



Evidence-based Employment Scenarios

Manufacturing Exports and Employment Growth

R. Davies
November 2006

Manufacturing exports and employment growth

Prof. Rob DAVIES

Research Associate

Employment Growth & Development Initiative
Human Sciences Research Council (HSRC)

November 2006



employment growth & development initiative

Human Sciences Research Council

November 2006

Produced by: Prof. Rob Davies

Contact: Dr Miriam Altman
Executive Director, EGDI

E-mail: maltman@hsrc.ac.za

Tel: +27 12 302 2402

Contents

Executive summary.....	
1. Introduction.....	7
2. Initial structure.....	9
3. Modelling exports and employment.....	11
3.1 Increasing exports in one sector only.....	12
3.2 Expanding several sectors simultaneously.....	15
3.3 Other methods of expanding exports.....	17
4. Conclusions.....	19

Tables

Table 1 – Changes in production for top and bottom 5 sectors	14
Table 2 – Selected results of combined capacity growth	16
Table 3 – Sectoral characteristics, 2003, current prices	22

Executive summary

This note reports on ongoing research by EGDI on the role of manufacturing in creating employment. The manufacturing sector employs about 15% of South Africa's current workforce and clearly will have an important role to play in future employment growth. This is intended to help us to understand not only the potential and limitations of the sector taken in isolation, but the interactions between it and other sectors that might be centres for job creation.

Export markets can be one source of demand for SA's goods and services, that in turn generate employment. The foreign exchange earned, finances imports of complementary inputs in production and capital goods required for investment. While such benefits are obvious in the aggregate, it is useful to consider where export growth might occur. Because different sectors face different constraints and have different labour-absorbing capacities, their contribution to meeting an overall target will differ.

We consider the short-run effects of a sector, which largely depend on characteristics such as the labour intensity of the sector, its backward and forward linkages to other sectors and the 'export dependence' of the sector.

Since we are concerned with employment generation through export growth, it is instructive to ask how these patterns in exports tie in with employment patterns. For any sector, how export growth translates into employment growth will depend, as a first approximation, on how important exports are and on how labour-intensive the sector is. There is not a strong relationship between these two characteristics; if anything, it appears to be negative. The sectors for which exports are a significant part of demand are not high employment generators, while those that are high employment generators are not significant exporters. We would like to shift into more labour-intensive sectors, but these sectors contribute relatively small shares of South Africa's exports and, more importantly, export markets are relatively insignificant in their overall demand. This means that there has to be enormous growth exports for there to be any impact on these sectors.

So, rather than focussing on how export growth in a particular sector generates employment directly in that sector, we need to think of how the growth is spread through the economy as a result of linkages to other sectors. We make use of an economy-wide model to explore the employment consequences of various changes to exports.

We use the standard IFPRI model, applied to South Africa by Thurlow and Van Seventer. We apply the model to 2003 as a base year. We impose certain changes that are designed to stimulate exports in specific sectors to grow to a target level. For the targets we have adopted the projected annual growth rates in sectoral exports by the IDC for the period 2006-2010. They are **not** rates designed to meet the unemployment and poverty targets. At this stage, we are interested in understanding the various processes involved in employment responses to different export growth

patterns. We use a numerical model to assist us in this. The numbers that we derive should not be regarded as forecasts.

Increasing exports in one sector only

Our initial experiment is to increase exports of only *Basic Iron and Steel*. The IDC suggests that initially exports of *Basic Iron and Steel* will grow by 7.9% per year. We simulate the increase by raising capital stock in the *Basic Iron and Steel* sector sufficiently to meet this export growth rate.

We find that a capital stock increase of 5% is sufficient to generate the export growth. This amounts to real growth in investment in that sector of 82% (much higher gross investment would be required if we allow for depreciation). Employment in this sector rises by 4%. Output expands by 4.6%. Domestic sales rise by 1.3%.

The expansion of capital stock in this one sector has repercussions for other sectors, and there are various channels through which this works, such as demand for inputs, reduced price of output, and the impact on the current account and the exchange rate. These various channels mean that the capacity growth in *Basic Iron and Steel* acts in both positive and negative ways on other sectors. The net effects on a particular sector will depend on its specific characteristics: how important are sales to, or purchases from, *Basic Iron and Steel*? How much does the sector have to compete with *Basic Iron and Steel* for inputs? Are imported inputs an important component of costs?

What is the employment impact? Since the expansion in capacity is small relative to the whole economy, the quantitative impacts are small and dominated by what happens in the *Basic Iron and Steel* sector. However, the qualitative impact is instructive. The change in demand for labour varies across sectors, moving in accordance with the change in output. Demand for each kind of skill changes by the same percentage within each sector, a result of the structure of the model. However, since the skill composition of sectors differs, the aggregate effect on each skill is different. Employment of low-skilled labour does not change, while that of skilled and high-skilled labour increases.

Expanding several sectors simultaneously

ASGISA proposes that there should be expansion in a number of sectors simultaneously. We might ask whether the whole will be equal to the sum of the parts. To examine this, we expand capacity in two sectors simultaneously. It seems likely that the impact will depend on the relationship between the two sectors. If they are closely related – as shown by their linkages – there might be mutually reinforcing effects. We select *Basic Iron and Steel* and *Metal Products* as exemplars of complementary industries, as our model shows the expansion of *Basic Iron and Steel* to have a significant impact on *Metal Products*. The different effects this combined expansion of capacity induces are caused primarily by the nature of the linkages between the two sectors. *Metal Products* has a stronger backward linkage with *Basic Iron and Steel* than vice versa. Purchases from *Basic Iron and Steel* constitute 36% of the costs of production in *Metal Products*, while purchases from *Metal Products* constitute 9% of *Basic Iron and Steel's* costs. This

means that *Metal Products* benefits more from the price-reducing effects of capacity expansion in *Basic Iron and Steel* than vice versa.

The expansion of any one sector has both complementary and competitive effects on other sectors. The complementary effects generally operate through strong backward or forward linkages. However, sectors also compete in the markets for inputs even when they complement each other. Both sectors may buy inputs from a third sector, whose capacity has not expanded. The induced price increase chokes off the expanding sectors, even when their linkages create positive interactions.

The difference in the effects on employment also stands out. The expansion in *Metal Products* on its own leads to a fall in employment in that sector. The additional capital required to meet the export target causes returns to fall. The change in relative factor prices causes substitution effects that outweigh the positive output effects on the demand for labour. In effect, the sector has been induced to become more capital intensive. Clearly this effect depends on the underlying elasticities built into the model. However, even if the accuracy of these measures might be disputed, we should be alert to the *possibility* of such effects. The second striking employment result is that the foregoing negative impact is reversed when the two expansions are undertaken together. The fall in the price of capital is less than before and the output expansion more than offsets the substitution effects.

We can also assume different source of growth than an increase in the capacity of sector, such as productivity growth in the sector concerned; productivity growth in other sectors; improved infrastructure, including transport; higher world prices for the export; and improved access to foreign markets. This note discusses each in turn in.

General lessons emerging from this initial research

- The impact of economy-wide export growth depends crucially on its underlying cause and on how the macroeconomy is managed.
- The impact of growth in one sector sets off forces that can have both positive and negative effects on another sector, depending on the relationship between the two.
- The combined impact of growth in several sectors simultaneously can be greater or smaller than the sum of their individual impacts. This suggests that we need to understand better what kinds of ‘export clusters’ exist, so that policies can address them jointly.

It also raises the question of sequencing of actions. Although this is not directly addressed in our (static simultaneous) model, we did see that easing of a capacity constraint in one sector could reverse the negative impact of expansion in another. This suggests further research should be done on the possible ordering of interventions.

1. Introduction

This paper reports on ongoing research by EGDI on the role of manufacturing in creating employment. The manufacturing sector employs about 15% of South Africa's current workforce and clearly will have an important role to play in future employment growth. EGDI therefore felt it was useful to undertake a study focussing on the sector specifically. This is intended to help us to understand not only the potential and limitations of the sector taken in isolation, but more importantly, the interactions between it and other sectors that might be centres for job creation. This is in keeping with a central aim of EGDI's broader research programme, which is to complement insights from studies of the microeconomics of individual sectors with an economy-wide perspective.

The broad perspective of this project can be explained relatively easily. Creating jobs requires creating demand for those jobs. Therefore, the source of the demand for the output from accelerated growth and employment is central to understanding the feasibility of a particular job creation strategy. This is not simply a question of the level of demand but also its pattern – what products are demanded has an impact on the growth of employment.

At the same time there are macroeconomic and institutional constraints which mean that a purely microeconomic concern with markets and prices will not provide an adequate basis for understanding South Africa's 'unemployment problem'. This motivates our preoccupation with using an economy-wide framework of analysis. It enables us to combine some level of disaggregation – necessary for understanding patterns of employment growth – with the economy-wide consistency necessary for understanding macroeconomic aspects.

There are many potential sources of demand for accelerated manufacturing output. When we implement a particular intervention designed to raise employment, it is useful to ask how much of the required demand for the additional output will be generated by the intervention itself ('endogenous demand') and how much has to come from some independent source ('exogenous demand'). An investment incentive that expands capacity in a domestic-oriented sector may generate some demand for its own output – workers and capitalists in the sector may buy the output – even though some demand will also have to come from elsewhere. We would include multiplier effects as part of endogenous demand generation. In a purely export-oriented project, on the other hand, demand has to come from the world economy entirely.

On the face of it, interventions that generate a higher proportion of their own demand would seem likely to have a greater impact and to be more sustainable than those that generate a lower proportion. This is a concern that economists have reflected upon for centuries. There are early premonitions of it in Adam Smith's maxim that the division of labour is limited by the extent of the market. For some of those on the left, it is one of the concerns raised by Marx when suggesting that capitalism can suffer from crises of disproportionality. It was at the centre of the debate on balanced versus unbalanced growth – one of the earliest debates in development economics. More

than 60 years ago, Paul Rosenstein-Rodan argued that taking 100 previously under-employed workers and putting them in a new shoe factory would not be sustained because the additional income generated would not buy the shoes produced. In contrast, he asked us to consider what would happen if 10,000 workers were employed in “a complementary system of one hundred factories and farms”. Nurkse similarly advocated balanced growth – investment in a wide range of industries simultaneously – as necessary for creating a market of sufficient size to support each other. On the other side, people like Hans Singer and Albert Hirschman made the case for unbalanced growth, which would be sustained by creating bottlenecks that would themselves create incentives for further investments that would expose new bottlenecks.

As with many old debates, this seems rather quaint. What we now understand is that this is not a dichotomous issue, a question of either/or. In Higgins’s words we need to “stop talking about balanced and unbalanced growth altogether and talk instead about functional relationships among the major sectors and regions of an economy”. This is what we are concerned with in this project. Endogenous demand generation is one aspect of the functional relationships we have to assess. Other things equal, higher demand generation is preferable to lower.

However, as Rosenstein-Rodan recognised, it is improbable that expansion of a single sector will generate sufficient demand to absorb its own output, even if we take into account indirect effects operating through inter-industry linkages and multipliers. We therefore have to think about additional sources of demand. Here we can think of domestic sources – injections from government spending and from investment – and foreign – exports and import replacement. We have already reported on initial attempts to explore the issues involved in generating manufacturing employment through import replacement. This note sets out some of the issues involved in exploring the relationship between exports and employment generation in South Africa.

It is clear that export growth will have an important role to play in reducing unemployment and poverty. Export markets can absorb some of the increased output arising from expanded employment. The foreign exchange earned finances imports of complementary inputs in production and capital goods required for investment.

While such benefits are obvious in the aggregate, it is useful to consider where export growth might occur. Because different sectors face different constraints and have different labour-absorbing capacities, their contribution to meeting an overall target will differ. This note lays out some of the considerations we should take into account in assessing these potential relative contributions.

It is useful to distinguish between the short-run or immediate contribution a sector can make and its long-run contribution. Short-run effects will largely depend on characteristics such as the labour intensity of the sector, its backward and forward linkages to other sectors and the ‘export dependence’ of the sector. Long-run consequences will derive from the contribution the sector makes to investment, its dynamic characteristics, externalities, its impact on income distribution and demand and so on.

In this paper, we consider the short-run effects. We begin with a brief look at some characteristics of exports. We then present some analysis informed by an illustrative application of the economy-wide modelling approach. We conclude by summarising some possible lessons and sketching where further research on the project may go.

2. Initial structure of exports

To begin to think about export diversification we need to look at the initial structure of exports. This is shown in Table 3. In aggregate, manufacturing sectors supplied 54% of exports in 2003 and mining 25%. Almost half of manufacturing exports come from four sectors: basic iron and steel (17% of *manufacturing* exports), vehicles (13%), machinery (11%) and chemicals (7%).

How dependent are sectors on export markets? We can measure this simply by the ratio of exports to total output. Mining as a whole exports 57% of its output and manufacturing 21%, compared to the weighted economy-wide average of 13%. There is considerable variation within manufacturing, from as high as 56% for scientific equipment and 55% for machinery, down to less than 5% for leather products and for printing and publishing. These differences mean that the same export growth rate translates into very different output growth rates. For example, a 20% rise in exports of scientific equipment would raise gross output by 11%, while similar growth in exports by the printing and publishing sector would raise its output by only 0.6%.

Since we are concerned with employment generation through export growth, it is instructive to ask how these patterns in exports tie in with employment patterns. Our concern is to investigate how export growth in different sectors can translate into employment growth. For any sector, this will depend (as a first approximation) on how important exports are and on how labour-intensive the sector is (*see Box 1*).

There is not a strong relationship between these two characteristics; if anything, it appears to be negative. This provides one way to characterise the problem South Africa faces trying to use exports as a means for generating employment. The sectors for which exports are a significant part of demand are not high employment generators, while those that are high employment generators are not significant exporters. We would like to shift into more labour-intensive sectors. But these sectors contribute relatively small shares of South Africa's exports and, more importantly, export markets are relatively insignificant in their overall demand. This means that there has to be enormous growth in exports for there to be any impact on these sectors.

BOX 1: Export shares, labour intensity and employment generation

Let the gross output for a sector, X , be sold domestically, D , or exported, E :

$$0.1 \quad X = D + E$$

Then the growth rate for the sector's gross output, g , is a weighted average of the rates of growth in the two markets, where the weight is the share of each in total sales:

$$0.2 \quad g = s_d g_d + s_e g_e, \quad s_d + s_e = 1$$

If employment in the sector is fixed in relation to gross output

$$0.3 \quad l = L/X$$

we can write the rate of employment growth in the sector as

$$0.4 \quad g_l = lg = ls_d g_d + ls_e g_e$$

Assuming that domestic sales do not respond to higher export growth, the rate of growth of exports required to meet some employment growth target, g_l^* , is

$$0.5 \quad g_e = \frac{1}{l.s_e} g_l^*$$

Thus, the higher the export share or the more labour-intensive a sector is, the slower will be the export growth rate required to meet any given target.

Stating the problem in this way is perhaps too strong. However, it provides us with a convenient starting point for thinking about how export growth might be translated into employment growth. Rather than focussing on how export growth in a particular sector generates employment directly in that sector, we need to think of how the growth is spread through the economy through linkages to other sectors. Tregenna has already estimated supply-use and social accounting multipliers (Tregenna, 2006). We now make use of an economy-wide model to explore the employment consequences of various changes to exports.

3. The impact of expanding exports in some sectors on employment & growth

We use the standard IFPRI model, applied to South Africa by Thurlow and Van Seventer. We have used this before in our work and will not describe it in detail again.

We apply the model to 2003 as a base year. In the current application we will be imposing certain changes that are designed to stimulate exports in specific sectors to grow to a target level. For the targets we have adopted the projected annual growth rates in sectoral exports by the IDC for the period 2006-2010. These are benchmark rates that might plausibly be expected, based on expectations about the domestic macroeconomy and world environment. They are **not** rates designed to meet the unemployment and poverty targets.

At this stage we are more interested in understanding the various processes involved in employment responses to different export growth patterns. We use a numerical model to assist us in this. The numbers that we derive should not be regarded as forecasts.

One of the main lessons that comes out of our initial work is that the employment consequences of export growth depend not only on where the growth takes place, but crucially on the reasons behind the growth and on the macroeconomic environment in which it takes place.

We can classify any stimulus to exports according to whether it arises from outside or inside the domestic economy. Thus exports of a specific commodity might occur because its world price has risen or because of improved efficiency in domestic production of the good. The consequences of these can be very different. Local firms will find it attractive to switch sales towards the world market when the world price of a good rises, so that the domestic price may rise. However, export growth because of productivity improvements might bring the domestic price down. There will thus be very different consequences for other domestic users of the product.

Differentiating the sources of export growth in this way may also be useful because most policy levers will operate on domestic causes. There is not a lot South Africa can do to raise world prices, but it may be possible to stimulate productivity and capacity growth.

Since we are looking at export growth, we might expect there to be some repercussions on the current account balance and/or the exchange rate. How this is managed will affect the impact of the growth. Similarly, how the government tax/expenditure/budget balance is managed will matter. It will matter whether the positive impact of higher exports results in lower taxes, higher expenditure or a lower budget deficit. Normally we can ignore such repercussions, since the changes we consider are too small to have macroeconomic consequences. However, if we

consider export growth on many fronts, coupled with other ASGISA changes, this may no longer be true.

We proceed by examining at some length the effects of increasing exports of only one sector. We then look at the interaction between export growth in two or more sectors.

3.1 Increasing exports in one sector only

Our initial experiment is to increase exports of only *Basic Iron and Steel*. The IDC suggests that initially exports of *Basic Iron and Steel* will grow by 7.9% per year. We simulate the increase by raising capital stock in the *Basic Iron and Steel* sector sufficiently to meet this export growth rate. We thus simulate only the first year of the process. This is to try to get a handle on the impact effects.

We find that a capital stock increase of 5% is sufficient to generate the export growth. This amounts to real growth in investment in that sector of 82% (it would actually require much higher gross investment if we allow for depreciation). The IDC projects investment growth rate for this sector of about 23.5% p.a. over the period 2006-2010, considerably lower than our estimate. Their projection is in the context of many other things happening concurrently, so we would not expect the two to be the same. However, the differences are something that we intend exploring later.

Employment in this sector rises by 4%. Output expands by 4.6%. Domestic sales rise by 1.3%.

The expansion of capital stock in this one sector has repercussions for other sectors. There are various channels through which this works, not all captured in the modelling process. We outline these different channels below, before looking at the net impacts of all combined.

3.1.1 Demand for inputs

Expanded output in *Basic Iron and Steel* requires additional inputs, not simply of labour but also of intermediate goods. Some sectors are therefore stimulated as demand rises. This additional demand for intermediates by *Basic Iron and Steel* can be met by:

- Producing more;
- Switching from other uses;
- Imports; and
- In the final analysis by raising prices.

There are constraints on increasing production in other sectors in the short run. In the longer run, investment may be stimulated in these supplying sectors, but we do not capture this. Therefore, additional output can only be achieved by increasing employment.

This channel thus has both positive and negative effects on other sectors. The net outcome will depend on how these effects balance up. Sectors that supply a large proportion of their output to *Basic Iron and Steel* will be stimulated, probably by more than they are harmed by having to pay higher prices for their own inputs. However, sectors that are not major suppliers will find that the negative consequences outweigh the positive.

3.1.2 *Reduced price of output*

The expanded supply capacity of *Basic Iron and Steel* brings down its price. The price does not fall by as much as it would in the absence of the export market, when producers would have to cut prices much more to try to sell the additional output domestically. Nonetheless the price of domestic supplies falls by a little more than 2%. The price received by producers only falls by 1% because the world price does not come down.

3.1.3 *Impact on current account and exchange rate*

Boosting exports in this way improves the current account and puts pressure on the rand to strengthen. How this is managed affects the outcome. If the rate is kept constant, the current account deficit is reduced. This affects the national savings-investment balance: foreign savings are reduced so that there has to be higher domestic savings to maintain investment levels. This will require either a reduction in the budget deficit or increased private savings. In both cases, domestic absorption is reduced below what it would otherwise have been, and the expansionary effects of the increased capacity is somewhat offset.

If, however, the exchange rate is allowed to adjust, it will appreciate at least in nominal terms. This will stimulate imports (possibly encouraged by the effects of expanded demand referred to above). This has a contractionary effect on production – and employment – in import-competing industries.

3.1.4 *Other channels*

We do not investigate here the possibility of crowding-out effects as the capacity of *Basic Iron and Steel* is expanded. In essence we look at the consequences of the expanded capacity, not of the process by which it is expanded.

In principle there should be a boost to GDP, which would stimulate demand. However, these effects are limited because the capacity expansion is relatively small.

Similarly, there are demand effects operating through differential impacts on income distribution.

3.1.5 *Net effects*

We have seen that these various channels mean that the capacity growth in *Basic Iron and Steel* acts in both positive and negative ways on other sectors. The net effects on a

particular sector will depend on its specific characteristics: how important are sales to, or purchases from, *Basic Iron and Steel*? How much does the sector have to compete with *Basic Iron and Steel* for inputs? Are imported inputs an important component of costs?

Table 1 – Changes in production for top and bottom 5 sectors

	Change in Production			
	Fixed ER		Flexible ER	
	%	Rank	%	Rank
<i>Basic Iron and Steel</i>	4.6		4.5	
Metal Products	1.1	1	1.0	1
Machinery	0.2	2	0.1	4
Transport Equipment	0.2	3	-0.2	38
Coal	0.1	4	0.1	7
Trade Services	0.1	5	0.1	3
-	-	-	-	-
Other Chemical Products	-0.1	38	-0.1	28
Scientific Equipment	-0.1	39	-0.2	41
Footwear	-0.1	40	-0.1	37
Medical and Other Services	-0.1	41	0.1	5
Wearing apparel	-0.1	42	-0.2	39

It is rather confusing to go through all the results sector by sector. More important are the patterns we can discern. Table 1 shows the changes in production for the top five sectors and the bottom five, ranked when the exchange rate is fixed. We include the impact on *Basic Iron and Steel* for comparison. There are a number of observations we can make:

1. Not unexpectedly, the products most positively affected appear to be similar in some broad respect – they belong to the same ‘cluster’.
2. *Metal products* benefits not only because it supplies the *Basic Iron and Steel* industry (9% of its sales) but also purchases a large proportion (36%) of its inputs from it. So it is boosted by both the additional demand and the cost-cutting effects of cheaper *Basic Iron and Steel* supplies.
3. The effects on other sectors are affected by the way the exchange rate is managed. To take one of the most striking examples, the positive effect on *Transport Equipment* when the exchange rate is fixed is completely reversed when it is flexible. As for all sectors, the appreciation of the rand makes its exports less competitive and encourages competition from imports. However, *Transport Equipment* has one of the highest ‘openness’ ratios. Its exports plus competing

imports are 245% of its domestic sales. This is third only to *Gold and Communication Equipment*. This means that exchange rate movements (other things being equal) have a more significant impact on it than on other sectors (the average for the economy is 26%, the median 37%). This combines with its strong linkages to *Basic Iron and Steel* to cause the dramatic change in its fortunes. When the rand is allowed to appreciate, the forces of external competition completely offset the positive forces coming from *Basic Iron and Steel* expansion. The changes to *Communication Equipment* are not as dramatic because it is not strongly linked to *Basic Iron and Steel* and therefore it does not have the initial positive impact.

What is the employment impact? Since the expansion in capacity is small relative to the whole economy, the quantitative impacts are small and are dominated by what happens in the *Basic Iron and Steel* sector. However, the qualitative impact is instructive. As we might expect, the change in demand for labour varies across sectors, moving in accordance with the change in output. Demand for each kind of skill changes by the same percentage within each sector, a result of the structure of the model. However, since the skill composition of sectors differs, the aggregate effect on each skill is different. Employment of low-skilled labour does not change, while that of skilled and high-skilled labour increases.

3.2 Expanding several sectors simultaneously

ASGISA proposes that there should be expansion in a number of sectors simultaneously. We might ask whether the whole will be equal to the sum of the parts.

To examine this, we expand capacity in two sectors simultaneously. Intuitively it seems likely that the impact will depend on the relationship between the two sectors. If they are closely related – as shown by their linkages – there might be mutually reinforcing effects. Improved capacity in one sector might remove a bottleneck that had previously constrained the growth of the related sector. If, however, the two sectors are relatively disconnected, the effects might be less, as the competition for scarce resources dominates.

We have already seen that the expansion of *Basic Iron and Steel* had a significant impact on *Metal Products*, so it makes sense to select these as exemplars of complementary industries. Selected results are given in Table 2. The IDC projects exports of *Metal Products* to grow at 7.6% p.a. We assume that this arises from increased capacity in that sector. If *Metal Products* was the only sector experiencing export growth, its capital stock would have to rise by 8.4% to meet this target (Table 2, column [4]). However, when capital stock in both sectors rise by these amounts, exports of *Metal Products* rise by 9.9%. We would expect the combined effect to be higher than when only *Metal Products* is targeted, since the rise in capacity in *Basic Iron and Steel* had a positive effect on *Metal Products*. However, the combined effect is greater than the sum of the two individual effects: the interaction is positive. This is not the case for *Basic Iron and Steel*,

where the combined effect is significantly lower than the sum of the two individual effects.¹

The difference is caused primarily by the nature of the linkages between the two sectors. *Metal Products* has a stronger backward linkage with *Basic Iron and Steel* than vice versa. Purchases from *Basic Iron and Steel* constitute 36% of the costs of production in *Metal Products*, while purchases from *Metal Products* constitute 9% of *Basic Iron and Steel's* costs. This means that *Metal Products* benefits more from the price-reducing effects of capacity expansion in *Basic Iron and Steel* than vice versa.

Table 2 – Selected results of combined capacity growth

	Only Iron		Only Metal Products		Both	
	Iron	Metal	Iron	Metal	Iron	Metal
	[1]	[2]	[3]	[4]	[5]	[6]
Change in capital stock	5.0	n.a.	n.a.	8.4	5.0	8.4
Change in exports	7.9	1.9	-0.5	7.6	7.4	9.9
Change in domestic sales	1.3	1.0	0.7	0.8	2.0	1.8
Change in production	4.6	1.1	0.1	1.9	4.7	3.1
Change in employment	4.2	1.7	0.2	-0.8	4.4	0.9
Change in returns to capital	-8.9	3.4	2.4	-16.3	-6.2	-13.3

There is an important lesson in this. We have seen earlier that the expansion of any one sector has both complementary and competitive effects on other sectors. The complementary effects generally operate through strong backward or forward linkages. However, sectors also compete in the markets for inputs even when they complement each other.² Both sectors may buy inputs from a third sector, whose capacity has not expanded. The induced price increase chokes off the expanding sectors, even when their linkages create positive interactions.

The difference in the effects on employment also stands out from Table 2. First, it is striking that the expansion in *Metal Products* on its own leads to a fall in employment in

¹ This does not show in the table because of rounding.

² We have removed another possible area of competition – the labour market – by assuming no constraints on all skill types.

that sector³. The additional capital required to meet the export target causes returns to fall. The change in relative factor prices – capital becoming cheaper relative to labour – causes substitution effects that outweigh the positive output effects on the demand for labour. In effect, the sector has been induced to become more capital intensive. Clearly this effect depends on the underlying elasticities built into the model. However, even if the accuracy of these measures might be disputed, we should be alert to the *possibility* of such effects.

The second striking employment result in Table 2 is that the foregoing negative impact is reversed when the two expansions are undertaken together. The fall in the price of capital is less than before and the output expansion more than offsets the substitution effects.

3.3 Other methods of expanding exports

In the above story we have induced export growth by increasing the capacity of the sectors. We could have assumed a different source of growth, which could include:

- Productivity growth in the sector concerned;
- Productivity growth in other sectors;
- Improved infrastructure, including transport;
- Higher world prices for the export; and
- Improved access to foreign markets.

We run through each of these in turn.

3.3.1 *Productivity growth in the sector concerned*

In principle this acts on exports in the same way as capacity growth. Producers turn to export markets to dispose of some of the additional output produced. Remaining with *Basic Iron and Steel* as our illustrative sector, we estimate that total factor productivity growth of 4.8% would allow the projected IDC export growth (7.9%). This has a similar effect on output, sales, GDP and most other real variables.

The difference is in the impact on employment and income distribution. When the export growth in *Basic Iron and Steel* is driven by increased capital stock, employment in that sector rises as well. When it is driven by productivity growth, employment falls. Similarly, although the return to capital in the sector falls, it does not do so by as much.

³ Although the effect on the sector is negative, the effect on total employment is positive.

Despite this difference within the sector, the impact on other sectors is much the same. Although productivity improvements reduce the demand for capital and labour, intermediate inputs tend to be needed in fixed proportion to output, which has risen by the same amount as previously. This has similar effects on other sectors as before: supplying sectors benefit while competing users suffer. At the same time, productivity growth reduces the price of *Basic Iron and Steel* by the same percentage that capacity growth did. Downstream sectors such as *Metal Products* derive much the same benefit.

This means that the fall in employment within *Basic Iron and Steel* is counter-balanced by rising employment elsewhere, and the net economy-wide effect is zero.

3.3.2 *Productivity growth in other sectors*

We have already seen how improved productivity in one sector can promote exports in another: the 4.8% total factor productivity growth in *Basic Iron and Steel* induced a 1.9% rise in exports of *Metal Products*. However, this is not a universal result: exports of *Nonferrous Metal Products* fell by 1.2%. As we have already seen this depends on the relationships between sectors. Where a sector is a major supplier of inputs into the expanding sector, its price may well be pushed up and exports might fall. This appears to be the case with *Coal Mining*, where the productivity growth in *Basic Iron and Steel* induces a 1.6% decline in exports (as indeed does the capacity growth).

In any event, trying to influence one sector by targeting another is, by and large, a roundabout way of doing things. It is probably better to regard these effects as by-products of targeted interventions rather than as instruments for intervention.

3.3.3 *Improved infrastructure, including transport*

One possible exception to the above rule may well be in infrastructure, as recognised by the framers of ASGISA. The costs of transport affect all exports (albeit in differing degrees), so that attempting to improve efficiency in transport can be regarded as a general export promotion strategy.

The effects of any given reduction in the costs of transport on the exports of any particular sector depend on the share of those costs in the export price. This sets a limit to the maximum size of the impact. Furthermore, it is mainly the domestic components of transport costs, as opposed to international costs, that can be reduced by South African policies. This reduces the room for gains even further. The data in the model suggest that these costs average 1% of the price of exports.

The impact of improvements in local transport efficiency on variables such as delivery times, wastage and reliability of service are thus likely to be more significant than their impact on price. These issues are better examined using sector-focussed studies than economy-wide modelling.⁴

⁴ EGD I has undertaken some work on this. See Botes (2005).

3.3.4 Higher world prices for the export

While this stimulates the sector concerned, it has positive terms-of-trade effects on the whole economy. This puts pressure on the current account and the exchange rate. If the current account balance is maintained, the rand will appreciate. This has negative effects on other exporting sectors. Sectors that use the benefiting sector's output as inputs are doubly hit. Thus a 25% rise in the world price of *Basic Iron and Steel*, which is sufficient to induce a 7.9% growth in that sector's exports, now causes exports of *Metal Products* to decline by 21%. These effects have been more fully explored within EGDI by Ngandu (Ngandu, 2006).

3.3.5 Improved access to foreign markets

It may seem that improved market access is a 'free' benefit to the economy in that it entails no off-setting negative consequences. However, it is likely that some of the effects would be similar to those of a higher world export price. In so far as it stimulates production in specific sectors, it will set up both the complementary and the competitive forces that will stimulate and inhibit other sectors. Normally the increase in exports stimulated by market access is too small to warrant worrying about these secondary feedback effects. However, this would not be the case if such deals were to stimulate exports sufficiently, and across a wide enough range of goods, to have the kind of impact needed for them to drive employment-enhancing growth.

4 Conclusions

The foregoing analysis was largely intended to illustrate what kinds of insights might be gained from using an economy-wide approach to analysing the impact of export growth on employment. We did not choose to simulate export growth rates that would be sufficient to 'solve' the unemployment problem, but were aligned to growth rates projected by the IDC. This was deliberate, since we want to focus on the processes behind the changes we observe. A wide range of combinations of sector growth rates and macroeconomic environments is possible. We need to explore further which combinations are most probable, before we can present empirical results that might be useful in the ASGISA debate.

Despite the preliminary and somewhat hypothetical nature of the research reported in this note, we believe that there are some general lessons that begin to emerge. These provide some guidance for the next stage of the research we need to undertake and include the following:

- The impact of economy-wide export growth depends crucially on its underlying cause and on how the macroeconomy is managed.

- The impact of growth in one sector sets off forces that can have both positive and negative effects on another sector, depending on the relationship between the two.
- The combined impact of growth in several sectors simultaneously can be greater or smaller than the sum of their individual impacts.

The last of these suggests that we need to understand better what kinds of ‘export clusters’ exist, so that policies can address them jointly. It also raises the question of sequencing of actions. Although this was not directly addressed in our model, which is a static simultaneous model, we did see that easing of a capacity constraint in one sector could reverse the negative impact of expansion in another. This suggests that we need further research on the possible ordering of interventions.

We propose to examine these questions in our future research. In addition, we intend to broaden our analysis away from the one illustrative case we have presented above. We need to undertake a more thorough and comprehensive analysis of the relationship between different sectors.

This should probably be complemented by more disaggregated sectoral research. The categories we deal with are themselves aggregates, and it is likely that similar positive and negative interactions operate at the intra-sectoral level.

References

- Botes, F (2005) *Quantifying the 'price wedge' in commercial transport*, unpublished working paper, Employment, Growth & Development Initiative, Human Sciences Research Council, February.
- Davies, R. (2006) Manufacturing employment and import dependence. Paper prepared for the Employment Scenarios Working Group, Employment, Growth & Development Initiative, Human Sciences Research Council, Pretoria, November.
- Higgins, B (1968) *Economic Development: Principles, Problems and Policies*, revised edition, (Constable: London)
- Hirschman, A (1958) *The Strategy of Economic Development* (New Haven)
- Ngandu, S (2006) The Sectoral Impact of the Exchange Rate in SA, unpublished working paper, Employment, Growth & Development Initiative, Human Sciences Research Council.
- Nurkse, R (1953) *Problems of Capital Formation in Underdeveloped Countries* (Oxford)
- Rosenstein-Rodan, P N (1943) "Industrialization of Eastern and South-Eastern Europe" *Economic Journal*, 53, 202-211.
- Singer, H (1958) "The concept of balanced growth and economic development: theory and facts" *Malayan Economic Review*. October.
- Tregenna, F (2006) *The contribution of manufacturing and services sectors to growth and employment in South Africa*. Paper prepared for the Employment Scenarios Working Group, Employment, Growth & Development Initiative, Human Sciences Research Council, Pretoria, October. Revised for ES Reference Group, November.

Table 3 – Sectoral characteristics, 2003, current prices

	Gross output				Value added						Employment						Exports			
	Total				Total	Share	Rank	Wage bill			Total	Share	Rank	Gross output per worker	VA per worker	Wage per worker	Total	Share	Rank	Share in gross output
	Rm				Rm	%		Rm			'000	%		R p.a.	R p.a.	R p.a.	Rm	%		%
	[1]				[2]	[3]	[4]	[5]			[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]
Agriculture	84 661	42 126	3.8	7	11 218	842	9.6	4	100 509	50 012	13 318	13 468	3.9	10	15.9					
Coal	32 380	15 446	1.4	17	6 479	47	0.5	21	685 451	326 976	137 153	13 491	3.9	9	41.7					
Gold	32 912	22 112	2.0	12	14 372	198	2.3	9	165 832	111 415	72 416	32 267	9.3	2	98.0					
Other mining	85 774	45 282	4.1	5	13 538	190	2.2	10	451 623	238 422	71 281	40 999	11.8	1	47.8					
Food processing	112 539	21 844	2.0	13	10 988	145	1.7	11	775 863	150 596	75 753	10 188	2.9	11	9.1					
Beverages and tobacco	29 271	12 959	1.2	20	3 842	31	0.4	31	951 286	421 157	124 862	6 138	1.8	19	21.0					
Textiles	19 222	3 979	0.4	34	2 495	60	0.7	18	318 947	66 023	41 399	3 103	0.9	26	16.1					
Wearing apparel	16 179	4 711	0.4	33	3 614	103	1.2	14	157 457	45 848	35 172	2 808	0.8	27	17.4					
Leather	4 534	687	0.1	42	296	8	0.1	40	556 456	84 315	36 328	1 784	0.5	32	39.3					
Footwear	3 606	884	0.1	41	437	13	0.1	37	283 379	69 470	34 342	180	0.1	40	5.0					
Wood	18 461	5 430	0.5	31	3 879	52	0.6	20	353 212	103 892	74 216	2 694	0.8	28	14.6					
Paper	39 958	9 382	0.8	25	4 289	37	0.4	29	1 072 094	251 724	115 076	7 175	2.1	15	18.0					
Printing and publishing	17 971	6 329	0.6	29	5 612	45	0.5	23	400 584	141 077	125 094	540	0.2	38	3.0					
Petroleum	64 769	15 597	1.4	16	1 537	13	0.2	36	4 897 837	1 179 448	116 228	9 662	2.8	12	14.9					
Chemical	54 415	12 132	1.1	21	4 561	16	0.2	33	3 490 826	778 291	292 596	13 809	4.0	8	25.4					

Manufacturing exports and employment growth

	Gross output				Value added				Employment						Exports			
	Total	Total	Share	Rank	Wage bill	Total	Share	Rank	Gross output per worker	VA per worker	Wage per worker	Total	Share	Rank	Share in gross output			
	Rm	Rm	%		Rm	'000	%		R p.a.	R p.a.	R p.a.	Rm	%		%			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]			
Other chemical	68 139	14 527	1.3	18	8 255	42	0.5	24	1 618 465	345 051	196 076	7 109	2.0	16	10.4			
Rubber	8 903	2 315	0.2	37	1 648	15	0.2	34	575 538	149 654	106 535	2 184	0.6	30	24.5			
Plastic	23 476	7 777	0.7	27	5 764	41	0.5	27	575 491	190 645	141 298	1 432	0.4	34	6.1			
Glass	4 864	1 639	0.1	39	818	6	0.1	42	819 960	276 298	137 896	678	0.2	37	13.9			
Non-metallic metal	19 093	6 252	0.6	30	1 958	46	0.5	22	415 119	135 931	42 571	1 552	0.4	33	8.1			
Basic iron and steel	68 232	13 554	1.2	19	4 783	32	0.4	30	2 100 222	417 200	147 223	31 967	9.2	3	46.9			
Non-ferrous metals	25 831	8 616	0.8	26	1 660	21	0.2	32	1 257 779	419 536	80 830	8 882	2.6	13	34.4			
Metal	40 895	11 755	1.1	22	7 873	96	1.1	15	426 630	122 632	82 133	6 324	1.8	18	15.5			
Machinery	38 525	9 757	0.9	24	6 731	95	1.1	16	405 603	102 725	70 866	21 339	6.1	5	55.4			
Electrical machinery	26 569	6 374	0.6	28	4 331	39	0.4	28	689 459	165 404	112 388	3 301	1.0	25	12.4			
Communication equipment	6 780	2 037	0.2	38	1 195	7	0.1	41	959 660	288 323	169 143	3 547	1.0	24	52.3			
Scientific equipment	3 927	1 090	0.1	40	505	8	0.1	39	463 910	128 766	59 657	2 185	0.6	29	55.6			
Vehicles	116 604	17 892	1.6	14	9 853	107	1.2	13	1 084 920	166 473	91 675	24 596	7.1	4	21.1			
Transport equipment	10 268	2 832	0.3	35	2 249	14	0.2	35	714 345	197 022	156 463	2 172	0.6	31	21.2			
Furniture	10 884	2 594	0.2	36	1 994	41	0.5	26	265 950	63 384	48 723	4 695	1.4	23	43.1			
Other industries	38 618	16 670	1.5	15	3 515	60	0.7	19	642 915	277 524	58 518	7 023	2.0	17	18.2			
Electricity and gas	43 325	23 263	2.1	11	9 287	41	0.5	25	1 053 060	565 432	225 730	464	0.1	39	1.1			

	Gross output				Value added				Employment						Exports			
	Total	Total	Share	Rank	Wage bill	Total	Share	Rank	Gross output per worker	VA per worker	Wage per worker	Total	Share	Rank	Share in gross output			
	Rm	Rm	%		Rm	'000	%		R p.a.	R p.a.	R p.a.	Rm	%		%			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]			
Water	15 324	4 918	0.4	32	1 599	12	0.1	38	1 332 174	427 541	139 007		0.0	42	0.0			
Construction	116 096	26 432	2.4	10	15 427	382	4.3	5	303 941	69 199	40 388	66	0.0	41	0.1			
Trade services	274 688	142 871	12.8	1	68 516	1 067	12.1	3	257 475	133 918	64 222	14 515	4.2	7	5.3			
Hotels and catering	29 236	11 280	1.0	23	4 600	207	2.4	8	141 435	54 569	22 253	5 574	1.6	21	19.1			
Transport services	157 252	64 912	5.8	4	29 193	235	2.7	6	667 995	275 741	124 009	18 737	5.4	6	11.9			
Communication services	106 244	43 946	3.9	6	14 629	66	0.7	17	1 620 858	670 440	223 179	5 250	1.5	22	4.9			
Financial and real estate services	159 623	93 426	8.4	3	42 273	219	2.5	7	729 789	427 139	193 270	7 774	2.2	14	4.9			
Business services	254 462	124 906	11.2	2	37 266	1 379	15.7	1	184 542	90 585	27 026	5 906	1.7	20	2.3			
Medical and other services	98 946	37 184	3.3	8	18 538	126	1.4	12	784 112	294 670	146 912	857	0.2	35	0.9			
Other producers	38 951	30 818	2.8	9	30 310	1 143	13.0	2	34 066	26 953	26 510	744	0.2	36	1.9			
Government services	266 999	169 362	15.2		148 770	1 436	16.3			117 955	103 613		0.0		0.0			
	2 689 405	1 117 898	100.0		570 697	8 784	100.0			127 264	64 970	347 181	100.0		12.9			