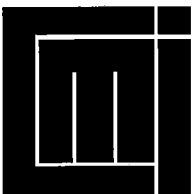


South African Manufacturing Industries – Catching up or Falling Behind?

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Summary:

This paper argues that intraindustry trade with developed countries is an important source of technology transfer, and creates incentives to climb up the learning curve. South Africa has an industrial structure that could be suited to such trade, but high costs and weak social capacity to assimilate technology are an impediment to productivity growth. Therefore, reintegration into the world economy is likely to reinforce dependence on resource-intensive industries. In the short run this need not adversely affect economic growth, but unless the quality and quantity of education are improved, the prospects for rebuilding the technological capacity and catch up with OECD countries are bleak.

Sammendrag:

Handel med industrivarer innenfor en bransje er en viktig kilde til teknologioverføringer. I tillegg skaper slik handel konkurranse og incentiver til produktivitetesvekst. Sør-Afrika har en industristruktur som er egnet til såkalt intraindustriell handel med industrilandene, men høye kostnader og lav kapasitet til å assimilere ny teknologi hindrer produktivitetesveksten som er nødvendig for å hevde seg i slik konkurranse. Derfor er det sannsynlig at Sør-Afrika vil bli mer avhengig av sin ressursbaserte industri når landet igjen deltar i verdenshandelen på like vilkår med andre land. På kort sikt trenger ikke dette være en bremse på den økonomiske veksten. På lengre sikt er det imidlertid helt nødvendig å øke kapasiteten til å assimilere teknologi, først og fremst gjennom et bedre utdanningssystem, for å kunne generere inntekst- og produktivitetesvekst.

Indexing terms:

Economic growth
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1. Introduction¹

The economy remains dependent on mineral exports, and the manufacturing sector cannot create jobs, meet the basic needs of the majority or compete on world markets (ANC 1994: 76).

With sanctions lifted, as a signatory to the new GATT agreement and a member of SADC, South Africa is about to be reintegrated into the regional as well as the world economy. After decades of protectionist trade policy, initially conceived of as a strategy for industrialisation and later to some extent designed to counteract international sanctions, reintegration poses a challenge to South Africa to massively restructure the economy. Reintegration means lower trade barriers and therefore increased competition from low-wage neighbouring countries as well as Asian emerging economies at the labour-intensive, low-technology end of the product range. At the medium- to high-technology end, competition from the fast-growing Asian "tigers" and the OECD countries will increase both on domestic and regional markets. Finally, the entry of the former Soviet Union onto the world market has had an immense impact on commodity markets.

Trade and industrial policy are closely linked. Industrial policy measures often have a distortive effect on trade, and are therefore increasingly regulated by international agreements. In South Africa there is an ongoing debate on how to adapt to such regulations. A majority of those taking part in the debate is cautious about further liberalising trade (Bell 1993; Hirsch 1993), but realises that implementation of the GATT agreement inevitably means scaling down protection of domestic industries. To avoid a shakeout in key industries, it is suggested that South Africa should seek to be classified as a developing country by the World Trade Organisation (WTO), and request a longer transitional period due to South Africa's special position. A broad consensus on the importance of the Southern African region as a market for the South African manufacturing sector has emerged (Tjønneland 1992; African Development Bank 1993), but South African scholars as well as the business community are cautious about what can be expected from regional integration (Leistner 1992; Maasdorp and Whiteside 1993; Davies 1993 and 1994). Institutional weaknesses, similar output structures and shortage of foreign exchange on the part of non-SACU countries in the region are pointed out as constraints on increasing intra-regional trade.² In addition, restructuring of national economies is thought to be a prerequisite for successful

¹ This research was conducted during my stay as a visiting fellow at the Institute for Social and Economic Research (ISER) at University of Durban-Westville, South Africa. I would like to thank the staff at ISER for their hospitality and support. Special thanks to Dr. Vishnu Padayachee for helpful comments and to the Norwegian Research Council for financial support.

² The members of SACU (Southern African Customs Union) are Botswana, Lesotho, Namibia, South Africa and Swaziland.

regional cooperation (Nomvete 1993). In this paper the implicit notion in much of the debate that imports are bad but exports are good for development is opposed. Instead the importance of trade as such as a source of technology, incentives and as a vehicle for development is emphasised. Further, I take a somewhat different approach to the issue at stake. Insights from the new trade and growth theories are combined, and trade and industrial policy are seen in the light of these theories.³ To do so, South African data are organised according to the OECD classification adopted in the OECD industrial policy reviews. This facilitates a richer analysis of competitiveness, comparative advantage and the gains from trade than what is possible within the framework of traditional analysis of relative abundance of capital and labour, which in turn gives the somewhat confusing result that South Africa's competitive advantage lies in relatively capital-intensive industries, and the least capital-intensive industries (Levy 1992). My approach and results are briefly summarised as follows:

The manufacturing sector is analysed along three dimensions, wage costs, technology and orientation. The focus is particularly on productivity performance and competitiveness in order to assess the manufacturing sector's ability to generate income and accumulate technological capacity in a more liberal trade regime. It goes without saying that competitive, high-technology industries generate the highest income, while they are a drain on resources if not competitive. It is found that South Africa's competitiveness lies mainly in resource-intensive and low-technology industries. Trade liberalisation will therefore initiate a reallocation of resources towards these industries. South Africa also has a potential for competitive labour-intensive industries if the rise in unit labour costs could be arrested or reversed. However, South Africa does not possess a sufficient stock of human capital to take advantage of better market access in high-technology industries. Even medium-technology industries may be in danger. A decline in such industries will undoubtedly lower the technological capacity of the economy, but South Africa is likely to benefit from other, more temporary sources of productivity growth like unexploited economies of scale and resource rent. Should South Africa seek trade concessions in order to maintain its technological capacity? I argue that beyond seeking recognition as a developing country by the WTO, it should not. The reason is that the cheapest and most important source of technology is the OECD area, and an important channel of technology transfer is trade as such, not only exports. However, a significant stock of human capital is required even for adopting foreign technology. Therefore, it is argued that scarce resources are better spent on education and training than subsidising or protecting high-technology industries.

³ Holden (1993) briefly discusses the relevance of this approach to South Africa. Otherwise we have not found studies within this framework in South Africa.

The paper is organised as follows: Section 2 sets out the analytical framework which is based on elements from the product cycle theory of trade as developed by Vernon (1966) and Krugman (1979), a model of intraindustry trade (Krugman 1981) and a model of technological diffusion developed by Grossman and Helpman (1991). Such an approach misses some important institutional and social factors that determine competitiveness and trade, but here I refer to a large body of previous research. In section 3, the South African manufacturing sector is classified along three dimensions: wage costs, technology and orientation. Section 4 continues with a brief description of the present structure of trade and specialisation within the OECD, the Southern African region and between the two areas. The description is followed by speculations about likely future development in this structure depending on the trade regime adopted, and implications for economic growth. Finally, conclusions are drawn in section 5.

2. Analytical framework

2.1 Comparative advantage and trade patterns

The marvel of comparative advantage is that everybody possesses it. According to neoclassical trade theory, free trade and specialisation in line with comparative advantage improve efficiency in worldwide resource allocation and makes everybody better off. This is, however, a static gain which raises the overall level of production. Taking dynamic aspects into account, some countries may gain substantially more than others. It has been suggested that if some industries have lower potential for growth through technological progress than others, countries having comparative advantage for such low-technology, mature industries at one point in time will be locked into a lower growth path than countries having comparative advantages for high-technology industries at the same point in time if both countries specialise according to comparative advantage (Lucas 1988).

A somewhat different trade pattern found mainly among developed countries is intra-industry trade. Such trade takes place between countries with similar factor or resource endowments, and depends on the existence of unexhausted economies of scale. By producing only a subset of the range of goods produced by the industry in question, and trading these varieties with other countries producing a different subset, all trading countries gain by exploiting scale economies. Moreover, consumers are offered a broader variety of products at lesser cost than what would have been the case with only interindustry trade (see Krugman 1981).

Product differentiation may occur along the horizontal or the vertical dimension, the latter often referred to as a quality ladder. The former tends to be found in trade among developed countries in medium- and high-technology industries and facilitates economic growth through a larger variety of intermediate products, as shown by Grossman and Helpman (1990), and through incentives provided by

competition. The product cycle theory is concerned with differentiation along the vertical dimension, and is mainly found in North-South trade. Product cycle models usually assume that innovation of new products takes place in developed countries and that the technology eventually becomes known to developing countries who imitate and produce them at lower cost. In some cases several qualities of a product may coexist in the market. In other cases a new quality renders all previous versions obsolete. After a product has been imitated and produced at lower costs in the South, the North can recapture the entire market or parts of it by new innovations moving further up the quality ladder. Such a product cycle facilitates economic growth in the South through technology transfer represented by the opportunity to imitate at a lower cost than the cost of innovation, and in the North through the incentive to innovate represented by temporary monopoly rent and the danger of losing the market to potential low-cost imitators (see Krugman (1979) and Grossman and Helpman (1991)).

In this paper both aspects of intraindustry trade are discussed, but let us first elaborate on Lucas' point on comparative advantage and growth in the South African context:

For mineral or oil-exporting countries, Lucas' point is of particular relevance, as extracting minerals or oil is not only of relatively low technology, but also subject to diminishing returns to scale in the long run as resources are depleted. Moreover, high, but volatile export earnings from minerals tend to create an uncompetitive environment for tradeables in other sectors of the economy, a phenomenon often referred to as the "Dutch disease". A characteristic symptom is the reallocation of resources towards non-traded goods and service sectors, and of course to the natural resource exploiting sector, including downstream activities, usually in vertically integrated mining companies.

The African National Congress description of South Africa's competitive position quoted above looks like a diagnosis of this disease. The illness' initial stage includes a real appreciation of the exchange rate due to persistent surpluses on the current account of the balance of payment. As long as the real price of the commodity in question and the level of output in the natural resource extracting sector is sustained, the disease causes no pain. To the contrary, windfall mineral revenue enables the country to enjoy a relatively high standard of living, and hence rising domestic consumption. However, when prices or output level start to decline, the economy might find itself burdened by an industrial structure that is not capable of maintaining the level of per-capita income achieved during the booming period of the mineral sector (Corden and Neary 1982; Corden 1984 and Krugman 1987).

As far as the level of income and competitiveness of manufacturing industries are concerned, the Dutch disease syndrome corresponds well with the South African experience. The real exchange rate followed the swings of the dollar gold price

closely during the 1980s, although with greater flexibility downwards than upwards (Kahn 1992). Other sectors of the economy, therefore, faced frequently changing international competitiveness for reasons over which they had no control. In spite of this, rather than allocating resources to sectors producing non-tradeables, South Africa has developed a sizable manufacturing sector, to a large extent behind a protective tariff wall and other import barriers. Thus, while manufacturing output as a share of GDP has declined in most other mineral- or oil-exporting countries during the period 1970 to 1991, the share has remained stable at 24-25 percent in South Africa (World Bank 1993). A large share of the manufacturing sector is, however, strongly linked to the mining sector, constituting the minerals-energy complex (see Jourdan (1993) for a discussion).

Maintaining a relatively large manufacturing sector in the face of better investment opportunities elsewhere in the economy (see figure 2.1) can be justified by the objective of *creating* comparative advantage for at least medium-technology industries, which in turn would contribute to sustaining the income level from the era of booming mineral incomes.⁴ Comparative advantage in a particular industry simply means having relatively abundant supply of the factor intensively used in that industry. Therefore, creating comparative advantage could be achieved by investing heavily in the relevant factor, or assets that can easily be transformed into this factor. However, when skills are the factor of production intensively used, and skills are accumulated through learning by doing, then the industry in question has to be established to create comparative advantage. In this case, industries that are crowded out by the mining sector will not return when minerals are exhausted, and the Dutch disease becomes a problem for long-run growth (Krugman 1987).

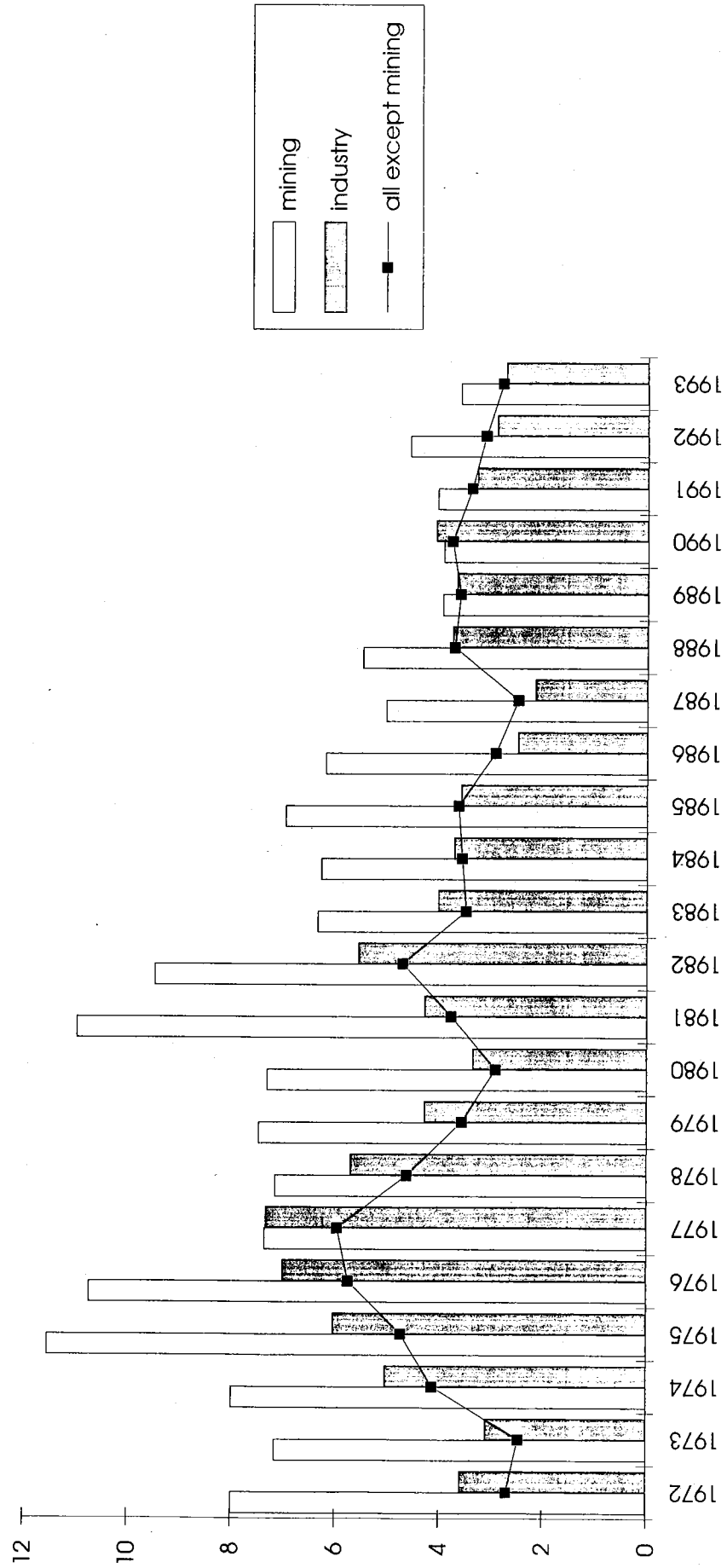
2.2 *Industry classification*

In order to analyse trade patterns focusing on competitiveness and dynamic aspects of specialisation, it is useful to categorise industries along the following three dimensions:

- * labour costs (wages)
- * technology
- * orientation

⁴ There are better measures of return on investment than the dividend percentage, but at this stage I do not have sufficient data.

Figure 2.1
Dividend yields by sector



Following OECD (1993) categorisation along the first two dimensions gives the matrix presented in table 2.1.⁵

Table 2.1
Wage and technology

Wage (column)/ Technology (row)	High	Medium	Low	G7 share of world exports (1990) %
High	Aerospace, Computers and office equipment, Pharmaceuticals	Scientific instruments, Communication equipment and semiconductors	Electrical machinery	81.6
Medium	Chemicals excluding drugs, Motor vehicles	Rubber and plastics, Non-ferrous metals, Non-electrical machinery	Other transport equipment, Other manufacturing	76.2
Low	Petroleum refining	Paper and printing, Non-metallic mineral products, Iron and steel, Metal products, Shipbuilding	Food, beverages and tobacco, Textiles, apparel and leather, Wood products	63.1

Source: OECD (1993). Classification according to wage was made for 9 OECD countries in 1985, but is according the OECD representative for the OECD area and for an extensive period.

High technology and high wage usually go together, but not always, as can be seen in this table. The outliers are petroleum refining which is high-wage, low-technology and electrical machinery which is low-wage, high-technology. High wages in petroleum refining can be explained by the fact that it is a strongly resource-based, downstream activity by the major oil companies, and as such enjoys its share of the oil rent. In addition it is among the most capital intensive industries in the economy. The other outlier, electrical machinery, is high-technology, but the technology is to a large extent embodied in standardised components which are assembled by medium-skilled labour, often in low-cost countries.

The third dimension determining competitiveness, i.e. orientation, classifies industries according to the factor of production relatively intensively used, or the characteristics of the sector that affects competitiveness the most:

⁵ All data in this section are based on OECD (1993) unless otherwise stated.

Table 2.2
Manufacturing by orientation

Factor	Industry	G7 share of world exports, 1990, %
Natural resource	Food beverages and tobacco, Wood products, Petroleum refining, Non-metallic mineral products, Non-ferrous metals	58.2
Labour	Textiles, apparel and leather, Fabricated metal products, Other manufacturing	66.8
Scale	Paper and printing, Chemicals excluding drugs, Rubber and plastics, Iron and steel, Shipbuilding, Motor vehicles, Other transport equipment	76
Specialization (differentiated products)	Non-electrical machinery, Electrical machinery, Communication equipment and semiconductors,	80
Science	Aerospace, Computers, Pharmaceuticals, Scientific instruments	80.1

Source: OECD (1993)

When comparing table 2.1 and 2.2, it emerges that high wages go together with science-oriented, scale intensive or natural resource-based industries. Hence, high wages can be supported by high productivity either through accumulation of human capital as in the science-based, high-technology industries, low labour share of total costs as in the scale intensive industries, or through rent in the resource-based industries. The limited number of industries in which low labour costs are the most important competitive factor is noteworthy.

In a long-term dynamic perspective, scale economies get exhausted, while rent on natural resources is dependent on volatile world market commodity prices. Income growth in long-run, full-employment equilibrium, therefore, is stable and sustainable only if technological progress is an important part of it.⁶

⁶ Full employment is admittedly is a far cry from South African reality. There is therefore scope for income growth through absorbing idle workers in formal employment. However, in this and forthcoming papers it will nevertheless be argued that technological progress is of immense importance to the development of the economy.

2.3 Technological progress

Technological progress takes place through two different channels that are not always easily discernable. One is research and development (R&D) in separate industrial or university laboratories. The outcome of R&D is usually new products and processes that are either complements to previously produced goods or existing processes, or substitutes to them. The other channel for technological progress is incremental improvement of existing goods and processes that to a large extent takes place on the shop floor as a result of learning by doing. Improved goods are substitutes to existing variants. Sometimes quality-improved variants are perfect substitutes to existing ones, which in practice means that the new product will render previous versions obsolete. Being able to adopt new versions quickly in such dynamic industries is therefore extremely important merely to stay in business. This is the case for companies in a microeconomic context as well as for industries of a country in an international trade context. When several versions of a product are traded at the same time, earlier versions trade at a discount if new versions are of better quality. This point is highly relevant to the motor vehicle industry in South Africa which is inclined to produce a particular model for a longer time than overseas competitors (Black 1993).

The R&D channel for technological progress is costly, human capital intensive and fraught with uncertainty. At the outset, investors in R&D have only a vague idea of the properties and potential use of the new product.⁷ Whether the laboratory will be able to come up with a marketable product design is uncertain, and if and when it does, any company with sufficient skill and capacity could imitate the product at a lower cost as captured by the product cycle theory briefly discussed in section 2.1.⁸ To avoid this disincentive to invest in R&D, rules for protection of intellectual property rights have been developed and included in the new GATT agreement. These property rights are, however, not likely to hamper technological progress through imitation in less- and semi-developed countries. Firstly, patents are perceived as an important obstacle to technology diffusion only in a few industries, i.e. pharmaceuticals and some other subsectors within the chemical industry. Secondly, licensing is widespread, and usually provides sufficient opportunity to adopt advanced technology without impeding the incentive to innovate.⁹ This is particularly the case when comprehensive training is part of the licensing agreement.

These characteristics of R&D-driven technological progress determine the structure and location of related industries. Firstly, the costs and the risk of R&D and the

⁷ See Rosenberg (1993) for a discussion.

⁸ These characteristics resemble those of large-scale mining. Exploration and extraction costs are high and irreversible, while the cash flow from mining is uncertain because of large fluctuations in world market prices, and development of synthetic substitutes to the minerals.

⁹ See Rosenberg et al. (1992) for a discussion.

intellectual property rights facilitate concentration in large, and usually multinational companies. Moreover, imperfect information related to R&D projects puts smaller firms at a disadvantage in raising funds for such costly and uncertain projects.¹⁰ Secondly, both the R&D activity itself and production of new goods are human capital intensive. Thirdly, the share of high-technology products in domestic demand seems to be an increasing function of GDP per capita. A fourth factor constituting a strong R&D driving force in countries like the USA, the former Soviet Union and South Africa, is the military-industrial complex. Comparative advantage in R&D-driven industries, therefore, is related to a relative abundance of human capital, a well-developed credit market or strong government involvement to diversify the risk associated with R&D, high income per capita and probably an active R&D policy facilitating cooperation between university-based or possibly defence-related basic research and industrial R&D. These characteristics constitute the rationale for assuming that innovations of new products take place in the North only in product cycle theories.

The potential of technological progress through the other channel, learning by doing, is greatest for relatively new products and processes, or at least new varieties of established products and processes. It is typically assumed that the learning-curve in producing a specific good or introducing a new production process is s-shaped. Very early in the product cycle, experience with the product or process is low and learning is more related to establishing routines for production than improving them or the product. Once a comprehensive understanding of the process and a more widespread use of the product are achieved, the incremental improvement process accelerates until the product and the process become more or less standardised. At that stage the product is no longer as human capital-intensive as it was at the outset. Increasingly, the price of the product, and therefore costs are the most important competitive factor. Moreover, the learning curve levels off at different levels in different industries. Thus, as the product cycle unfolds, science is replaced by specialisation or scale as the most important factor determining competitiveness. Eventually relatively low labour costs become the major competitive factor. Somewhere along this trajectory production is moved from the innovating country to a country that has relative abundance of the factor which determines competitiveness at a later stage. The earlier in the product cycle a country's firms are able to adopt a product and introduce it successfully in domestic and foreign markets, the greater the scope for generating relatively well-paid jobs. Conversely, a country that only has the capacity to take up production

¹⁰ The parallel to mining is again striking. In order to raise capital for risky projects and spread the risk, large mining houses with interests in several economic sectors developed in South Africa. Moreover, due to huge fluctuations in cash flow, a relatively sophisticated financial sector emerged. This sector is to an increasing degree included in the tradeable part of the economy, and South Africa has probably developed a comparative advantage in this sector (see Jones and Muller 1992).

of standardised, mature products is bound to compete mainly in terms of labour costs or scale efficiency.

In most industries technological progress takes place through a combination of R&D and learning by doing; new products and major improvements of existing ones are developed in the research laboratories and improved through learning-by-doing processes on the shop floor. Introducing existing, possibly modified products or processes to laggard countries can take either route as R&D can be applied to imitation or adoption as well as to innovation of products or processes. Generally, capacity for imitation and for moving up the learning curve is strongly related to the skill level among the R&D staff as well as among managers and workers.

The OECD countries have been able to increase the income level through continuous structural change within the manufacturing sector, a change characterised by movement from labour-intensive, low-technology and resource-based industries to high- and medium- technology, and scale- and science-based industries (OECD 1993). This development is also seen within industries. Hence, by improving productivity through technological progress, exploiting economies of scale and introducing more efficient ways of organising manufacturing activities, income and real wages have risen. Parallel to this structural change within the manufacturing sector, the share of manufacturing in total GDP has steadily declined in most OECD countries since the 1970s, to the advantage of the more labour intensive tertiary sector.¹¹

In accordance with the product cycle approach and other models of technology diffusion, empirical evidence suggests that there may be some advantage of backwardness in terms of the possibility of rapid catch-up growth, assuming that the cost of imitation is less than the cost of innovation. However, if the technology gap exceeds a critical value, this assumption may not hold, and the gap seems to widen rather than trigger a spurt in economic growth (Nelson and Wright 1992; Dowrick and Gemmell 1991).¹² What this critical value is, has not been established, and there are not even established methods for measuring it. In product cycle models the problem usually does not arise, since it is assumed that while countries in the North are the only ones that innovate, countries in the South have a gift for imitation, disregarding the possibility that innovation and imitation are two sides of the same coin. Nevertheless, a critical technology gap is likely to

¹¹ Measured at current prices, the manufacturing share of GDP declined in all the major OECD countries between 1970 and 1990. However, measured at constant 1985 prices the share actually increased in USA, Japan and Italy. The difference between the two measures is explained by declining relative prices of the manufacturing sector.

¹² This goes straight into the convergence debate in economic growth theory. Consensus seems to have emerged that absolute convergence is contrary to empirical evidence, while relative convergence is accepted as an empirical fact. This means, in turn, that the further a country is below *its own* steady state growth path, the faster it will grow.

vary among countries, depending on, among other things, economic structure. The critical gap is, for example, likely to be narrower in countries whose income is to a large extent based on extraction of natural resources than in countries whose income is based on producing low-cost, low-technology manufactures for a competitive market. The reasons are that the latter industries expose a larger share of the workforce to industrial practices, and the human and physical capital accumulated through labour-intensive, low-technology industries are probably less sector-specific than the capital accumulated through mineral-based industries. Therefore, it is probably easier to develop medium-technology industries producing goods and services for which demand is income elastic from a base of low-technology, labour-intensive industries. To put it differently, the transformation costs are probably higher in mineral-based economies.

2.4 Technological progress in South Africa

The product-cycle approach assumes that the main source of technological progress in developing countries is the learning-by-doing channel, supported by R&D to adapt products to local markets and processes to local technological capability. In South Africa, however, the R&D channel seems to dominate as a source of technological progress. According to FRD (1993), most innovation takes place in the R&D departments of large firms. The small share of incremental innovations on the shop floor is probably related to a shortage of skills throughout the manufacturing enterprise. In addition, hierarchical organisations leave little scope for initiative at the shop floor (see also section 3).

R&D expenditure was 1.04 percent of GDP in 1991, which is higher than most developing countries and even some OECD countries like New Zealand and Ireland (FRD 1993). However, unlike most OECD countries, in South Africa R&D has been directed towards national security objectives in the fields of defence and energy, and has only to a small extent been driven by economic motives.¹³ Moreover, civilian spin-offs from such research have been relatively fewer than in other countries with a strong defence industry.¹⁴ Hence, a remarkably sophisticated technological capacity not expected to be found in a developing country has been built up in production of weapons, fighter aircraft, nuclear energy, computers, electronics and radiation therapy to mention a few (Branscomb 1994). However, as Branscomb (1994) points out, defence and commercial markets are not highly compatible and good performance in the first is no guarantee for success in the latter. Furthermore, South Africa has, for security

¹³ In USA defence-related industries have been an important driving force for technological development. This fact has, however, from time to time caused concern as Japanese products became market leading in a number of industries.

¹⁴ Tegart (1994) finds the situation similar to the Eastern European countries which allocated excessive resources to defence-related activities to gain military advantage over the West.

reasons, to a large extent developed such technologies in isolation, while high-technology industries elsewhere are characterised by intraindustry trade (see section 4.1). Therefore, the cost structure of South African high-technology industries has only to a limited extent been tested against world market competitors.

In the field of energy, self-sufficiency was the objective of R&D efforts, resulting in, among other things, the path-breaking synfuel technology developed by the parastatal Sasol. However, although synfuel might be impressive from a technological and engineering point of view, it is expensive and not what the world market wants. The trend in the world market is rather to develop additives which allow for unleaded fuel to maintain the efficiency of leaded fuel. Unleaded petrol is still a few years away in South Africa (Jourdan 1993). Hence, due to lack of consideration for the market, South Africa has developed a significant technological capacity that to some extent is out of touch with consumer preferences.

The challenge facing South Africa as the high-technology industries are exposed to world market competition and investor demands for reasonable returns on their assets, is to transform such industries while maintaining their technological capacity. However, within energy and defence industries successful innovations are extremely costly, and it is the absolute level more than the share of GDP that determines the results. In order to maintain the technological capacity without draining an unacceptable amount of resources from an already stretched government budget, finding foreign partners, licensing or buying R&D services abroad are probably the only viable solutions. Finding partners might be difficult since South African high technology in many cases seems somewhat out of pace with cost-efficient technologies developed elsewhere.¹⁵ Transformation may thus be a prerequisite for attracting foreign investors and for participation in international networks.

This section has outlined a framework for analysing the interrelationship between technology, comparative advantage, trade patterns, sector allocation of output and economic growth. I will now proceed by analysing the structure of the South African manufacturing sector along the three dimensions suggested in section 2.1.

3. Output structure of the South African manufacturing sector

In this section I will first give a snapshot of the structure of the manufacturing sector in 1990, and after that analyse the trends since 1972. Table 3.1 shows the

¹⁵ Several technologies developed in South Africa are pointed out to be the only of its kind in the world. In some cases, this probably means that South Africa is at the technology frontier in the field. In other cases it means that the technology, although extremely sophisticated, coexists with other, more cost-efficient and perhaps even simpler technologies that meet the same ends.

percentage distribution of value added in manufacturing industries along the wage/technology dimension as classified by OECD.

Table 3.1
Value added in manufacturing industries, South Africa 1990
(percentages); OECD classification

Wage/ Technology	High	Medium	Low	Total
High	1.66	2.03	3.73	7.42
Medium	10.51	13.28	1.25	25.04
Low	13.75	30.20	23.58	67.53
Total	25.92	45.51	28.56	100.00

Source: Calculated from IDC (1992). Scientific instruments was given as part of "other manufacturing", and petrochemicals were lumped together with "other basic chemical products" (ISIC code 3511) in the IDC data, which were therefore supplemented by trade statistics from Customs department and CSS's "South African Statistics" to estimate the data for these two subsectors.

One feature of the South African economy that immediately catches the eye is the asymmetry depicted in this table. The figures in the cells falling under the diagonal (from upper left-hand to lower right-hand corner) are significantly larger than the part above the diagonal, i.e. industries in which the wage level is supported by other factors than the technology level dominate. This becomes even clearer when applying the same method of classification along the wage dimension for the South African wage structure as that of the OECD.¹⁶

Table 3.2
Value added in manufacturing sector 1990
(percentages), South African wage structure

Wage/ Technology	High	Medium	Low	Total
High	6.95	0.47	0.00	7.42
Medium	20.00	4.06	0.97	25.04
Low	31.79	7.56	28.18	67.53
Total	58.75	12.10	29.15	100.00

Source: calculated from IDC (1992)

¹⁶ "High wage" > 15% above the manufacturing average, "low wage" < 85% of manufacturing average.

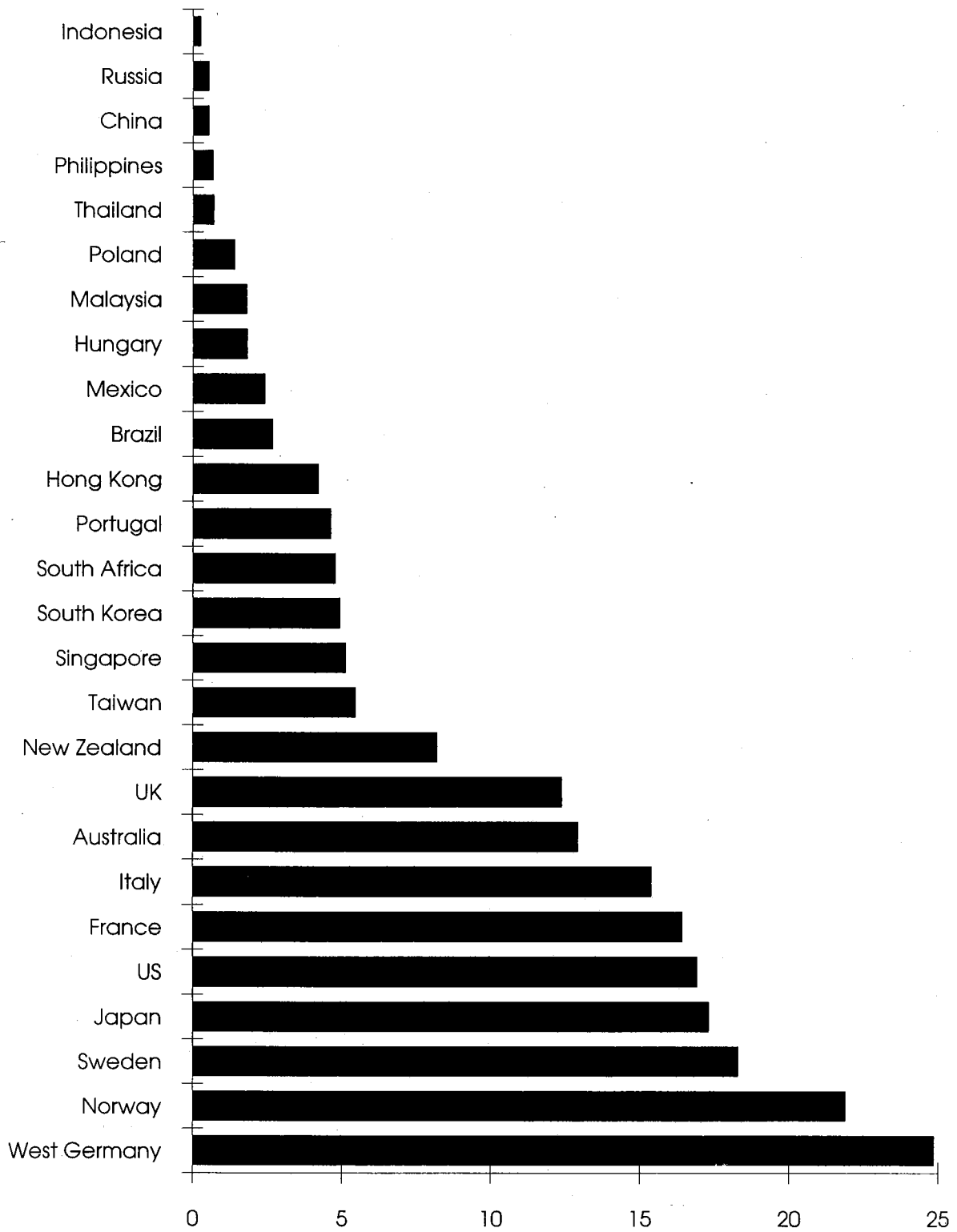
While the bulk of manufacturing employment is found in the medium-wage industries in OECD, it is the smallest category in South Africa, accounting for only 14.3 percent of total employment and 12.1 percent of output.¹⁷ Assuming that relative wages reflect differences in skill levels, the polarity characterising South African sector distribution along this dimension is explained by the dual education and training system, including very limited prospects for career development for black workers (Pillay 1993). Lack of career opportunities also implies that there are no incentives to acquire additional skills on the shop floor. As can be expected in a semi-developed country, next to no high-technology industries earns low wages.¹⁸ However, a larger number of low-technology industries earn relatively high wages in South Africa than in the OECD.¹⁹

¹⁷ Medium-wage industries constitute between 44 percent (Canada) and 56 percent (Netherlands) of total manufacturing value added in 1989 in OECD (OECD 1993).

¹⁸ The only exception is scientific instruments, which accounts for a tiny share of total output.

¹⁹ High wage industries in SA are in addition to those included in table 3.1: paper and printing, iron and steel, non-ferrous metals, non-electrical machinery, electrical machinery, communication equipment and semiconductors.

Figure 3.1
Remuneration costs in \$ per hour, manufacturing sector, 1993



Source: NPI

The absolute wage level in the manufacturing sector compared to OECD and other developing countries is given in figure 3.1. As can be seen from this figure, employees in South Africa earn more in terms of remuneration per hour than colleagues in OECD countries like Mexico and Portugal even though GDP per capita is twice as large in Portugal and around 70 percent larger in Mexico compared to South Africa.²⁰ Comparisons converting the average wage in local currency into USD at the going market exchange rate conceal the large wage differentials illustrated by table 3.2, and do not take into account purchasing power in local currency.²¹ Nevertheless, it is obvious that such labour costs have to be founded on equally high labour productivity if sustainable in a competitive market, be it the domestic and regional market in a more liberal trade regime, or the world market.

Labour productivity is simply output per worker employed or output per man-hour, and may increase through several channels: Adding more capital per worker will improve labour productivity, but at a declining rate if the standard assumption of declining marginal product of factors of production is applied. In South Africa this source of improving productivity has been used extensively; the capital/labour ratio for manufacturing as a whole has increased from a capital stock of about R 25,000 per worker in 1960 to R 74,000 per worker in 1992, both figures at constant 1990 prices.²² This capital deepening was accompanied by an improvement in labour productivity from around R 25,000 value added per worker in 1960 to R 42,000 per worker in 1992, or an average annual growth of 1.6 percent. Over the same period the output to capital ratio declined from around 1 in 1960 to 0.55 in 1992, or an annual average decline of 1.8 percent.²³ Hence, the marginal product of labour has been increasing over the period, while the marginal product of capital has declined, as predicted by neoclassical growth theory.

Increasing the stock of human capital embodied in the labour force improves the productivity of both labour and capital as workers develop skills to utilise new capital equipment more efficiently and solve problems as they arise on the shop floor. Productivity growth through this channel has been largely foregone in South Africa. Years of schooling of the economically active population is far below the OECD countries, but also below Asian and Latin American countries such as the Philippines and Chile (NPI 1994). Although the average number of years of

²⁰ Source for remuneration data: National Productivity Institute (NPI), source for GDP per capita: tables included in chapter 10 of Barro and Sala-i-Martin (1995). GDP per capita in 1990, calculated at constant 1985 USD is 3,193, 5,376 and 6,520 for SA, Mexico and Portugal respectively.

²¹ In a perfect world equilibrium exchange rates do reflect purchasing power. Besides, customers do not care about the purchasing power of the wages earned in producing the goods they buy.

²² Source: CSS for employment data, Reserve Bank for data on capital stock.

²³ Author's calculations based on data from the Reserve Bank on capital stock and value added, and CSS on employment.

schooling was relatively high compared to countries like Portugal and Mexico in 1960, these countries are rapidly catching up with South Africa as can be seen from table 3.3.²⁴ Moreover, numerous studies have documented a very low quality of education for the black population. For example, Rustomjee (1993) finds firms in which 50-75 percent of the workforce is illiterate even in medium-technology manufacturing industries like the engineering industries. The World Bank (1994) illustrates the situation as follows: "Out of every 10,000 African children who enter the school system, 1,300 will reach matriculation, 113 will pass, 27 will qualify for university acceptance and 1 will qualify for university acceptance in either mathematics or science."

Table 3.3
Average number of years of schooling

	1960		1985	
	Male	Female	Male	Female
South Africa	4.06	4.07	5.51	4.43
Mexico	2.69	2.13	4.8	4.06
Portugal	2.41	1.54	4.29	3.43
South Korea	4.58	2.04	9.17	6.59
Taiwan	4.49	1.85	8.23	5.65
Chile	5.20	4.80	6.55	6.36

Source: Table 10.1 in Barro and Sala-i-Martin (1995).

There is abundant evidence that investment in human capital has been of low priority also in the business sector. For example, when licensing agreements provide an opportunity for transferring technology through training by the licensor, Kaplan (1991) finds that the opportunity is not utilised. This neglect of skill accumulation has probably had a serious impact on productivity in South African manufacturing. After all, physical capital is not operating on its own, but has to be matched by adequately skilled labour. A sharp increase in the capital/labour ratio with relatively sophisticated imported technology embodied in new capital (Kaplan 1991), combined with poorly skilled labour is therefore likely to lead to a mismatch of factors of production.

Further research is necessary to establish the optimal trajectory of physical and human capital accumulation in the South African economy, given the economy's present factor endowments. It is nevertheless very likely that the social return on

²⁴ Average number of years of schooling for South Africa in 1960 is probably somewhat overstated, since the "Independent homelands" are not included in the statistics. However, data from South African sources, for instance Pillay (1990), confirms that the figure was significantly above Mexico and Portugal.

investment in human capital is much higher than the return on investment in physical capital.²⁵ Investment in human capital does, however, give high rates of return only in the long run. And even then the return is likely to accrue to the individual being educated and the society as a whole rather than the firm investing in its labour stock.²⁶

Finally, other factors like scale economies, new technology embodied in the capital stock, better infrastructure and better organisation contributes to productivity growth. The impact of such factors is best captured by total factor productivity (TFP). This is the most important source of income growth in developed countries. In developing countries, on the other hand, capital deepening and structural change are more important, and TFP growth is usually of less significance. Even in the Asian NICs, capital deepening was the most important source of growth over the period 1966-1990. In Hong Kong, South Korea and Taiwan TFP accounted for 30, 12 and 20 percent of observed growth during the period respectively, while TFP growth was negative for Singapore during the same period (Barro and Sala-i-Martin 1995). These are figures for the economy as a whole. However, TFP in a long-established manufacturing sector as the South African, could be expected to grow significantly. This sector has constituted more than 10 percent of GDP since the 1920s and more than 20 percent of GDP since the early 1950s. In spite of South Africa's relatively sophisticated infrastructure, the contribution was negative during the period 1981-1990, while only 0.4 percent of actual growth in the manufacturing sector could be explained by growth in TFP during the period 1960 to 1992. 68.5 percent of observed growth was accounted for by increase in the real capital stock and 31.1 percent by increased employment.²⁷

We have now seen that neither the technology level nor accumulation of human skills account for the relatively high real wage level in South Africa. Classifying industries according to orientation sheds more light on which factors contribute to the income level, and whether it is sustainable in a competitive environment.

²⁵ The social return on black education is estimated at between 6 and 18 percent, depending on the method applied and the period over which it is estimated (Hosking 1992). In comparison, a rough estimate of the private rate of return on physical investment (net operating surplus as a share of total fixed capital stock for the economy as a whole in 1990) was around 7 percent.

²⁶ The dominance of a few conglomerates in South African industry may however reduce the risk that a competitor reaps the benefit from intra-firm training.

²⁷ Author's calculations based on data from the Reserve Bank and CSS.

Table 3.4
Value added in manufacturing by orientation, South Africa 1990

Orientation	Share of VA, %	VA per worker
Resource intensive	38.15	R46 000
Labour intensive	16.06	R22 000
Specialized supplier	10.75	R41 500
Scale intensive	32.91	R49 500
Science based	2.13	R43 500

Source: calculated from IDC (1992).

According to the above table as much as 70 percent of manufacturing output is either resource- or scale-intensive. These are the industries with the highest value added per worker. Only 16 percent is labour-intensive. Thus, labour costs are not the decisive factor determining competitiveness for the majority of South African manufacturing industries. Or, put differently, just as in the OECD relatively high labour costs can be compensated by high productivity. In South Africa's case a high productivity potential stems from either scale economies or access to relatively cheap raw materials and energy. Let us therefore examine productivity performance along the three dimensions mentioned above over the last two decades.²⁸

Table 3.5 shows that productivity performance has been very poor during the period 1972-90 for the manufacturing sector as a whole, as well as for most categories as classified along the wage, technology or orientation dimension. Along the wage dimension, TFP performance deteriorates with rising wage levels. As can be seen from columns 5-8 in the table, labour productivity, and hence wage levels, are strongly related to capital intensity. Consequently, TFP turns out to grow slower the more capital intensive the industry. Looking at individual industries, TFP contribution to growth is related to a moderate capital deepening. In low-wage industries, capital deepening was moderate and TFP accounted for almost 50 percent of output growth during the 1970s. During the 1980s the positive trend in TFP growth was reversed, and even labour productivity declined slightly. In medium-wage industries, moderate capital deepening has led to improved TFP over the entire period. Although TFP contributed less to total output growth in these industries than in the low-wage ones, its contribution increased from the first to the second period. However, as opposed to the trend in low-wage industries

²⁸ TFP is calculated by means of a standard growth accounting method: The equation

$$\ln[A(T)/A(t)] = \ln[Y(T)/Y(t)] - \{a \cdot \ln[K(T)/K(t)] + (1-a) \ln[L(T)/L(t)]\}$$

where Y is real output, K real capital stock and L number of employees, T and t are end and beginning of period respectively, and a is the period average capital share. This method is based on the assumptions that capital and labour are paid according to the value of their marginal products, and the production function exhibits constant returns to scale. Neither is likely to hold in South Africa, so the results must be considered indicative only.

where the capital/labour ratio increased from adding more capital stock, capital deepening came mainly from shedding labour in medium-technology industries during the 1980s, and labour productivity improved as a result.

High-wage industries are characterised by tremendous capital deepening, particularly during the 1970s followed by a substantial decline in TFP. During the 1980s, even labour productivity declined sharply. The worst performers were the motor vehicle industry and petroleum refining. The former is scale intensive, but highly protected and inward oriented.²⁹ Besides, the industry is highly fragmented. Seven manufacturers are competing mainly on the domestic and regional markets, producing 11 makes and 34 models in 1993. While minimum efficient scale per plant is assumed to be in the range of 150-200,000, the South African motor industry produced 198,000 vehicles combined in 1991 (Black 1993). Hence, satisfying consumers' preference for variety in a stagnant economy has not allowed for efficient scale, a factor that has contributed to the dismal performance of the motor vehicle industry. Petroleum-refining productivity has probably suffered from the fact that parts of the sector are being operated for strategic rather than economic reasons. Nevertheless, a combination of protection and an exceptional increase in the capital/labour ratio is responsible for petroleum refining (and other basic chemicals) having the highest average wage level in South African manufacturing industries in 1990.

Along the technology dimension, TFP has, in fact, contributed most to growth in high-technology industries, followed by a minor, but increasing contribution in low-technology industries and slowing down growth in medium-technology industries. In high-technology industries, as in low-wage industries, TFP improvements followed a moderate capital deepening, leading to a more productive input mix. The relatively good performance in high-technology industries again reflects the duality of the South African economy. In the midst of strongly resource-based or Fordist-type industries, pockets of high-technology industries like pharmaceuticals, computers, semiconductors and even aircraft are found.³⁰ Moreover, one of them, computers and office equipment, is strongly export-oriented. High-technology industries have a relatively low capital intensity, but is strongly human capital intensive. In spite of the fact that skill shortages are identified as the major constraint to most manufacturing industries (CEAS 1993), the high-technology industries seem to have been able to match sophisticated machinery with human capital.

²⁹ The nominal rate of protection for completely built up units is 115 percent.

³⁰ "Fordist-technology" was introduced in the car assembly industry in USA to be able to produce large quantities at low costs with an unskilled and often multilingual workforce.

Table 3.5		Sources of growth, manufacturing						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Growth rate net output	Contribution from capital	Contribution from labour	TFP growth rate	K/L beg. period	K/L end period	Y/L beg. Period	Y/L end period
Total manufacturing								
1972-1981	5.48%	3.02%	1.99%	0.47%	36528	56910	31627	38931
1981-1990	-0.27%	0.47%	-0.26%	-0.49%	56910	65511	38931	39521
1972-1990	2.60%	1.83%	0.82%	-0.05%				
By wage category								
low-wage industries								
1972-1981	6.10%	1.47%	1.71%	2.92%	19377	21559	18634	25217
1981-1990	-0.35%	1.32%	-0.20%	-1.47%	21559	30308	25217	25161
1972-1990	2.88%	1.39%	0.75%	0.73%				
Medium-wage industries								
1972-1981	4.72%	2.03%	2.08%	0.61%	47372	58702	36492	41649
1981-1990	-0.05%	0.09%	-0.43%	0.29%	58702	63891	41649	44169
1972-1990	2.33%	1.10%	0.79%	0.44%				
high-wage industries								
1972-1981	6.18%	6.04%	2.66%	-2.52%	66633	168625	65757	76530
1981-1990	-0.69%	0.50%	-0.10%	-1.09%	168625	187311	76530	73344
1972-1990	2.74%	3.67%	1.14%	-2.07%				
By technology category								
Low-technology industries								
1972-1981	5.22%	3.51%	1.68%	0.03%	38305	67854	27706	34648
1981-1990	0.59%	0.38%	-0.14%	0.34%	67854	74894	34648	37353
1972-1990	2.90%	2.08%	0.72%	0.10%				
Medium-technology industries								
1972-1981	5.84%	1.33%	2.71%	1.79%	34077	32404	44900	51804
1981-1990	-2.40%	0.94%	-0.53%	-2.81%	32404	44022	51804	44984
1972-1990	1.72%	1.13%	1.09%	-0.50%				
High-technology industries								
1972-1981	6.34%	1.77%	3.01%	1.56%	23313	26527	32757	39226
1981-1990	0.28%	0.56%	-0.83%	0.55%	26527	34715	39226	44826
1972-1990	3.31%	1.17%	1.08%	1.06%				
By orientation								
Resource intensive								
1972-1981	5.65%	5.84%	1.35%	-1.55%	40841	95375	31254	41030
1981-1990	1.72%	0.94%	0.18%	0.61%	95375	106670	41030	46193
1972-1990	3.69%	3.61%	0.72%	-0.64%				
Labour intensive								
1972-1981	4.94%	0.82%	2.07%	2.04%	13196	13231	19928	23973
1981-1990	-1.84%	-0.22%	-0.71%	-0.91%	13231	13410	23973	22177
1972-1990	1.55%	0.29%	0.69%	0.57%				
Specialised supplier								
1972-1981	5.52%	1.53%	3.29%	0.69%	20568	22033	39277	42640
1981-1990	-2.18%	0.29%	-1.35%	-1.12%	22033	28619	42640	41570
1972-1990	1.67%	0.92%	0.97%	-0.21%				
Scale intensive								
1972-1981	5.68%	2.08%	2.25%	1.35%	67912	81030	43537	52531
1981-1990	-0.88%	0.28%	-0.16%	-1.00%	81030	88789	52531	49695
1972-1990	2.40%	1.18%	1.05%	0.18%				
Science based								
1972-1981	4.17%	1.04%	2.33%	0.80%	28879	37714	37769	42574
1981-1990	0.11%	0.03%	-0.08%	0.15%	37714	38528	42574	43389
1972-1990	2.14%	0.64%	1.07%	0.42%				
Y= net output, K = capital stock, L = labour force (number of employees)								
Growth rate of net output: average over the period								
Contribution from capital is the product of capital share and the growth rate of capital input								
Contribution from labour is the product of the labour share and the growth rate of labour input.								
Capital and net output per worker are given as R 1000 (1990 prices) per worker								
Source: Author's calculations based on data from IDC (1992)								

This somewhat rosy picture needs, however, to be qualified. Although TFP may have improved over the period in question, absolute levels are discouraging. Net output per worker has been lower than in medium-technology industries during the entire period, although the gap has narrowed. Some, mainly defence-related industries, had a negative gross operating surplus over most of the period analysed. Moreover, the relatively good export performance found in IDC data is contradicted by Hirsch (1993), applying his own, "cleaned-up" dataset. Hence, because data on trade and production in defence-related high-technology industries are not easily available, they are subject to guesswork, and results must be interpreted with great caution. Finally, it has been suggested that the defence industry gives sophisticated equipment as gifts to foreign countries or sells it at large rebates.³¹

Along the orientation dimension, perhaps surprisingly, the labour-intensive industries have performed best, followed by science-based industries. TFP made a small contribution to real output growth in scale-intensive industries (in spite of the dismal performance of motor vehicles), but slowed down growth in resource-intensive industries as well as industries in which product differentiation is the most important competitive factor. Looking at the two time periods, science-based industries are the only ones experiencing TFP growth in both periods, while TFP contributed positively to growth in resource-based industries during the second period. For the latter, changes in productivity probably has a lot to do with fluctuations in commodity prices, since trade margins, and hence operating surplus to a large extent varies with commodity prices. Science-based industries overlap with high-technology industries to a large extent, and the qualifications made for the latter apply to the former as well.

From this analysis it is clear that TFP growth is associated with moderate capital deepening, while a sharp increase in the capital/labour ratio is followed by declining TFP. We interpret this result in the light of the new theory of economic growth (Romer 1986 and 1989) and numerous growth accounting studies.³² This body of research explains theoretically and finds supporting empirical evidence that a necessary condition for exploiting the possibilities offered by technological progress is employment of new machinery and equipment in which this technology is embodied, combined with a higher level of skill and education to understand and apply the fruits of technological progress. If capital deepening is not accompanied by skill accumulation, it runs into diminishing returns. In South Africa, the science and engineering workforce grew faster than the total workforce during the last decade (FRD 1993), but skill accumulation has been insufficient to increase the capital/"efficient labour" ratio, except for a few industries. Another factor that contributed to diminishing returns is the fact that some large investment

³¹ Personal communication with A.S. Minty, former director of "World Campaign against military and nuclear collaboration with South Africa".

³² A recent study is Mankiv, Romer and Weil (1992).

projects have been implemented for strategic reasons rather than on the basis of economic viability. Finally, and strongly related to this, large investments in new capacity, producing for a stagnant domestic market, have led to low capacity utilisation and hence dismal productivity performance.

The slight improvement in TFP following moderate capital deepening can either have been achieved by upgrading labour skills following the introduction of new or improved production technology, or by introducing machinery that facilitates better utilisation of existing skills through more extensive specialisation. Judging from various indicators of investment in human capital which were discussed above, and from several sector studies pointing to a Fordist-type production technology, division of labour and other organisational changes are likely to have contributed most to TFP growth in low-technology industries. In medium-technology industries, upgrading skills has probably been a necessary, but neglected precondition for further productivity gains, leading to declining TFP in spite of moderate capital deepening. Since a large share of medium-technology industries is scale-intensive, inefficient scale following inward orientation and small and stagnant domestic and regional markets has also contributed to the decline in TFP.

From this analysis, two potential sources for future productivity growth recovery can be identified. The first is exploitation of economies of scale, which in turn requires a larger market. Where existing capacity is below minimum efficient scale, scale economies can be improved either through large-scale investment in new capacity or by concentrating production on fewer varieties. Large-scale investments in new capacity runs the danger of cementing the existing industrial structure. This would be the case particularly if combined with costly investment incentives and further protection, perhaps within a regional framework like SADC. In that case it would only have a temporary effect on productivity as moving from inefficient to efficient scale provides an increase in productivity *level*, but only a short-term increase in the productivity *growth* rate.

Concentrating on fewer product varieties would probably require less investment in physical capital. Some of the motor vehicle producers, for example, have close to minimum efficient scale capacity.³³ Combined with scaling down the level of protection (see section 4.2) this would open for intraindustry trade and enhanced competition: Locally produced varieties would have to compete with imported versions on the home market to a larger extent than at present, and a larger share of production would have to be exported out of the region. Due to the ownership structure of South African industry with some six conglomerates dominating the manufacturing sector as well as the entire economy, foreign competition is likely to be the most fierce. Intraindustry trade would also facilitate output as well as

³³ VW has according to Black (1993) a capacity of 120-130,000 vehicles.

productivity growth through a greater variety of inputs as discussed in section 2.1, and possibly a faster adoption rate of new varieties. The latter is probably dependent on South African companies becoming a part of international networks, be it a foreign parent company or joint ventures.

The second, and probably most important source of further productivity growth in the long run is investment in human capital. Such investments should, however, be accompanied by investment in physical capital for two reasons. Firstly, low levels of investment during the last decade has rendered the manufacturing sector with a somewhat outdated capital stock (Maasdorp and Whiteside 1993). Secondly, upgrading skills leads to a decline in the capital/“efficient labour” ratio. To the extent that this ratio is on or below the optimal ratio, investment in physical capital must accompany investment in human capital to maintain or increase this ratio.³⁴ However, building a sufficiently large human capital base from a low initial level may take decades, while growth in the short term is important, particularly in an economy where expectations are high and the consequences of frustration probably severe. Therefore, a faster route to income growth is likely to be opted for in the short run. With rising commodity prices as world economic recovery gathers momentum, investment is likely to flow to commodity-based industries. This trend is already observed with large-scale investment in an aluminium smelting plant (Alusaf), and a world scale steel mill, ISCOR’s Columbus project.

So far the structure of the manufacturing sector is analysed in terms of allocation of output, represented by value added. This structure is to a large extent determined by resource endowments, comparative advantage and trade policy. I will, therefore, analyse trade patterns by sector in more detail in the next section before jumping to conclusions regarding the sustainability of the present size, structure and wage level in the manufacturing sector.

4. Trade

As is typical for natural resource-rich countries, South Africa has run a surplus on the balance of trade for long periods of time, while trade in manufactures has been in deficit most of the time. Table 4.1 shows trade patterns in 1990 along the three dimensions applied throughout this paper. This trade pattern will be compared to OECD patterns and the likely outcome of trade liberalisation will be discussed in the next two sections.

³⁴ A study by Van Zyl, Kleynhans and Bruwer (1994) finds that in the motor vehicle manufacturing industry, the capital/labour ratio is by far below the efficient rate (i.e. the ratio that equates the ratio of marginal products to the ratio of factor prices).

4.1 Trade patterns involving the OECD countries

In OECD countries import penetration measured along the wage dimension is highest for high-wage industries and lowest for medium-wage industries.³⁵ Along the technology dimension, import penetration does not differ very much between high and medium technology, but is significantly lower for low-technology industries. Apart from "food, beverages and tobacco", the industries for which import penetration is the lowest are the low-technology, medium-wage industries. However, in these industries import penetration has increased over the last decade in the G7 countries.³⁶ For iron and steel, which is of particular relevance to South Africa, import penetration increased substantially during the 1980s to the benefit of developing countries like Brazil, South Africa and South Korea (Jourdan 1993).³⁷

Exports as a percentage of production are higher than the manufacturing average for high-wage industries and declining with average wage costs. Along the technology dimension high technology industries have the largest export share in the USA, United Kingdom and Japan while medium-technology industries have the highest export share in the other G7 countries. The difference among high- and medium technology is small, however, while the export share of low-technology industries is much lower than for the other two categories. For the United States, for example, the export share of total manufacturing was 9.9 percent in 1989, while the distribution on technology categories was 18.2, 12.5 and 4.5 percent on high, medium and low technology respectively. The G7 share of total world exports in manufacturing industries classified along the technology dimension is given in table 2.1 and along the orientation dimension in table 2.2. The share is generally very high in the manufacturing sector, and it is increasing with the wage level. Along the orientation dimension it is increasing from a relatively small share in labour-intensive industries to totally dominating the world market for science-based manufacturing industries.

Bearing in mind the concern of OECD countries about unemployment and the fact that they are relatively rich in both physical and human capital, such a trade pattern tallies with the product cycle described above. Thus, world trade in high-technology products is dominated by the OECD countries selling such products to each other. As less developed and lower-cost countries catch up with the no-longer-so-new technology, OECD countries protect, subsidise or support the restructuring of maturing, medium-wage industries so as to prevent job losses. This is why import penetration is low for this part of the product range. Industries such

³⁵ All data in this section are taken from OECD (1993) if not otherwise stated.

³⁶ The period 1980-1989 (1988 for some of the countries).

³⁷ Import penetration in iron and steel industries rose from 0.8 to 2.7 percent in Japan, from 15.5 to 24.1 percent in Germany and from 22.1 to 28.5 percent in France, to mention the largest increases.

as clothing and textiles, import-sensitive electronics and steel are, for example, excluded from the EU's General System of Preference (GSP). However, as the competitive pressure from low-cost countries increases, protection becomes too costly and is therefore scaled back. The formerly protected industry is then either eliminated, or the OECD country is left with only an up-market proportion of the product range of the industry. Thereafter, import penetration rises. The garment industry is an illustrative example of such a product cycle. Like the textile and garment industry, most industries include standard, low-technology, mass-produced goods alongside specialised, up-market products. Technological progress therefore takes place in all sectors, but the pace, the extent and the characteristics of the markets vary widely among sectors.

4.2 South Africa's trade patterns

In contrast to the OECD countries, import penetration increases with the wage level in South Africa, in spite of the fact that the effective rate of protection increases with the wage level as well. This indicates that South Africa is very unlikely to have comparative advantage for high-wage industries. Moreover, looking at the effective rate of protection, the unit labour costs are probably too high even in low-wage industries compared to foreign potential competitors. Along the technology dimension, import penetration increases with technology level, while protection is highest for medium-technology industries and lowest for high-technology industries. The relatively low level of protection in high-technology industries is probably explained by the limited endowment of human capital in South Africa that makes import substitution in such industries extremely costly.³⁸ Except for the most labour-intensive low-technology industries, the level of protection is moderate in this category, at least compared to other developing countries, suggesting that with lower factor prices, South Africa could become competitive on domestic and external markets following the implementation of GATT rules in these industries.³⁹ Along the orientation dimension, import penetration is relatively low for resource-intensive industries compared to other categories along this dimension in South Africa, as well as compared to most OECD-countries. Import penetration in labour-intensive and scale-intensive industries is also relatively low, reflecting comparative advantage as discussed above, and a relatively high level of protection. Specialised supplier and science-based industries have high levels of import penetration and low levels of protection reflecting lack of comparative advantage and high cost of protection.

³⁸ Protection of high-technology industries could be underestimated in this table due to large share of high-technology industries for which data are not available and the embargo that "protected" domestic high-technology defence-related goods.

³⁹ Labour-intensive industries with high rates of protection are "spinning, weaving and knitting" and "clothing" with effective rates of protection of 104 and 239 respectively.

Table 4.1		COMPETITIVENESS INDICATORS, 1990					
Name of sector	Exports	Imports	Trade	Export	Import	Effective rate of protection	
			balance	share	penetration		
Food, beverages, tobacco	3106	1872	1234	7.6%	4.7%	-17 - 55	
Textiles, apparel, leather	2651	2065	586	19.4%	15.8%	-26 - 239	
Wood products	547	303	244	11.8%	6.9%	37 - 44	
Paper and printing	1009	1446	-437	7.7%	10.6%	15 - 22	
Chemicals excluding drugs	753	3467	-2714	6.4%	23.9%	21 - 348	
Pharmaceuticals	137	1059	-922	6.0%	33.2%	24	
Petroleum refining	2719	5215	-2496	13.2%	22.5%	na	
Rubber and plastic products	193	597	-404	3.0%	8.7%	56 - 215	
Non-metallic mineral products	484	838	-354	8.5%	13.8%	25 - 34	
Iron and steel	5683	986	4697	36.7%	9.1%	27	
Non-ferrous metals	2286	315	1971	36.4%	7.3%	16	
Metal products	811	1766	-955	6.2%	12.6%	27	
Non-electrical machinery	831	7906	-7075	9.9%	51.2%	2	
Computers and office equipm	20	1973	-1953	40.8%	98.6%	na	
Electrical machinery	271	2881	-2610	3.7%	29.0%	22	
Communication equipm. and semiconduct	121	1890	-1769	4.5%	42.5%	na	
Shipbuilding	129	212	-83	35.8%	47.9%	2	
Other transport equipment	100	336	-236	29.6%	58.5%	2	
Motor vehicles	712	6416	-5704	5.4%	33.8%	46	
Aerospace	44	1100	-1056	10.2%	73.9%	na	
Scientific instruments	204	2246	-2042	31.1%	83.3%	na	
Other manufacturing	1045	375	670	62.1%	37.1%	na	
Total manufacturing	23856	45264	-21408	12.6%	21.5%		
Low wage	7720	7832	-112	11.30%	11.44%	-26 - 239	
Medium wage	11751	18202	-6451	16.25%	23.11%	2 - 215	
High wage	4385	19230	-14845	9.05%	30.38%	21 - 348	
Low technology	17139	14703	2436	13.44%	11.76%	-26 - 239	
Medium technology	5920	19412	-13492	12.28%	31.47%	2 - 348	
High technology	797	11149	-10352	5.95%	46.93%	22 - 24	
Resource intensive	9142	8543	599	11.72%	11.04%	-17 - 55	
Labour intensive	4507	4206	301	15.84%	14.94%	-26 - 239	
Specialized supplier	1223	12677	-11454	6.65%	42.49%	2 - 22	
Scale intensive	8579	13460	-4881	14.09%	20.47%	2 - 348	
Science based	405	6378	-5973	11.90%	68.03%	24	
Sources: IDC (1992) and Hirsch (1993)							
Effective rates of protection are calculated for the period 1988-90 at four-digit ISIC level							

Export coverage figures for one year must be interpreted with caution, since they may be affected by special circumstances like export incentives and the absolute decline in domestic expenditure starting in 1990 and continuing through 1993. Bearing this qualification in mind, export coverage was highest for medium-wage industries and lowest for high-wage industries, while it was declining with technology level, reinforcing the anticipation that South Africa's comparative advantage lies in low-technology, low-to medium-wage industries. Finally, along the orientation dimension, labour-intensive industries have the highest export coverage followed by scale-intensive and science-intensive industries. It should, however, be noted that the differences among the five categories along this dimension, except for specialised supplier, are rather small, so no clear conclusion can be made on export patterns along this dimension. The largest exporting category, resource-intensive industries, come next to last in terms of exports as a share of production, reflecting a large domestic market for the output of these industries, mainly as inputs to other industries. It should also be added that South African companies have engaged in large investments abroad mainly in mining and mineral-related industries, suggesting that they have a highly competitive technology. According to these observed trade patterns, South Africa has revealed comparative advantage in low-technology, medium-wage and resource-based industries.⁴⁰

One important structural difference between OECD and South African trade patterns is worth noticing. As illustrated in table 4.2, there is a strong positive correlation between import penetration and export coverage along all three dimensions for the OECD countries, here represented by the USA, while the correlation is negative for South Africa. The negative correlation is particularly strong along the technology dimension, indicating that this is a highly relevant dimension for international division of labour as far as South Africa is concerned, while the strongly positive correlation indicates that it is not for the USA, nor for the other advanced OECD countries. Hence, in South Africa trade is mainly of an interindustry character at this level of aggregation, facilitating static gains as a result of more efficient international division of labour, but leaving less scope for the dynamic gains related to intraindustry trade.

⁴⁰ Import penetration is a very simplistic indicator of comparative advantage, but still provides an indication that in this case accords with other empirical evidence as discussed in this paper.

Table 4.2
Correlation coefficients between export share and import penetration

Dimension	USA	South Africa
Labour costs (wage)	0.94	-0.17
Technology	0.91	-0.90
Orientation	0.35	-0.43

Source: Calculated from OECD and IDC data.

Implementation of the new GATT agreement means lower levels of protection both in South Africa and the OECD countries. In South Africa, relative prices will change in favour of resource-intensive, low-technology industries, and some of the labour-intensive, low-wage industries, while liberalisation will most significantly affect medium-wage, low-technology industries in the OECD. Hence, the industries that gains from liberalisation in South Africa match fairly well with the markets to which access is about to improve in OECD. This is, however, no guarantee that South African industries will be able to make inroads into the OECD markets, as long as there are third countries with similar comparative strengths as those of South Africa relative to the OECD countries. Competition in low-technology industries is growing more intense as emerging market economies enter the world market with low wage costs, state-of-the-art technology imported from the OECD countries, skilled labour being able to operate the technology efficiently and access to markets allowing them to operate on an efficient scale.⁴¹ South Africa is probably at a disadvantage compared to these countries both in terms of wage costs (see figure 3.1) and technology, and has to reduce unit costs substantially in order to increase world market shares for standard, low-technology manufactures. In resource-intensive industries, on the other hand, South Africa has developed state-of-the-art technology in some of the mining and mineral beneficiation industries (Jourdan 1993), and is likely to benefit from better market access to the OECD. Besides, mineral beneficiation is energy-intensive, and South Africa has low energy prices, although probably subsidised.

If South Africa is granted Lomé Convention terms for entry to the EU market, competition from Asian non-ACP countries will ease somewhat.⁴² As the general level of protection is being reduced and an increasing number of countries, particularly the Eastern and Central European transitional economies, are given preferential access to the EU market, the significance of the Lomé Convention will be diminished. There are also doubts as to whether the Lomé Convention will be extended beyond the year 2000 when the current one expires. Therefore,

⁴¹ Even in low-technology industries rather sophisticated technology is embodied in machinery equipment that requires an ever increasing minimum level of skills in the course of technological development to be efficiently operated.

⁴² ACP countries include African, Caribbean and Pacific former European colonies.

preferential access to the EU countries will only provide temporary breathing space for South African manufacturing industries.

Trade liberalisation will increase the scope for economies of scale in industries like motor vehicles, chemicals and paper and printing. As far as the latter is concerned, South Africa is an important player on the world market through foreign direct investment. Motor vehicles as well as other industries with significant technological potential have, however, not revealed comparative advantage according to a study by Hirsch (1993). Substantial restructuring would therefore be necessary for these industries to survive trade liberalisation. The likely outcome of liberalised trade with the OECD countries is therefore resource allocation towards food processing and more or less beneficiated minerals including related down-stream activities. This would reinforce the complementarity between South Africa and the OECD. Since the OECD economic structure entails more promising prospects for technological progress, interindustry trade may widen the technology gap in the long run, although all parties will gain from a more efficient resource allocation. In addition, there is some scope for increased intraindustry trade in the resource-based industries. Worldwide they are differentiated both vertically and horizontally, and there is scope for both moving up the quality ladder and gain from a wider range of intermediate inputs through trade even in resource-based industries.

4.3 Trade patterns within Southern Africa

Due to the limited data available, it is difficult to analyse the breakdown of regional trade by sector. However, rough "guesstimates" suggest that Africa is a very important market for South African manufactures, particularly the medium-technology, high-wage industries that were found uncompetitive on OECD markets. Hence, at least 25 percent of South Africa's manufactured exports went to African markets while 28 percent of total exports of chemicals and 27 percent of motor vehicles and parts went to non-SACU African markets in 1985. Non-SACU Africa is an even more important market for medium- technology, medium-wage industries like machinery (36 percent of total exports) and plastic and resins (46 percent of total exports) (African Development Bank 1993).⁴³

The prices of a wide range of exports to the Southern African region were in 1992 15-25 percent above the fob prices of comparable goods from elsewhere (Leistner 1992). The reasons why South Africa has been able to sell over-priced goods to its neighbours are partly preferential access to their markets, which is particularly the case for the SACU countries, and partly non-price advantages such as shorter

⁴³ In addition there are exports to the SACU countries. In South African and international official trade statistics, SACU is treated as one area, hence South African trade with SACU partners is treated as domestic trade in the statistics.

delivery times and easier credit terms (Davies 1993). Whether more appropriate technology is another factor contributing to the relatively high market share probably needs further research to establish. Black (1993), however, suggests that South African-made cars are adapted to the special conditions in Southern Africa, and Römer-Heitman (1992) suggests that South African-produced military equipment is particularly designed with the geographic and climatic conditions in Africa in mind. While natural protection will prevail in future, implementation of a more liberal trade regime in the SADC countries will imply that South African industries will face increased competition on these markets from the OECD and overseas developing countries as well.

South African membership in SADC will improve its access to regional markets. Such membership may also secure South Africa access to markets overseas on terms similar to that of the other SADC countries. The least favourable option is to be granted GSP terms in trade with the OECD countries while the most favourable option is to join the Lomé Convention as discussed above. An intermediate solution is to include South African products as originating products in the ACP countries under the Lomé Convention which in turn would stimulate intra-regional trade (Trade Monitor No.7 1994).

Increased emphasis on regional trade and cooperation is important and even crucial in fields like transport and communication, energy and environmental issues to mention but a few. However, looking at the significance of the regional market for medium-technology manufacturing industries, the scope for basing recovery on exports to the region in these industries is limited. Besides, managing trade towards the region in excess of what will emerge from removing remaining obstacles to intra-regional trade has several caveats: SADC is one of the slowest growing areas in the world with low purchasing power, particularly for high value added manufactures. Managed trade within the SADC framework is likely to facilitate division of labour along the technology dimension, as was the case with liberalisation of trade with the OECD countries, but this time South Africa would have comparative advantage for medium and a few high-technology products relative to SADC trading partners (African Development Bank 1993). Although this could create some well-paying jobs in South Africa and provide an opportunity for somewhat improving the scale efficiency of the industries in question, they would meet limited competition from SADC firms. Consequently, SADC is not likely to constitute the dynamic and competitive market that would drive technological development by moving up the quality ladder, even though a more liberal trade policy will make some difference in this regard.

Increasing exports to the SADC countries would prompt counterdemands of increasing imports from these countries in order to diminish South Africa's large trade surplus versus SADC. To the extent such imports are competitive, a reorientation towards regional markets would emerge as a result of lower trade barriers and benefit all parties. If it is not, "managed" reorientation would not only

impose a cost on consumers or firms importing intermediates, but also represent foregone opportunities for technology transfer through a greater variety of intermediates embodying new technology. This argument also applies to the SADC countries if South African goods are not competitive in a neutral trade regime. Consequently, SADC (and possibly PTA) membership is not an alternative but rather complementary to a more open trade policy towards the OECD countries, and developing countries in Asia and Latin America.

The African Development Bank (1993) found that countries such as Zimbabwe and Kenya are competitive in the region as well as the world market for a range of labour-intensive, low-technology industries. Moreover, Zimbabwe is found to have a better trained and educated semi-skilled labour force than South Africa. Therefore, a trade and investment pattern that may emerge in a regional free trade area or common market is an increase in South African direct investment in SADC low-technology, low-wage industries which in turn would export to the South African as well as regional and overseas consumer markets. This would indeed reduce South Africa's large trade surplus while providing capital and jobs to neighbouring countries. Poor infrastructure, small market size and foreign exchange constraints are, however, likely to prevent an exodus of such South African industries. In addition, a possible outflow of investment may be counterbalanced by repatriation of firms that established themselves in neighbouring countries to countervail sanctions during the 1980s (Maasdorp and Whiteside 1993).

Increased South African investment in the mineral sector in the region is another likely effect of strengthened regional cooperation. South Africa has developed state-of-the-art technology in the mining sector and is in a good position to further develop the rich mineral resources in Southern Africa. To the extent that resources rather than world demand is the limiting factor on the South African mineral beneficiation industry, this would in turn facilitate investment in large-scale beneficiation and processing plants in South Africa as minerals could be imported over relatively short distances and provide feedstock for scale-efficient plants. Due to high transport costs of unprocessed minerals, some beneficiation would inevitably take place in the SADC host country. South Africa already has one plant based on imported ore, taking advantage of low energy costs and local know-how, the Alusaf project.

Hence, given that South Africa is relatively rich in capital, economic infrastructure and to some extent human capital compared to regional trading partners (except Zimbabwe), a more liberal trade regime in the region is likely to lead to a division of labour in which an increasing share of mineral processing is done in South Africa, alongside production of medium-technology manufactures, while an increasing share of the region's labour-intensive, low-wage, low-technology industries is located in the other SADC countries, perhaps by means of South African capital.

In this section it has been argued that when embarking on a free trade regime, the existence of comparative advantage for resource-based industries is bound to cause an increase in the share of such industries in the economy as competition with the OECD countries (and other relatively advanced countries like the Asian NICs) is likely to take its toll on high-technology industries, while competition with low-cost regional as well as Asian and Latin American producers is likely to eliminate parts of the labour-intensive low-technology industries.⁴⁴ Removing trade barriers in the Southern African region would facilitate trade and foreign direct investment within the region. The region would probably also become more attractive for foreign direct investments from extra-regional sources, since such investments would serve a larger market. Despite this, the region is not likely to constitute a springboard for a significant increase in South African manufacturing's market share in overseas markets.

4.4 Consequences for economic growth

In a perfectly competitive economy, resources are allocated among sectors in such a way that marginal product to the last unit of capital and labour employed is equal in all sectors. Therefore, sector allocation of resources is not an issue in standard growth models. South Africa is, however, not a perfectly competitive economy, and it cannot be assumed that the marginal products of the factors of production are the same throughout the economy. Therefore, structural change will influence economic growth in South Africa. The structural change likely to follow a change in relative prices in favour of resource-based industries, is an increasing share in GDP of resource-based industries. Simulations on a computable general equilibrium model for South Africa predicted the same outcome - a reduction in tariff protection gave an increased share of mining and resource-based industries in GDP (Naude and Brixen 1993). These industries are mainly in the low-technology category.

On the one hand such reallocation of resources would lower the technological potential of the manufacturing sector, and probably the economy as a whole. This would mean that the capacity to imitate would be limited to products and processes that have reached a mature state. Without significant reductions in unit labour costs, existing protected industries, as well as industries moving from OECD countries to South Africa, would also have to be scale-intensive since labour costs are less important for competitiveness in such industries. If this is the structure of the manufacturing sector that emerges from reintegration into the world economy, the prospects for economic growth based on technological progress would appear to be bleak. The steady-state income growth path would be lower than in countries with comparative advantage in industries with higher technological capacity. On the other hand, South Africa is probably far away from

⁴⁴ Unless unit labour costs declines substantially.

such a steady state, so there should be room for a transitional spurt in growth after a period of restructuring.

If South Africa is able to reduce unit labour costs through a spurt in productivity growth, lower real wages, or both, labour-intensive industries could expand as a response to access to broader markets as well. If they do so at the expense of medium-to-high-technology industries, this would again contribute to a lower technological capacity of the economy. Even in this case, some qualifications must be made with respect to the conclusion that this would unambiguously reduce the prospects for long-run technology-driven growth. Firstly, as discussed in section 2.4, the technological capacity of the South African manufacturing sector may be less impressive than anticipated. If so, there is not that much technological capacity to lose in the event of high-technology industries being partly or totally wiped out. Moreover, maintaining such capacity may be more costly than the South African government is willing or able to pay in terms of subsidies, protection and R&D expenditure. Secondly, if labour-intensive industries became more competitive, employment in the manufacturing sector would increase. In an economy with very high unemployment and a large informal sector, this would mean that total employment would increase. If this formal-sector employment effect outweighs the income effect following lower average real wages, real output would increase as well.

Whether the income or the employment effect dominate, is an empirical question that calls for further research. The prospects for actually reducing average real wages are dependent on, among other things, the strengths of the trade unions and the development of the exchange rate. As far as the latter is concerned, there is an upward pressure (i.e. for appreciation) in periods of rising commodity prices, which seems to be the consensus forecast for the near future. The need to control inflation by means of relatively high interest rates points in the same direction. Pointing in the other direction is the possibility of abolishing the financial Rand. In that case the unified exchange rate would probably settle somewhere between the financial and the commercial Rand, implying a depreciation of the latter. However, this would be a one-off effect. Hence, even if more sectors are exposed to international competition, booming resource-based industries are still likely to crowd out some import-competing industries, limiting the extent of the employment effect.

To conclude this section, South Africa is a developing country in spite of some pockets of high-technology industries. The prospects for a recovery in economic growth following reintegration into the world economy in the short run depends on the ability to exploit the comparative advantage for resource-based industries and economies of scale in these industries. However, the ability to catch up with at least the poorest OECD countries, depends first and foremost on having the social capabilities to imitate and adopt new technologies. Perhaps the most

important element of such social capabilities is a well-educated workforce. To quote Nelson and Wright (1992: 1959),

Convergence [towards the US income level] has occurred among those nations with modern educational systems, strong internal scientific and engineering communities, and sophisticated industrial enterprises. Nations without these attributes have tended to fall farther and farther behind the frontiers. There are now few technological secrets, but it takes major investments of many kinds to command a technology.

Further research is necessary to establish how far South Africa has fallen behind, and to assess the prospects for catching up if the structural change predicted in this study materialises.

5. Conclusions

South Africa is a mineral-rich country and as such has inherited comparative advantage in resource-intensive industries. As is common for mineral or oil-rich countries, South Africa has a cost level that is not justified by productivity performance stemming from technological development. South Africa can afford such cost levels without running into balance of payment difficulties because of mineral rents. To be able to sustain such income (and cost) levels, South Africa has tried to create comparative advantage by protecting import-substituting industries, particularly in the medium-technology category. The potential for a rapid spurt in productivity growth through catching up with technology-leading countries is large in these industries, but the social capability to capitalise on this potential has been inadequate. In addition, there has been lack of incentives as industry demands for more protection have been successful most of the time. Finally, unexhausted economies of scale due to a small market has contributed to the dismal productivity and growth performance. Or to put it in terms of the product cycle framework, South African manufacturing industries have been able to imitate medium-technology products, but not at a lower cost than the innovators.

Promoting medium-technology manufacturing industries can be justified theoretically on the grounds of distortions leading to suboptimal market solutions. Dynamic effects like larger technology potential and more generic technology in other sectors have been identified as one distortion that can justify such interventions. Another is the fact that minerals are assets included in the national wealth portfolio, and mineral rents should be transformed to high-yielding assets like technological capacity in order not to deplete total wealth. The first best correction of this latter distortion is to tax the revenue from mineral rent. Holden (1992) shows that the import-substitution policy, which from the early 1970s was combined with export incentives, has indeed constituted an implicit tax on the gold mining-industry.

The dynamic distortion represented by accumulation of generic technology, or technology spillovers takes place across national borders as well as between firms and industries within a country. Technology spillovers across borders are related to imports through technology embodied in products and services, direct investments through transfer of process technology as well as work organisation and exports through exposure to technology possessed by competitors and standard requirements set by customers.⁴⁵ Hence, this distortion calls for stimulating *trade* and foreign investment in medium-and high-technology industries with generic properties, not necessarily just *export* promotion.⁴⁶

The new South Africa stands on the doorstep to full participation in the world markets. What makes this situation difficult is the fact that all these measures, except facilitating trade as such, have been tried rather unsuccessfully as the above analysis has shown. Hence, income earned mainly from minerals has been invested in sophisticated infrastructure and high-technology industries with meagre results in terms of productivity growth. While investment-led growth followed by relatively slow TFP growth is common in newly industrialised countries, TFP growth has picked up when protection was gradually scaled back as new industries “grew up”. To facilitate “growing up” the NICs - particularly South Korea - invested heavily in human capital (see table 3.3). In South Africa, protection has not declined to any significant extent. To the contrary, in a wide range of industries the effective rate of protection has increased since 1985 (see Hirsch 1993). Thus, South Africa finds itself burdened by overprotected “young adults” rather than “infant” industries. The infant industry protection argument for continuing on an inward-oriented trade and industry policy, even if SADC is included in the “home” market, is therefore weak.

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⁴⁵ The latter, “demanding customers”, is pointed out as an important driving force for competitiveness by Porter (1990).

⁴⁶ Moreover, the available battery of export promotion measures is limited as the new GATT agreement is being implemented. It must also be kept in mind that export subsidies ultimately is a transfer from domestic taxpayers to foreign consumers.

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