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**THE IMPACT OF TRADE LIBERALISATION ON
THE SOUTH AFRICAN AUTOMOTIVE INDUSTRY**

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INTRODUCTION¹

As South African industry becomes increasingly exposed to international competition, among the sectors most affected are those which previously enjoyed the highest levels of protection such as the automotive industry. Protection of this sector has been declining since 1989, a process which accelerated with the introduction of the Motor Industry Development Programme in 1995. The latter programme is now approaching mid term and is under review providing an appropriate point for an evaluation of its impact.

Trade liberalisation will tend to reduce the prices of liberalised products relative both to other goods in the domestic market and to similar commodities internationally. Both standard trade theory and the general equilibrium models used to analyse the sectoral impact of tariff reductions predict a fall in output for the affected sector with the benefits accruing to the rest of the economy in the form of lower prices and a more efficient allocation of resources. But of course reality at the sectoral level is more complex and there are a number of important dynamic effects which will affect the outcome in the sector in question. The actual impact will of course depend on how firms respond to the new unfolding incentive structure. While the change in relative prices would at face value, be to the detriment of the sector, these changes are refracted through the prism of variables such as domestic demand (influenced by lower prices), structural change (which may reduce production costs), growing international integration (which will impact on investment and trade in the sector) and productivity initiatives (spurred by growing competition). These dynamic effects can be of particular importance in an industry such as the automotive industry where economies of scale are important and where a handful of multinational vehicle producers dominate global production and also exercise considerable influence over the location of new investments by first tier component suppliers.

In the South African context, the pressures of trade liberalisation are compounded by difficult economic conditions. Current sales are still below the levels achieved in the early 1980s. The domestic market grew by nearly 25% in 1995, the year that the MIDP was introduced, but have since stagnated and at the time of writing the industry is entering recession as the economy slows under the impact of punitive interest rates. To date the costs of liberalisation have been quite low. The share of imports has grown and profit margins have been eroded but investment and in particular exports have expanded and employment is still above 1993 levels. If the current global crisis leads to a protracted slow down, the consequences of a major recession in a cyclical sector combined with the impact of falling trade barriers would be severe.

The objective of this paper is to illustrate how incentives (specifically changes to the regime of protection and export assistance) affect firm behaviour and the structure of the industry. The reorientation of production can take place very rapidly, sometimes in unexpected ways leaving

¹ The author has benefited from close involvement with the industry through his work as an advisor to the Department of Trade and Industry on the automotive industry. This paper is written in his personal capacity.

both winners and losers in its wake. These transformations carry with them costs and also a warning to governments about the importance of stable policy. Also of great importance are the dynamic effects resulting, for example, from the achievement of scale economies, the forging of international alliances and the emergence of new markets. In this environment, comparative advantage is much less a function of existing endowments but quite clearly created by the interplay of the locational behaviour of multinational corporations, host country policy and domestic market conditions.

THE STRUCTURE OF THE INDUSTRY

Table 1: Sales and Production of Vehicles in South Africa 1950-97 (000s)

	Domestic Sales			Exports	Imports	Local Production
	Cars	Commercials	Total			
1950	37	8	45			
1960	99	20	119			
1970	202	96	298			
1980	277	128	405			
1981	302	152	454			
1982	283	143	426			
1983	273	132	405			
1984	269	137	406			
1985	204	101	305			
1986	174	90	264			
1987	201	108	309			
1988	230	129	359			
1989	221	131	352			
1990	210	125	335	10	2	343
1991	198	110	308	10	3	315
1992	183	101	284	13	4	293
1993	194	104	298	16	6	308
1994	195	113	308	15	10	313
1995	247	140	387	16	19	384
1996	273	148	421	12	39	394
1997	268	131	399	20	54	363
1998 proj.	269	130	399	29	60	368

Note: Vehicle exports and imports were minimal prior to 1990

Sources: NAAMSA, DTI

Market Overview

There are eight producers of light vehicles in South Africa. In 1997 they assembled 350 000 light vehicles of which 5.3% were exported. The value of vehicle production in 1996 was approximately R18.8bn in 1997. Toyota is the dominant producer of both passenger cars and light commercials.

Heavy protection has resulted in proliferation to the extent that most manufacturers build a variety of models and in some cases more than one make in a single assembly plant. All assemblers are now wholly or partly owned by the parent company in Japan, the US or Europe.

Table 2: Assembly firms operating in South Africa

Assembler	Ownership	Makes	Market share %	
			Cars	LCVs
Automakers	Nissan Sankorp	Nissan Fiat	6.4	13.8
BMW (SA)	BMW AG	BMW	5.0	-
Delta	GM	Opel Isuzu	11.2	23.2
Land rover	BMW AG	Landrover	0.8	-
MBSA	MB AG	Mercedes Honda Mitsubishi	8.1	5.2
Samcor	Ford Amic	Ford Mazda	13.6	19.2
Toyota	TMC Wesco	Toyota	22.0	30.3
VW (SA)	VW AG	VW Audi	18.7	4.6
Importers				
Daewoo	Daewoo	Daewoo	3.0	-
Hyundai	HMD	Hyundai	7.5	0.5
Other			3.8	3.2
Total			100	100

Notes: The recently opened Hyundai plant is in Botswana which is part of the Southern African Customs Union (SACU).

Market share for assembler firms includes imports of these makes.

The category "other" includes Chrysler, Volvo, Peugeot, Renault, Subaru and Ssangyong vehicles.

POLICY DEVELOPMENTS

The experience of the past decade illustrates that the overall regulatory regime remains very important in determining the actions of firms. In most respects, South Africa has followed a programme of import substitution similar to that adopted in other developing countries especially in Latin America. High tariffs were placed on CBUs which when combined with a rapidly growing market acted as a magnet to a large number of (initially foreign) companies which established assembly plants in the country. These operations, although in many cases highly profitable, were very small in international terms with correspondingly high unit costs. Production was aimed solely at the domestic market and South African assembly plants were kept isolated from the global production networks of the parent companies except as markets for CKD packs.

Ford and General Motors were the first to establish a production presence in South Africa in the 1920s.² The domestic market expanded rapidly and production of cars reached 87 000 units in 1960 a level higher than any other developing country at the time. The level of local content at this stage was only 20% prompting the introduction of the first of a series of local content programmes in 1961. Local content rose rapidly rising to 52% on a mass basis by 1971. Contrary to government expectations rising local content requirements did nothing to reduce the number of assembly operations in the country which numbered no less than 16 in 1970. Rapid growth was thus accompanied by the proliferation of assemblers and also by the development of a low volume component industry oriented towards the production of heavier components such as body pressings (due to local content being measured on a mass basis). Later phases of the local content programme increased local content requirements to 66% for all light vehicles³.

In all these developments the main motivating factor for increasing local content remained the desire to save foreign exchange. A series of Board of Trade and Industry⁴ reports recognised the need to encourage higher production volumes and the advantages of standardisation and frequently referred to the need for rationalisation. However, proponents of more interventionist policies to rationalise the industry by limiting the number of assemblers and pushing up local content level to 90% did not prevail. Thus prohibitive rates of protection were maintained on built up vehicles, no restrictions were placed on the number of assemblers entering the market and local content requirements were kept at fairly low levels.

² For further detail on the history of automotive development policy see Black (1994) and Duncan (1997)

³ This requirement was introduced under Phase III of the local content programme in 1971 and extended to light commercials in Phase V which was introduced in 1980.

⁴ Now named Board on Tariffs and Trade (BTT).

The Phase VI Programme

The problems inherent in the above approach to the promotion of local content had become obvious during the recessionary years of the 1970s. The situation was aggravated by the severe slump which followed the gold boom of the early 1980s. Exports were minimal and with the increased introduction of highly sophisticated components it had become increasingly easy to meet the mass based local content requirements while increasing the value of imported componentry.

Phase VI of the local content programme, introduced in 1989, marked a substantial change of direction. It was the first attempt to address the problems of an inwardly oriented, overly fragmented industry with low volume output and associated high unit costs. Local content was to be measured by value rather than mass. Most importantly local content was to be measured not just by the value of domestically produced components fitted to locally assembled vehicles but on a net foreign exchange usage basis. In other words, exports by an assembler counted as local content and enabled it to reduce actual local content (to a minimum of 50%) in domestically produced vehicles. Exports especially of components grew extremely rapidly with firms citing the increased availability of incentives and the desire to increase the scale of production and improve product quality as the major factors motivating exports (Black, 1994:59). Rapidly rising exports gave assemblers greater flexibility in their sourcing arrangements.

One of the problems of the previous programmes was uneconomic volumes and the resulting high cost production structure. Phase VI was intended to encourage both local content and specialisation. However, it did not address the major factor impacting on the scale of production in the component sector - proliferation of makes and models in the domestic market. In fact the impact was rather the reverse. By increasing the flexibility of component sourcing (and hence reducing protection on components) but at the same time maintaining high nominal protection level on CBUs, the effective rate of protection on CBUs increased sharply under Phase VI leading predictably to an increase in the variety of models and makes being assembled locally in spite of the stagnant market.

Phase VI came in for heavy criticism with frequent changes adding to the atmosphere of uncertainty and in late 1992 the Motor Industry Task Group was appointed to re-examine the programme and the future development of the industry. The eventual outcome was the Motor Industry Development Programme which was introduced in 1995 and runs until 2002. It continued the direction taken by Phase VI and entrenched the principle of export complementation. However it went a step further by abolishing local content requirements and introducing a tariff phase down at a steeper rate than the terms of South Africa's offer to the GATT.

The main elements of the MIDP are the following:

- a) The excise duty based local content system has been changed to a tariff driven programme.

- b) There is no minimum local content requirement.
- c) Tariffs on light vehicles are being phased down to 40 % for light vehicles and 30% for components by 2002
- d) Manufacturers of light vehicles are entitled to a duty free allowance (27% of the wholesale value of the vehicle) for the importation of original equipment components.
- e) Import duty on components and vehicles may be offset by import rebate credits derived from the export of vehicles and components.
- f) Provision is made for a Small Vehicle Incentive (SVI) in the form of a higher duty free allowance for low cost vehicles.

While nominal duties on imported vehicles will remain high even until the year 2002, the ability to rebate import duties by exporting enables importers to bring in vehicles at lower effective rates of duty. Export complementation also enables assemblers to use import credits to source components at close to international prices. This means that there is still a strong incentive to assemble locally as evidenced by the recent introduction of low volume new models which are being locally assembled (e.g. Mercedes E Class). A number of manufacturers such as Daewoo have also been investigating the establishment of small scale assembly plants in South Africa.

A survey of component firms undertaken in 1995 just before the introduction of the MIDP showed that firms were well aware of the changes that would have to be made in response to the new programme. They also proved remarkably accurate in forecasting a rapid increase in exports, moderate increases in investment and roughly stable employment.⁵

Table 3: Competitive Responses to Phase VI and the New Programme

	New Prog Phase VI	
Improving Plant efficiency (e.g. Work organisation)	151	120
Expanding Exports	116	112
Increasing Investment to raise productivity	83	60
Improving product/process technology	74	55
Expanding output	68	60
Standardising product line	56	33
Increasing training	49	45
Establishing links with foreign\local partners	32	54
Diversifying product line	21	33
Reducing product price	18	53
Sourcing subcomponents internationally	17	19
Reducing employment	11	17
Drastically curtailing manufacturing operations/moving into distribution	0	2

Note: Firms were asked to rank the five most important responses to the pressures and opportunities resulting firstly from Phase VI which was introduced in 1989 and secondly expected to arise from the new programme.

⁵ See Black (1995).

Imports

Until the early 1990s, prohibitive tariff levels resulted in low levels of imported vehicles into South Africa. The opening up of the economy and the phasing down of tariffs have led to an increased level of vehicle imports which have increased from 2% of the market in 1990 to 13%⁶ in 1997. In 1997, nearly 55% of light vehicle imports were from Korea comprising mainly Hyundai and Daewoo vehicles but these accounted for only approximately 30% in value terms. It is estimated that light vehicle imports will account for approximately 20 - 25 % of the market by the year 2002.

Components and local content

The introduction of a series of local content programmes led to increased level of local content as detailed above. with the introduction of phase VI and later the MIDP the sector has been coming under increasing pressure from imports. When Phase VI was introduced the switch from mass based to value based local content had a highly differentiated effect on the component sector. OEMs began looking at ways of increasing local content by value rather than mass. Heavy components such as body pressings were no longer required and came under increasing pressure especially as high tooling costs made short production runs especially uneconomic.

Components which formed part of sub assemblies were also at risk because they became easier and cheaper to import in a semi assembled form thus simplifying assembly and limiting the problems of re-engineering, quality and supply complexities.

However, for models introduced under Phase V, manufacturers tended to maintain sourcing arrangements as they had already invested in tooling. Also, it took time to build up large export volumes. Thus the increased flexibility to source additional components abroad was most apparent with new model introductions and started to have a significant impact during 1992.

Component producers have continued to come under severe pressure under the MIDP with annual price increases significantly below inflation levels. The result has been a decline in local content although as Table 4 indicates this has not been dramatic. Of greater concern is the local content level in new models which as Table 5 indicates is very low in some cases⁷. On this measure a local content level of under 40% is very low in terms of actual local components fitted and could comprise mainly peripheral components such as wheels, exhausts, certain trim components, batteries and glass.

⁶ This includes imports of semi-knocked down vehicles imported under a temporary concession.

⁷ Some caution should be exercised in the interpretation of the data. The data on new model local content levels (Table ?) are not weighted according to volume. Lower local content models would tend to be lower volume vehicles. The measurement of local content in Table 5 includes assembly and profit margins so these figures are not comparable with the local content percentage in Table 4.

As a result of growing component and vehicle imports the overall trade deficit widened dramatically from under R5bn in 1992 (a year of weak demand) to R14 bn in 1996 before declining as a result of falling domestic vehicle production, growing exports and a relatively strong currency in 1997.

Table 4: Purchases of original equipment components by vehicle manufacturers

	Local purchases (Rm)	Imports (Rm)	Total purchases (Rm)	Local content (%)
1994	5490	7562	13052	42
1995	6709	9272	15980	42
1996	6652	10031	16683	40
1997	6641	10380	17021	39

Note: Data includes only OE components used in domestic assembly
Source: DTI Survey

Table 5 :Local content level of new models introduced since September 1995

New model	Local content (%)
A	61
B	60
C	58
D	51
E	41
F	39
G	37
Average (new models - unweighted)	49.6
Weighted average for the industry	57.5

Note: Local content measured by ex works price less foreign content.
Source: Department of Trade and Industry

5.2. Exports

Exports have grown by nearly 1900% from 1988 to 1997 and all indications are that growth will continue for the next few years at least. A number of factors have accounted for this. The export import complementation arrangements of Phase VI and the MIDP have powerfully assisted exports. Secondly, falling protection and limited domestic market growth possibilities have forced firms into the export market.

Table 6: Automotive Exports (Fob values, Rm)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998*
Components	139	300	400	700	1,100	1,700	2,100	3,300	4,050	4,747	5 500
Vehicles	176	229	381	392	419	581	695	900	750	1,447	2 315
Total	315	529	781	1,092	1,519	2,281	2,795	4,200	4,800	6,194	7 815

* Estimates based on exports for the first six months

Source: Dept of Trade and Industry

Light vehicle exports have increased from 11 400 units in 1992 to 18 700 units in 1997 following a sharp decline in 1996 with the ending of the VW's China contract. Approximately 1 100 medium and heavy trucks were exported during 1997. The main destination for vehicle exports is to Africa. However exports to non - African markets are likely to be the fastest growing in the short term and will consist mainly of passenger cars. Volkswagen have a large contract to export Golfs to the UK and BMW exports the 3 Series vehicle to Australia and a number of Asian markets.

As Table 7 indicates, component exports have expanded dramatically. The prime objective of the export complementation scheme is assist component suppliers to generate high volumes which make them more efficient, and able to compete in the domestic market against imports. While this objective has been achieved in part, component exports are dominated by a small range of products, some of which could be described as peripheral. The industry supplying leather seat covers supplies the bulk of BMW's global requirements and is an important supplier to a number of other foreign vehicle manufacturers. The industry is labour intensive and a significant specialised tanning industry has developed to supply it. The catalytic converter industry is more capital intensive but has also encouraged the development of a significant base of sub suppliers. The advantage for this industry is the fact that 90% of the precious metal content in the catalytic converter is included in the valuation of exports for import rebate purposes.

While the objective of creating opportunities for existing component producers to increase volumes and reduce unit costs has to some extent been achieved, the bulk of export expansion has not been by 'traditional' component suppliers but by a rapidly emerging new group of mainly foreign owned firms frequently with links to vehicle manufacturers. In the short term at least, a number of vehicle manufacturers have sought to rapidly develop new sources of exports

and therefore the ability to rebate import duties on imported components and vehicles. This has also been the route followed by independent vehicle distributors who are marketing imported brands newly available on the South African market. Relatively light investments with a low level of integration into the domestic industry either in terms of supply to domestic vehicles or in terms of the use of sub-components has been one outcome. However, it should be stated that there are very significant exceptions in the form of major component exports such as engines which in the case of the Samcor engine project are in sufficient volume to generate high level of local content.

Table 7: Exports of components (Fob values, Rm)

	1995	1996	1997	% of 1997 Total
Stitched leather covers	1019	1259	1396	29.4
Catalytic converters	388	485	686	14.5
Tyres	219	296	327	6.9
Automotive tooling	259	279	326	6.9
Road wheels/parts	175	227	301	6.3
Silencers/exhaust pipes	76	170	228	4.8
Engine parts	112	137	163	3.4
Glass	49	71	106	2.2
Batteries	53	60	90	1.9
Engines	10	86	62	1.3
Filters	13	42	50	1.1
Brake parts	23	29	39	0.8
Body parts/panels	18	39	37	0.8
Shock absorbers	38	53	35	0.7
Gauges/instruments/parts	18	28	33	0.7
Clutches/shaft couplings	16	21	33	0.7
Car radios	7	4	28	0.6
Jacks	13	21	24	0.5
Springs	16	19	21	0.4
Other components	797	727	762	16.1
TOTAL	3318	4051	4747	100

Source: Department of Trade and Industry

INVESTMENT AND PROFITABILITY

Net profits before tax of the seven light vehicle manufacturers increased off a low base from R328m in 1992 to a record level of R2 032m in 1995. Profits were boosted by a 25% increase in sales in 1995 and also a one off advantage resulting from the changeover to the MIDP which

allowed one off gains from duties on components. Since then profits have dipped precipitously and the industry incurred a large aggregate loss in 1997 with 1998 unlikely to show any improvement. The entry of imported vehicles in significant volumes has led to much greater price competition and lower margins which have added to the pressures of stagnating sales volumes.

Table 8: Aggregate Profit Performance of Vehicle Manufacturers

	Net profit before tax (Rm)
1992	328
1993	612
1994	1 158
1995	2 032
1996	520
1997	(547)

Source: Department of Trade and Industry

Profitability in the component industry has also fallen sharply. A survey conducted by the Department of Trade and Industry in 1997 indicated that for a sample of 21 firms profits fell by 74.6% during 1996 from the record levels of 1995 (Department of Trade and Industry, 1997). The key factor here has been falling margins largely resulting from price pressure applied by vehicle manufacturers.

A survey of 35 component firms conducted by Barnes (1998) indicated that the decline in profitability may be levelling out with an increasing number of firms showing increased profits from 1996-97 compared to 1995-96. However, dismal current market conditions are likely to ensure that profit levels will continue to come under pressure. There is also a clear division in the fortunes of component suppliers - exporters have done well while those restricted to the domestic market for reasons of size, licensing restrictions or the lack of a link to a foreign company are under growing pressure.

The supply response to the realignment of domestic and international prices is the key variable which will determine the impact of liberalisation on the automotive industry and this in turn will hinge on investments made by firms. Historically, protection led to the expansion of production capacity in vehicles and a wide range of components. However, this was initially aimed at low volume production capability, ill suited to the requirements of high volume and efficient exporting. In the assembly industry, for example, much of the investment was in model specific tooling for bringing new products to the market and the industry is characterised by limited automation and low productivity.

While profits are declining in a more competitive market, there is clearly the risk of investment being reduced and gradual attrition taking place leading to the withdrawal of firms. However,

the investment behaviour of the assemblers is influenced by a number of industry specific factors. The importance of economies of scale means that the increased competitive temperature places some pressure on firms to increase production as a way of reducing unit costs. This in turn may require that the parent company creates export opportunities for the SA subsidiary and invests accordingly. Investments have to be enlarged or firms face the prospect of losing market position and eventually becoming unviable, thus the situation now facing the local assemblers and their parent companies is akin to a game of poker - to stay in the game the stakes have to be increased. Given that the key investment decisions are made outside South Africa by the global parent, short term profitability in a minor SA subsidiary is likely to be a much smaller consideration than medium term market prospects and strategic concerns related to market share and the locational logic of global production networks.

Interestingly, investment has been rising in both assembly and the component sector. Some firms such as BMW have announced major expansion plans and aggregate investment has been increasing steadily (Table 9). While inflows of foreign direct investment into the South African economy have totalled a moderate R27.3bn during 1995-97, the automotive sector has been the third largest recipient (after telecommunications, food and beverages) In the assembly sector apart from plant upgrades and expansions a significant trend has been the purchase of majority or minority stakes by Ford (Samcor), Toyota Motor Corp. (Toyota SA), Nissan Motor Corp. (Nissan SA) and General Motors (Delta). However the investments made in plants have not reached the level of the massive investments that have been made in emerging market countries such as Brazil, Thailand, Argentine and eastern Europe. Neither with a few exceptions have major investments been attracted into first tier components.

Table 9: Investment expenditure by vehicle manufacturers

	Vehicle assembly Rm
1990	660
1991	697
1992	858
1993	400
1994	492
1995	847
1996	1 171
1997	1 265
1998 proj.	2 067

Source: NAAMSA

Note: The projected figure for 1998 is likely to be an over-estimate.

The automotive industry is exceptionally cyclical and this shows up in employment levels. Disaggregating the effect of trade liberalisation from the impact of market conditions is

complicated by the impact on market growth resulting from the reduced price of vehicles in real terms which in turn is partly the result of liberalisation. The export sector has now also become a major source of employment. However, the potential for massive productivity gains make employment losses in the assembly sector unlikely and the potential for employment growth will be primarily in the component sector.⁸

Table :Employment in automotive manufacturing

	Assembly	Components	Total
1993	37 200	33 700	70 900
1994	37 600	36 200	73 800
1995	38 600	41 300	79 900
1996	38 600	43 500	82 100
1997	37 100	42 600	78 700

Source: CSS, NAAMSA

RATIONALISATION

The scale of production is one of the central policy issues facing the South African automotive industry. South Africa's seven light vehicle plants produced an average of only 53 000 vehicles last year and in addition produced a total of 38 different basic models. Resulting average volumes per model are way below the world norm and significantly lower even than in relatively low volume producers such as Brazil and Australia. As Table 10 shows this has changed little in recent years in spite of the new competitive pressures introduced by the MIDP. The cost premium incurred by component makers for producing a wide range of products at low volume is considerable.

This is an issue which policy sought to address via tariff reductions and export complementation arrangements. However, low volumes have continued to be produced in spite of growing price pressures on assemblers. The reason is that the effective rate of protection has remained high because of the ability to reduce component prices and the abolition of local content requirements. The result has been that low volume models can be introduced at low cost in relatively low volume. This process has been exacerbated by measures such as the Small Vehicle Incentive which has encouraged new entrant models into this segment.

Vehicle exports have taken longer to materialise partly and no major export programme is yet in place although BMW are beginning to ramp up production and VW have recently begun delivery on a large export order to the UK.⁹ With one or two exceptions, domestic production of large volumes depends on exports which in turn requires an allocation from the parent company. Rising production efficiencies, pressure on local margins as well as clear government

⁸ Nearly all the scenarios in the Motor Industry Development Council's model produce this outcome.

⁹ Ironically the new generation Gold being exported to Britain will have virtually no local content.

policy are necessary to force the hand of the parent company. Indications now are that more (especially German based firms) may chose this route which could act as a catalyst for direct investment by foreign first tier suppliers.

Table 10: Volume performance by passenger motor vehicle model lines

Production volumes (annual)	Number of model lines					
	1992	1993	1994	1995	1996	1997
0-9999	10	8	8	10	9	10
10 000 - 19 999	9	8	8	7	8	8
20 000 - 29 999	0	0	1	3	3	4
30 000+	1	1	1	1	1	0
Models Manufactured in the Year	20	17	18	21	21	22

Figure 1:

Examples of the scale of production in South African components producers compared to international producers

Body pressings - SA firm makes 1000 different components. Press shop in Japan would typically make 150 with much higher total volume.

Alternators, starter motors, electronic control units - SA firm produces 300 000 alternators per year. German parent company has recently established new plant in Wales with a capacity of 8 million alternators per year. The new SA plant producing electronic control units is more suited to low volume production as it is organised on a cellular basis. A European plant would be similar but with a larger number of cells replicating a similar production process.

Exhaust systems - largest SA plant is one third of group's largest European plant and makes a larger variety of products.

Steering Wheels - SA plant has capacity of 300 000/year compared to 2 million in German plant which produces a smaller variety.

Pistons - SA producer uses 5 lines to manufacture a wide range of pistons at a rate of 60 000 per month. Current batch size of 500 is being reduced to 200. A US based piston

producer in the same world-wide group uses 7 highly automated lines to manufacture only 7 variants but has a capacity of 600 000/month.

Various components - Major automotive holding company with several component subsidiaries have conducted a survey of parts produced which indicated that less than 5 percent of the various parts produced were in volumes of more than 2000/month.

Source: Black (1994)

As the following case study demonstrates, the cost premium incurred by component makers for producing a wide range of products at low volume is considerable.

Alfred Teves produces braking systems under licence from Alfred Teves AG which is in turn owned by the giant US component maker ITT. Ate was set up originally for volume production in the early 1980s when the South African market was booming and there was the perception that it would also become a major supply source to Africa. Instead, however, volumes declined and a wider range of vehicles was produced. The future of firms such as Ate depend very much on the strategies of local assemblers. The advantages of higher volume production are apparent in the strategy of BMW which is planning to source the right hand drive version of the E46 from South Africa. The firm plans to be producing 40-50 000 3 Series vehicles out of South Africa by the turn of the century.

This will have a major impact on the local component sector as BMW wishes to source 60% of its components domestically and is encouraging its German component suppliers to take equity stakes in South African licensee firms. The price savings that can be achieved from greater economies of scale are considerable. Ate's current production of 15 000 disc brake sets for the 3 series at a cost of R146.00 each is 28% above the price in Germany. If volumes increase to 60 000 vehicle sets it could match the German price.

The major cost savings result from a reduction in fixed costs especially in the amortisation of machinery. These in turn result from reduced machine downtime because of a reduced number of machine changeovers. As the chief executive of Ate puts it:

“If you want to have a Japanese JIT system and make (a part) when the customer wants it, this would require 280 hours/week (35 part numbers - changeover time of 6-8 hours) just to change over and since a week on a triple shift basis has 168 hours you could not make every part each week so you have to do cost comparisons of how much it costs to change over - make an appropriate quantity for a month (or even 6 months) worth then carry the costs of inventory. The alternative is to put in other machining equipment - so you have six lines but then you have excess capacity”.

On the existing line 380 000 pieces (190 000 car sets) can be machined per year at 65% machine efficiency. Change overs also require that before a volume run begins the first off sample is tested for quality. Then production can begin at a rate of one piece per minute. In theory at the end of one shift (480 minutes) 480 parts could be produced. This amounts to five months worth of stock for a low volume vehicle such as the BMW 5 series. So for low volume vehicles, the tendency is to invest in flexible CNC equipment (R1-2m) with a changeover time of 20 minutes. This machinery is highly flexible but very slow for low volumes with a machining time of 14 minutes per piece (Table 11). Dedicated machining lines are designed for speed and comprise a set of eight hydraulically operated fixtures on a rotating table. Eight processes (drilling, milling etc.) are therefore happening simultaneously. With flexible CNC machining equipment each process is separate, accounting for a total of at least 8 minutes plus the time for the machine to replace each tool back in the magazine. Machine changeovers on dedicated equipment are a complicated and arduous task involving removal of the machining table, fixture stations and tools and the disconnection of hydraulic clamping devices. These tasks are carried out by artisans. This type of dedicated machinery is not designed for frequent changeovers and foreign technical experts visiting the plant have been amazed that what they consider to be machine rebuilds are carried out on a routine basis. Frequent changeovers can also lead to quality problems.

Table 11: Flexible machinery vs. dedicated automation

	Flexible CNC machining line	Dedicated automation
Cost	R1-2m	R10m
Changeover time	20 minutes	6-8 hours
Machining time per piece	14 minutes	1 minute

Source: Interviews

Low volumes and the proliferation of models in the domestic market is the major obstacle to improved competitiveness. For example Ate produces 28 different part numbers of brake calliper for total production of 300 000 pieces per year (an average of 10 700 units per part number). The minimum number of changeovers is therefore 28 but in reality would be much higher because otherwise the firm would be holding a year's worth of stock. The decision on how many times to change over depends on the balance of the cost of downtime versus the balance of the cost of inventory. Because of the length of changeovers, low volume parts are only produced once or twice per annum. In contrast, the Ate licensor supplying fist callipers to BMW in Germany produces 425 000 vehicle sets per year of the same part number on dedicated lines out of plants in the UK and Germany. The only changeover required is between left and right which is not as complicated as a changover between different makes. The diversity of part numbers and the resultant need to queue production means that machine utilisation levels are low particularly for dedicated machining facilities (Table 12).

Table 12: Comparative Machine Utilisation Rates in a European and a South African Brake Plant

	Europe	South Africa
Dedicated machining	75-80%#	55-60%
CNC machining	85%	80%

80% can be achieved without machine change overs.

Another problem arising out of such low volume requirements are the huge levels of inventory that have to be carried. Ate has a huge inventory store and stocks of raw material, components, half assembled and completed products are valued at R24million for a firm which has a turnover of R130m. With higher production levels, raw material subcomponent costs can also be substantially reduced.

Considerable technological effort goes into incremental changes to increase flexibility. To reduce tooling costs for the wide diversity of part numbers produced, a number of innovations have been introduced. For example, broach tools have been divided into segments to make them more versatile. Another large investment is in milling cutters which cost R20 000 each. The numbers of these required have been reduced by putting in special inserts which allow 4 sides of the cutter instead of two to be used. The presetting of tools on CNC equipment has reduced downtime in that area due to machine changeovers. On transfer lines changeover times have been reduced from 16-20 hours to 6-8 hours.

Ate's initial investment was in high volume transfer lines which are unsuitable for low volume production runs. Since then the firm has invested in some flexible machinery which minimises machine downtime but cannot compete with dedicated lines where high volumes are required. Many other South African component producers are in an even more intractable situation now that they are confronted with international competition and the need to export. Since the early 1980s a number of component firms (and assemblers) have geared themselves for flexible production and simply lack the output capacity for high volume production. This is a major obstacle for breaking into high volume production for overseas OE markets

The cost penalties incurred as a result of low volumes and complexity in the domestic market are significant. What is clear, however, is that firms such as Ate have developed considerable production capability in operating complex machinery under very unfavourable conditions, in introducing small innovations to increase flexibility and in the capacity to undertake machine rebuilds to stretch the life of capital equipment. In terms of technological capability, firms like this are a match for many low cost producers internationally although on a simple, price comparison they would be regarded as "uncompetitive". It is, therefore, important that the process of trade liberalisation takes account of the fact that a significant amount of firm level "inefficiency" may result from the specific industrial structure and also that the nature of fixed investments mean that adjustment to new market conditions cannot be achieved overnight.

CONCLUSIONS AND POLICY IMPLICATIONS

The first conclusion that can be drawn concerns the nature of comparative and competitive advantage. The automotive industry long thought to epitomise protected inefficiency and the denial of comparative advantage has proved capable of massive (albeit assisted) export expansion to the point where it has become one of South Africa's major manufactured exporters. Much of the 'inefficiency' that exists is a result of factors external to the firm namely a fragmented industry structure which forces upon firms patterns of investment and production management which are efficient in a particular context but very sub-optimal in a globalising industry. The requirements of restructuring (new capital equipment, new forms of production organisation, new suppliers and new markets) can therefore be very significant - this in turn has clear implications for what is achievable in terms of the pace of tariff reform. The process of adjustment will certainly be helped or hindered by prevailing economic conditions. Liberalisation at a time of low growth and economic uncertainty can easily lead to a vicious circle of rapid falls in investment and output.

Another consideration is the balance of tariff reform. Arguably in the automotive industry, too much pressure has been placed on component suppliers relative to the assemblers. Suppliers have thus had to meet increasingly stringent pricing demands in spite of the fact that domestic volumes have stayed low. The result has to some extent been the emergence of dualism in the sector - the growth of a large export sector which is not very closely integrated with a low volume, low local content assembly industry supplying the domestic market.

There is widespread agreement that the structure of the industry needs to be rationalised. The sledgehammer route is to simply accelerate the pace of tariff reductions. A rapid reduction in protection would lead to plant closures and the result would be perhaps three remaining plants producing quite high volumes with probably high local content levels. While this is not altogether a negative outcome the risks and transition costs would be extremely high. There is some merit in the policy currently being considered by government could make use of a system of incentives and penalties to encourage higher volumes per model. The object would be to attempt to create a set of incentives for firms which approximate those of a more competitive market while retaining around 75% of the market for local assembly. Australian experience with this system indicates that it is essential that tariffs and other policies are pushing in the direction of a more rationalised industry with the extra spur being provided by more interventionist measures.