 prices*

Our main concern is to use these changes to see what the limits for the future are, rather than to investigate what was driving them in the past. However, the trend is slightly puzzling when we recall that the rand was depreciating for much of the period. We would expect this to push import intensities down, as it would encourage firms to substitute imports with cheaper domestic products where possible. The rand has not recovered enough since 2003 to make it obvious that any initial move away from imports would have been totally reversed. Surprisingly, the intensities of some sub-sectors are not even U-shaped over the period; several sub-sectors show fairly steady increases in intensity.

These results need to be explored more fully. Although we cannot do so here, there are a number of possible explanations. Perhaps the potential for substituting domestic for imported intermediates is more limited than we think. Although the level of aggregation of the data available to us suggests that the imported and domestic inputs are similar, more disaggregated data may show that there is little domestic production of the imported inputs. It is possible that technology (embedded in imported machines?) ties producers into using proprietary inputs that have to be imported. Alternatively, while there may be substitution possibilities, it could be that depreciation of the rand did not raise costs of imports sufficiently to stimulate substitution. This would raise questions about the magnitude of changes required to evoke a response. It may be useful to undertake a microanalysis of this.

Returning to our main concern, the potential for changing the import intensity of manufacturing through compositional effects could be judged by looking at the range of sub-sectoral import intensities. The lowest sectoral import intensity (5.2 for Tobacco in Table 6) gives an absolute limit for how far the manufacturing intensity might be reduced in this way. However, it is unrealistic to speculate about shifting production entirely to one sector. More relevant perhaps is to consider how much sectoral shifts have contributed to changes in the past. We confine ourselves to considering changes over 10-year intervals – the relevant period for the scenarios project. Table 5 shows decompositions based on 10-year periods since 1970. There have been some large shifts in the manufacturing import intensity since 1970. It fell by 7.6 percentage points between 1974 and 1984 and rose by 6.3 points between 1985 and 1995. However, it has risen in every 10-year period since 1982-92, except in the most recent. Furthermore, the contribution of changing sectoral composition to these changes has been small and – in all by two periods – positive.

**Table 5 – Sources of changes in manufacturing import intensity**

| From | To | Contribution of share changes | Contribution of intensity changes | Interaction term | Total change |
|---|---|---|---|---|---|
| 1970 | 1980 | 0.3% | -6.5% | 0.2% | -6.0% |
| 1971 | 1981 | 0.5% | -5.7% | 0.0% | -5.2% |
| 1972 | 1982 | 0.3% | -2.9% | 0.0% | -2.6% |
| 1973 | 1983 | 0.2% | -7.3% | -0.1% | -7.1% |
| 1974 | 1984 | 0.4% | -7.8% | -0.2% | -7.6% |
| 1975 | 1985 | 0.0% | -7.2% | 0.2% | -7.0% |
| 1976 | 1986 | -0.1% | -4.9% | 0.4% | -4.6% |
| 1977 | 1987 | 0.2% | -3.2% | -0.1% | -3.2% |
| 1978 | 1988 | 0.1% | 0.0% | -0.1% | 0.0% |
| 1979 | 1989 | 0.1% | 0.4% | 0.1% | 0.5% |
| 1980 | 1990 | -0.2% | -0.7% | 0.3% | -0.5% |
| 1981 | 1991 | 0.0% | -2.1% | -0.1% | -2.2% |
| 1982 | 1992 | 0.0% | 1.0% | -0.2% | 0.8% |
| 1983 | 1993 | 0.0% | 3.9% | -0.1% | 3.9% |
| 1984 | 1994 | 0.0% | 3.8% | -0.1% | 3.7% |
| 1985 | 1995 | 0.1% | 6.2% | 0.0% | 6.3% |
| 1986 | 1996 | 0.5% | 5.2% | -0.2% | 5.5% |
| 1987 | 1997 | 0.1% | 6.1% | 0.1% | 6.3% |
| 1988 | 1998 | 0.4% | 3.4% | -0.2% | 3.7% |
| 1989 | 1999 | 0.6% | 2.3% | -0.1% | 2.9% |
| 1990 | 2000 | 0.9% | 2.4% | 0.0% | 3.3% |
| 1991 | 2001 | 0.8% | 1.8% | 0.2% | 2.8% |
| 1992 | 2002 | 0.9% | 0.0% | 0.5% | 1.5% |
| 1993 | 2003 | 0.9% | 0.2% | 0.5% | 1.6% |
| 1994 | 2004 | 0.9% | 0.1% | 0.5% | 1.4% |
| 1995 | 2005 | 0.7% | -1.2% | 0.5% | -0.1% |

*Source: Author's estimates based on SASID data*

In Table 6 we see that changes in the manufacturing intensity between 1993 and 2005 were driven largely by changes in the motor vehicles sector. Although the intensity of some other sectors rose more, their share in manufacturing output meant they had little impact on the overall intensity. In fact intensities fell in 13 of the 28 sectors, but this was swamped by the motor vehicle sector. Compositional shifts contributed about a third to the overall rise, whereas intensity effects contributed nearly two-thirds.

**Table 6 – Change in manufacturing import intensity, 1993-2005**

| | Import intensity in 2005 (%) | Change in import intensity (%) | Contribution to change in manufacturing sector intensity (%) | | | |
|---|---|---|---|---|---|---|
| | | | Intensity effect | Composition effect | Interaction effect | Total contribution |
| Food | 6.3 | -0.34 | -0.05 | -0.24 | 0.01 | -0.28 |
| Beverages | 5.5 | -0.25 | -0.01 | -0.07 | 0.00 | -0.07 |
| Tobacco | 5.2 | -1.45 | -0.02 | -0.05 | 0.01 | -0.06 |
| Textiles | 13.5 | -1.32 | -0.03 | -0.07 | 0.01 | -0.10 |
| Wearing apparel | 10.7 | -2.38 | -0.06 | -0.12 | 0.02 | -0.16 |
| Leather and leather products | 11.0 | 0.25 | 0.00 | 0.01 | 0.00 | 0.01 |
| Footwear | 15.2 | 0.93 | 0.01 | -0.06 | 0.00 | -0.05 |
| Wood and wood products | 7.4 | 0.40 | 0.01 | 0.01 | 0.00 | 0.02 |
| Paper and paper products | 10.2 | -0.48 | -0.02 | -0.03 | 0.00 | -0.05 |
| Printing, publishing and recorded media | 9.5 | 1.08 | 0.04 | -0.12 | -0.02 | -0.09 |
| Coke and refined petroleum products | 25.3 | 3.59 | 0.18 | 0.26 | 0.04 | 0.48 |
| Basic chemicals | 20.9 | 0.47 | 0.02 | 0.32 | 0.01 | 0.34 |
| Other chemicals and man-made fibres | 14.1 | -1.78 | -0.11 | 0.28 | -0.03 | 0.14 |
| Rubber products | 12.4 | -2.11 | -0.02 | -0.04 | 0.01 | -0.06 |
| Plastic products | 10.4 | -1.83 | -0.05 | 0.01 | 0.00 | -0.04 |
| Glass and glass products | 12.8 | 0.62 | 0.00 | 0.01 | 0.00 | 0.02 |
| Non-metallic minerals | 18.9 | 4.77 | 0.12 | -0.07 | -0.02 | 0.03 |
| Basic iron and steel | 20.0 | 2.79 | 0.17 | 0.15 | 0.02 | 0.34 |
| Basic non-ferrous metals | 18.4 | 0.12 | 0.00 | 0.05 | 0.00 | 0.05 |
| Metal products excluding machinery | 8.6 | -3.15 | -0.19 | -0.20 | 0.05 | -0.33 |
| Machinery and equipment | 19.8 | 3.50 | 0.19 | -0.17 | -0.04 | -0.02 |
| Electrical machinery and apparatus | 12.8 | -2.11 | -0.05 | 0.03 | 0.00 | -0.03 |
| Television, radio and communication equipment | 33.1 | 11.47 | 0.12 | -0.05 | -0.02 | 0.04 |
| Professional and scientific equipment | 14.5 | -1.40 | -0.01 | -0.02 | 0.00 | -0.03 |
| Motor vehicles, parts and accessories | 23.8 | 9.14 | 0.78 | 1.02 | 0.63 | 2.43 |
| Other transport equipment | 33.8 | 18.89 | 0.18 | 0.01 | 0.02 | 0.21 |
| Furniture | 8.4 | -1.87 | -0.02 | 0.02 | 0.00 | 0.00 |
| Other manufacturing | 18.7 | 5.96 | 0.33 | -0.12 | -0.06 | 0.16 |
| Manufacturing | **15.9** | **2.90** | **1.48** | **0.77** | **0.64** | **2.90** |

Note: Import intensity is measured by the ratio of the value of imported intermediates to gross output, both in 2000 prices. See appendix for explanation of intensity, composition, and interaction effects.

The foregoing investigation seems to show that a) the manufacturing sector's import intensity has been rising and b) this has been driven more by changes to sub-sector intensities than by changes in the structure of production. While there are no theoretical reasons why these patterns should not be reversed, a compelling argument has to be made if we believe that a strong empirical regularity in the past will be reversed in the near future. We need to understand better what has been driving these regularities, a topic for future research.

For the present, we turn our attention to the scope for doing reducing the manufacturing intensity by changing intensities in sub-sectors. If we were undertaking a partial equilibrium study

based on one sector we could do this simply by changing import coefficients in the production process. It is a bit more complicated from an economy-wide perspective. Reducing imports has feed-backs through the current account and the exchange rate. At the same time we need to replace the imports with domestic inputs. Where do these domestic inputs come from? We presumably expect domestic supply to expand rather than for the inputs to be drawn in from other competing sectors. But what lies behind the expansion of domestic supply? Is it productivity growth, investment, employment expansion, some combination of the three, or something completely different? Unfortunately the effects of the switch depend on these issues. Unlike sector focussed analyses, the cause of the change is important for determining its effects.

To illustrate this we conduct three experiments. In all three imports of labour intensive intermediate goods (LIG) are reduced by 5%, but how this is done varies:

- In the first, we raise the world price of imports (only of LIG);
- In the second, we raise productivity in the domestic LIG industry;
- In the third, we increase the capital stock of the domestic LIG industry.

In both the latter two, we make sure the changes are sufficient to cause LIG imports to fall by the same quantity as in the first. The imports of LIG goods account for a third of South Africa's imports, so that a 5% decrease has a significant impact on total imports.

In all three cases the changes are driven by relative price changes but, as might be expected, the subsequent consequences are very different. It is useful to separate those effects that come about because relative price changes cause substitution between factors in production or commodities in use (substitution effects) from those that arise because of changes in the levels of production and/or income (income effects).

In the first case, substitution effects dominate. As imports of LIG become relatively more expensive, all users shift away from them towards domestic supplies. Production (and employment) in the local LIG sector rise. This stimulates demand for other goods, through backward linkages. This will stimulate some expansion in the economy. However, when we take the impact on other sectors into account, it is possible that the net economy-wide effect is negative. In part this depends on what happens to the current account and the exchange rate when imports are cut. If the current account balance is kept fixed by exchange rate adjustment, we would expect exchange rate appreciation. The fall in imports creates pressures to improve the current account balance so that the exchange rate has to appreciate in order to keep it fixed. The appreciation will cause exports from some other sectors to fall. The effects on each sector are complicated, and depend on the structure of their production costs and of their sales. Appreciation simultaneously reduces imported input costs and increases competition from imports in their markets.

GDP falls, as might be expected from a negative terms of trade shock. Although employment in the labour-intensive intermediate goods rises (by 1.2%), it falls in 10 of the 13 other sectors, and overall employment declines (by 0.3%). Whether a sector's output (and employment) fall depends primarily on a mix of two things: the share of imports in its domestic market and the structure of its demand. For example, a quarter of the sales of capital intensive intermediate goods are to the labour intensive intermediate good sector. The latter's expansion thus has strong backward linkage effects, which are sufficient to off-set the effects of having to compete with imports that are cheaper because of the appreciated rand.

If the exchange rate is fixed, the current account improves. This affects other macroeconomic adjustment mechanisms in the economy. Foreign savings are reduced, so either investment must fall or domestic private or public savings must rise. We assume that investment does not go down, and that the adjustment is made by domestic private savings rising. This reduces domestic household consumption. GDP falls. The net impact on employment is much the same as when the exchange rate was flexible, even though the chain of adjustment is different.

In both the other simulations the change in relative prices needed to make imports less desirable are caused by greater domestic production. In the first case, the relative price change was caused by a rise in world prices; in contrast it is now caused by a fall in domestic prices. This stimulates demand. At the same time the higher production stimulates GDP. Income effects tend to dominate.

When the shift results from domestic productivity growth, there is a negative impact on employment in the LIG sector. Productivity growth only stimulates employment when it is accompanied by sufficient demand growth, which cannot be endogenously generated. However, the lower price of LI goods reduces costs in sectors using them, stimulating their demand, output and employment. These effects are compounded by the rise in real incomes, so that employment rises in many other sectors, particularly services. These effects offset the reduced employment in the LIG sector, so that total employment rises by 1.5%. However, when the shift results from increased capital stock – effectively a rise in the capacity of the LIG sector - there is a strong positive employment impact. GDP rises by a similar amount to the productivity case, but it is accompanied by employment growth.

As in the first case, the precise results in both these cases depend on the assumptions we make about the macroeconomic adjustment processes. The impact on GDP is greater when the exchange rate is flexible than when it is fixed, primarily because foreign savings do not fall.

We have rather arbitrarily chosen one major sector on which to conduct these experiments. Had we chosen some other sector the effects could well be different, depending on the specific linkages with the rest of the economy. We can also affect the results by making different choices about the macroeconomic processes at work. Our purpose here was not to generate empirical forecasts. Rather it was to use the model to illustrate the issues involved in thinking through how a reduction in imports might work through the economy. There are several general lessons we would draw at this stage:

1. The cause of the reduction in imports matters. Essentially it depends on whether it is been the domestic industry out-competing imports, or by imports becoming more expensive.
2. Thinking through reduced import dependence entails more than simply thinking about changing the share of imports in the market for a particular good. It seems that the increased domestic production that is meant to be stimulated by reduced import dependence is typically viewed as simply being added to existing production. But if there are any resource restraints or capacity bottlenecks, the net economy-wide impact may be considerably smaller.
3. While the impact of increases in productivity on GDP and output are similar to those of increased capacity, their effects on employment are very different.

# 4. Conclusion

This paper reports on work in progress and the conclusions we draw must be tentative. We began with a brief review of trends in manufacturing employment over the past eight years. The sector's direct employment output ratio is one of lowest in the economy: it ranks 8th out of 10 major sectors (Table 2). This reduces its attractiveness relative to other sectors, since it is difficult to see how to stimulate significant employment growth directly. However, its backward linkages with other sectors means its ranking as an employment generator rises (from 8th to 3rd, out of 10) when we take into account indirect employment creation. We compare estimates based purely on inter-industry linkages with some that include on income and demand linkages as well. While this does not affect the sector's ranking, the relative size of its multiplier falls. This is because value added is a lower proportion of output than in service sectors.

In the second part of the paper we begin exploring consequences of changing the characteristics of manufacturing. We focus on reducing import dependence. It is the intention to look at exports and changing labour intensities in later research. The argument for reducing import dependence is that it will strengthen backward linkages and indirect employment creation.

The sector's import intensity can be reduced by promoting production in sub-sectors that have lower import intensities or by reducing their import intensities. We examine the importance of these effects historically. We find that

- the sector's import intensity has risen in the recent past;
- this rise has been driven largely by the motor vehicle industry;
- the contribution from changes to the structure of output is about a half of the contribution from changes to sub-sectoral import intensities.

We then consider the effects of reducing imports that compete with a particular sector. The main lesson we learn is methodological: when changing one characteristic of the economy it is important to think through what other changes might take place to accommodate it. We find that the impact of the reduction in imports depends crucially on what drives it. When it is some external change that has made the import more expensive the effects can be negative. While the domestic import-competing industry is able to expand, other sectors may be negatively affected by rising costs and exchange rate appreciation. When the import reduction is driven by some internal change that has made domestic production more competitive, the effects can be positive. Even in the latter instance, however, the consequences for employment depend on whether the improved competitiveness is driven by productivity or by capacity growth.

There may be some general conclusions we can draw from this. For example, policies that affect the composition of output, through differential impacts on incentives, are less likely to reduce import dependence than policies that encourage investment and productivity growth. If this is so, it may be that industrial policy needs to focus more on investment promotion, rather than offering incentives through trade policy. Similarly, there may be a case for reviewing existing policies when we consider that the main rise in import intensity has been in motor vehicles and telecommunications, sectors which the state has been actively involved in stimulating.

However, we stress that this is still very much a 'work-in-progress' and we would not yet like to place great weight on these conclusions. There is need for further research. We intend proceeding with the current study by

- strengthening the existing analysis and relating it more to employment creation;
- examining how changes in export intensities affect employment;
- examining how changing employment intensities affects the manufacturing sector's ability to create jobs.

Exploring these issues will help us have a better understanding of the role of the manufacturing sector as an engine of employment generating growth.

# Appendix A: derivation of decomposition

Suppose there are two sectors with total imported intermediate costs of $M_1$ and $M_2$. Then

$$M = M_1 + M_2 \tag{1}$$

Dividing total output X gives the economy-wide imported intermediate input intensity:

$$\frac{M}{X} = \frac{M_1}{X} + \frac{M_2}{X} \tag{2}$$

Multiplying and dividing each term on the right by the relevant sector output gives

$$\frac{M}{X} = \frac{M_1}{X_1}\frac{X_1}{X} + \frac{M_2}{X_2}\frac{X_2}{X} \tag{3}$$

$$m = m_1 s_1 + m_2 s_2 \tag{4}$$

We can then write the change in the economy-wide ratio as a sum of changes in sectoral intensities and shares:

$$\Delta m = \Delta m_1 s_1 + m_1 \Delta s_1 + \Delta m_1 \Delta s_1 + \Delta m_2 s_2 + m_2 \Delta s_2 + \Delta m_2 \Delta s_2 \tag{5}$$

Re-arranging gives

$$\Delta m = \underbrace{m_1 \Delta s_1 + m_2 \Delta s_2}_{\text{compositional effect}} + \underbrace{\Delta m_1 s_1 + \Delta m_2 s_2}_{\text{structural effect}} + \underbrace{\Delta m_1 \Delta s_1 + \Delta m_2 \Delta s_2}_{\text{cross effect}} \tag{6}$$

The general case for more than two sectors is:

$$\Delta m = \underbrace{\sum_i m_i \Delta s_i}_{\text{compositional effect}} + \underbrace{\sum_i s_i \Delta m_i}_{\text{intensity effect}} + \underbrace{\sum_i \Delta m_i \Delta s_i}_{\text{cross effect}} \tag{7}$$

If the intensity remained the same but the shares changed

$$m\big|_{m_i} = \sum_i s_i^t m_i^0 \tag{8}$$

If the shares remained the same but the intensities changed

$$m\big|_{s_i} = \sum_i s_i^0 m_i^t \tag{9}$$

# Appendix B: SUT and SAM multipliers

SUT multipliers show by how much the supply of goods and services has to increase to meet a given rise in final demand (private and public consumption, investment and exports) for a particular good. They assume each material input into a sector remains in some fixed proportion to its output. If the final demand for a sector rises by R1m output clearly has to rise by R1m. But to produce this will require additional inputs from other sectors, so the output of other sectors has to rise. But these increases in output will in turn require additional inputs, which will require third round increases in output and so on. The multiplier measures the total increase in output once all of these ripple effects have played themselves out. Although this focuses solely on the inter-industry flows of inputs, once we know what the required rise in output of each sector is, we can estimate the required employment expansion by assuming a fixed relationship between inputs of labour and outputs. We can also estimate the required increase in capital or any other input in the same way.

In a SAM multiplier we include the labour and capital incomes (value added) and private consumption demands in the calculations. Thus we assume there are fixed proportions between value added and output, and between household income and use of household income. Now when final demand rises (from government, investment or exports – household demand is determined endogenously), we not only have the ripple effects running from interindustry flows, but also from value added and household demand. As a sectors output rises, so the value added it generates will also rise, by a fixed proportion. This means that household income rises, and household demand rises. Output has to be raised not only to produce the additional intermediate inputs required, but also to meet the additional household demand generated.

While the assumption of fixed proportions can be questioned, the multipliers do give a reasonable idea of what the impact of a change might be. A computable general equilibrium model takes the analysis further by relaxing the assumption of fixed proportions.