

**COMPETITION AND MARKET STRUCTURE IN THE PLASTICS
SECTOR:
A PRELIMINARY ANALYSIS**

Chris Malikane, Simon Roberts, Ndiadivha Sikhweni¹
Department of Economics, University of the Witwatersrand, Johannesburg

February 2000

Contents

1.	Introduction	4
2.	Methodology and approach	5
3.	Product market	8
	3.1 Overview of the plastics and chemicals supply 'chain'	8
	3.2 Derivatives from commodity polymers (intermediate products)	11
	3.3 Finished products	
	3.4 Prices	11
	3.5 Concentration in the plastics sector	13
		16
4.	Corporate structure and market structure in polymer manufacture	17
	4.1 Main corporate groupings	
	4.2 Ownership and control relationships	18
	4.3 Vertical relationships: market power and efficiencies	22
		22
5.	Barriers to entry and competition	24
	5.1 Economies of scale, and technology	
	5.2 Trade, transport costs and tariffs	24
	5.3 Vertical supply relationships and sunk capacity	25
		27
6.	Market power, corporate strategies and growth of the sector	28
7.	Conclusions: the relationship between structure and behaviour	33
	Notes	
	References	37
		39

1. Introduction

The South African Competition Act of 1998, implemented on 1 September 1999, establishes a range of criteria for evaluating mergers and company practices that are deemed to harm economic efficiency, among other objectives. In particular, the Act prohibits a range of practices if the firm is 'dominant', including charging an 'excessive price', engaging in an 'exclusionary act', or price discrimination (Sections 8 and 9). 'Dominance' is defined as having at least a 45 percent market share, or less than 45 percent if the firm has market power (Section 7). A range of horizontal and vertical restrictive practices are also prohibited (Sections 4 and 5). For the implementation of the Act the links between structure and behaviour are therefore extremely important. This paper seeks to explore these relationships in a particular industrial sector, that of plastics, and in so doing to highlight issues in the implementation of competition policy.

Plastics manufacture covers a supply chain or *filiière* which runs from polymers to finished plastic products.² Plastic products themselves also provide inputs to a range of industries such as motor vehicles, packaging, textiles and clothing, construction and furniture. This implies that plastic products are more important in the development of manufacturing than their share of manufacturing production of 2.8 percent would suggest.

The levels in the supply chain differ greatly in their production characteristics. Polymer manufacture is relatively capital intensive and is broadly characterised by economies of scale, significant transport costs and a corresponding concentration of production. Downstream plastics manufacture, by contrast, is characterised by low or negligible scale economies. While many firms in some of the industries use plastic products, there is a very small number of plastics firms. An overview of the sector is necessary to understand the linkages between different levels, and the study then analyses polymer production in more detail. Assessment of corporate structure and performance, market structure, vertical relationships and barriers to entry provide the foundation for an analysis of market power and some tentative conclusions for the implementation of the new competition legislation.

2. Methodology and approach

Three main approaches to the analysis of market structure can be distinguished³:

1. The **Structure-Conduct-Performance (SCP)** school holds that market structure is the key determinant of firms' behaviour which, in turn, determines the performance of the sector. The more concentrated a market, the more likely firms are to collude, reducing output, raising price and reducing incentives to innovate, yielding inefficient outcomes.
2. In contrast, the **Efficient Structure** approach, associated with the Chicago school, holds that the large market share of firms reflects their competitive success, and that market structure is the result of vigorous competition, which itself yields economic growth. This approach emphasises that if firms fail to innovate and attempt to exploit their size then new entrants will undercut them as barriers to entry are believed to be relatively low.
3. **New industrial organisation** theories and **institutional economics** encompass a variety of analyses, which together point to important factors for understanding the inter-relationship of structural characteristics and firm behaviour. While industrial organisation theories (including those underpinning the SCP school) relax the assumptions of perfect competition to generate different models of oligopoly and monopolistic competition, research within this framework has increasingly included an explicit focus on the interdependence of firms' decisions and the importance of institutional and other non-market relationships. In these approaches, the outcomes are very sensitive to the initial conditions and assumptions made, particularly over areas such as information. For example, game theory models have been developed examining the establishment of barriers to entry, such as through committing to sunk costs or building a reputation to fight entrants (which relies on information). In this case, the models demonstrate the need to extend the consideration of barriers to entry beyond exogenous factors (such as technology and economies of scale), to endogenous outcomes of decision-making by firms within a dynamic context. The institutional arrangements therefore both reflect past decisions and influence the structure within which future decisions are taken.

Institutional approaches, starting from the insights of Coase (1937), examine the decision-making processes in terms of the nature of the firm. This approach views the firm as a governance structure incorporating sets of non-market relationships for production and exchange. The firm internalises costs which would otherwise be associated with market transactions where there are imperfect information, asset specificity, uncertainty, small numbers bargaining and conditions for opportunism (Williamson, 1986). These factors also apply to relationships between firms, and provide a framework within which to assess the nature of these relationships and the contracts governing them. The boundaries of firms in this interpretation may therefore be fuzzy, as long-term arrangements may govern the development and use of technology, the supply of important inputs and the marketing and distribution of products. Competition is less about a series of discrete decisions by homogenous entities than the interaction between heterogeneous institutions governing the organisation of production and exchange. Best (1990) calls the strategic interactions between entrepreneurial firms, including institutional relationships within production chains, the 'new competition'.

Research Approach

Drawing particularly on the insights of recent industrial organisation theories and institutional economics, the study analyses structural characteristics (including concentration, economies of scale and barriers to entry), the institutional arrangements which exist, the interplay between major firms, and the various factors which have influenced the evolution of the sector over time. These include the vertical relationships between firms operating at different levels in the production chain.

Rather than employing a rigid framework and a pre-conception of competition (for example, as the conduct characterising a particular market structure), the study examines the different dimensions of the environment within which firms interact and the processes of competition or rivalry between firms. Firms are understood to be structures governing the control and use of managerial and technical resources in the organisation of production. The study assessed the resources, the sources of competitive strengths, the factors which influence

firms' strategies, and their corporate decision-making in terms of price, production, investment, product differentiation, and arrangements governing the purchases of inputs and sales of outputs. It therefore attempts to examine both horizontal and vertical aspects of firms' relationships, of which structural factors are an important part.

This approach necessitates a qualitative as well as quantitative research approach. Possible interpretations of data on the performance of the sector and the firms were therefore explored through semi-structured interviews conducted with firms at the different levels in the production chain as well as with representatives of government and industry organisations.

Section 3 provides the overview of the product chain, examining production, trade, product differentiation and polymer prices. Section 4 analyses the main corporate groupings involved in the production of polymers, their performance, corporate strategies and institutional relationships. Section 5 assesses barriers to entry in terms of economies of scale, technology, supply relationships and capacity decisions, as well as impediments to imports. Section 6, which deal with market power and corporate strategies draws on this information and analysis, with some conclusions being drawn in Section 7.

3. Product market

3.1 Overview of the plastics and chemicals supply chain

Based on the processing of oil, natural gas and coal, a number of distinct levels in the chemicals and plastics production chain can be distinguished. The chain starts from seven main organic chemical groupings which are the 'building blocks' from which various polymers are produced (Table 1). A few of these polymers then form the main inputs into manufactured plastic products, which can be separated into intermediate and final products. Figure 1 indicates the main levels in the production chain.

Figure 1. Plastics and polymers production chain

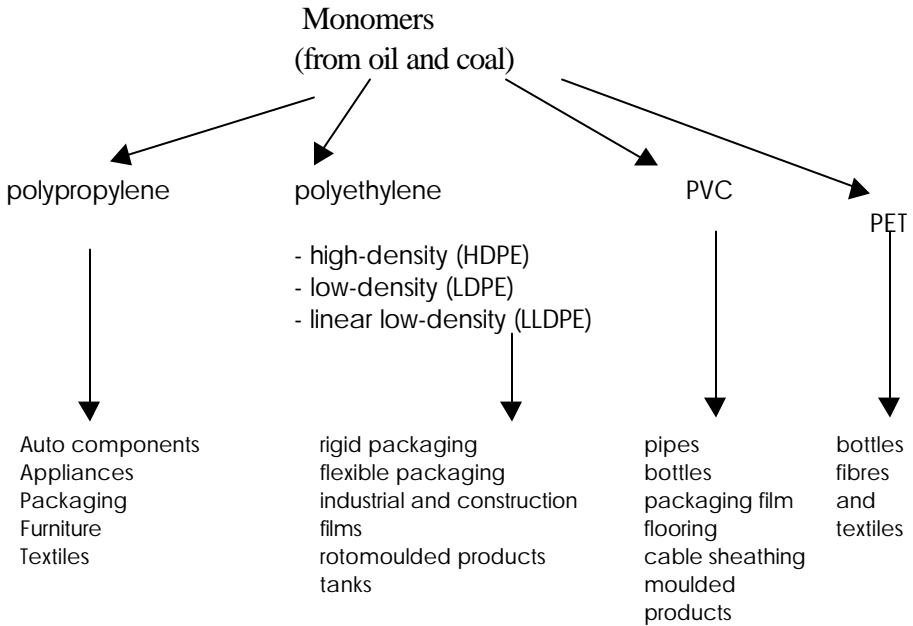


Table 1. South African production capacity of the seven main chemical 'building blocks' (tonnes per annum)

Ethylene	410000 (all produced by Polifin)
Propylene	875000 (>80% are produced by Polifin)
C4 Olefins	
Benzene	< 30000 (produced by Engen)
Toluene	(produced by Engen)
Xylenes	(produced by Engen)
Methane	

Source: PARAS Report, 1998

The main polymer products, which form part of the plastics chain and in which

production takes place in South Africa, are indicated in Table 2. South Africa has a negative trade balance in polyethylene and PVC and a large trade surplus in polypropylene. When disaggregating polyethylene into the different product groupings, it is evident that the deficit is due to LDPE, as supply exceeds demand in both HDPE and LLDPE. In PVC, however, there is a trade deficit despite the excess of supply over demand in terms of volume. This appears to be largely due to 'once-off' factors related to the temporary shut-down of the main South African production facility during 1997.⁴

Table 2. Polymer supply and demand by volume, and trade (1997)

	Supply (tpa)	Demand (tpa)	Exports (R million)	Imports (R million)	Trade Balance (R million)
Polyethylene:					
High-density polyethylene (HDPE)	180 000	155 000	99.2	98.1	1.1
Low-density polyethylene (LDPE) ¹	93 000	135 000	44.2	267.0	-222.8
Linear low-density polyethylene (LLDPE) ¹	105 000	87 000			
Other ²			13.9	72.8	-58.9
Polypropylene (PP)	310 000	132 000	246.2	48.5	197.7
Polyvinyl Chloride (PVC)	160 000	152 000	26.6	205.2	-178.6
Polyethylene terephthalate (PET)	165 000	108 000 ³	22.4	7.2	15.2

Source: *PARAS Report, 1998 and DTI*

Notes: ¹ LDPE and LLDPE are not distinguished in the trade data.

² The other six-digit classifications within polyethylene (HS codes 390130 and 390190) include products which are co-polymer combinations of ethylene with other products.

³ Estimate

⁴ Trade data are for SACU

Despite the large trade surplus in polypropylene and excess of domestic supply, there are significant imports. In addition to reporting errors, this may reflect differentiation of grades of polypropylene and the pricing practices of domestic producers.

Product differentiation of commodity polymers

While the main polymers are relatively homogenous products, there are differences in grade and quality, especially in polyethylene. This is separated into three quite different forms: low-density polyethylene (LDPE), linear low-density polyethylene (LLDPE) and high-density polyethylene (HDPE). These products are not substitutes, as they have quite different qualities. HDPE is heavier and is used for rigid packaging, LDPE is more flexible, while LLDPE is easier to mould (as opposed to extruding).

Producing different grades in some cases requires different processes and technological capabilities so that, from the supply-side, products are not close substitutes. The properties of the product also determine its uses. For example, there is an important distinction between 'bottle-grade' PET (which is increasingly in use due to its particular qualities) and PET of the grade used for fibres and textiles. These differences in product function and use also imply differentiation and low substitutability to consumers. Firms which manufacture products in the same category may, therefore, not be competing when the differing grades and characteristics are taken into account.

3.2 Derivatives from commodity polymers (intermediate products)

The main polymers identified above are processed into intermediate materials (plates, sheets and rolls of plastic) that can be used in moulding finished products. The different properties of the materials depend on their polymer components.⁵ Despite significant South African production capabilities, a trade deficit has been recorded in each of the main intermediate product groupings.⁶

3.3 Finished products

Finished plastic products may be sold directly to consumers, and are recorded within the plastics sector (Table 3), while many of these finished products act as

inputs into other sectors (Figure 2). South Africa has a trade surplus in two product areas, namely 'baths, showers, basins etc.' and 'packaging products'. In both of these areas, data indicates that there are major exports to European countries, while in the first area the main raw material is imported.

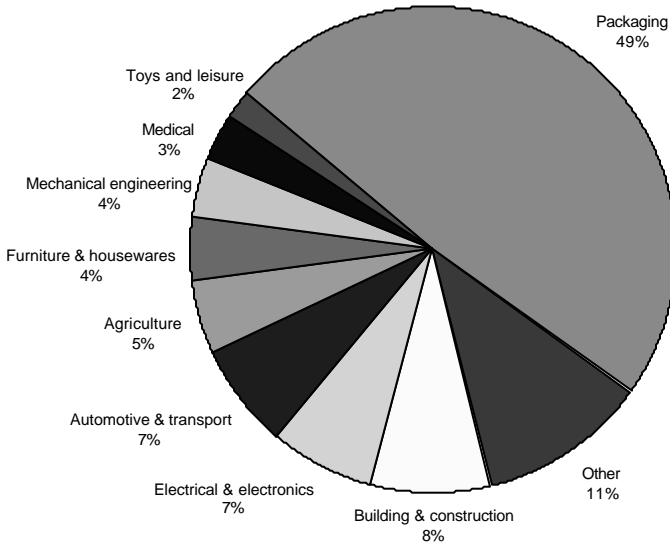
Table 3. Production and trade of final products (1997)

	Production (volume)	Production (Rmn)	Exports (Rmn)	Imports (Rmn)	Trade balance (Rmn)
Tubes, pipes, hoses	67 690t	399.7	43.5	140.6	-97.2
Pipe fittings	7 112t	89.1			
Floor coverings	5 951 th.m ²	84.6	9.8	51.0	-41.2
Baths, shower basins, etc.			41.4	5.2	36.2
Packaging			198.4	145.0	53.4
Bags and sacks	101 774 t	714.8			
Bottles	84 197 t	702.1			
Tableware, kitchenware	9 543 t	119.4	24.8	76.2	-51.4
Buildersware			8.3	8.6	-0.3
Gutters and downpipes	1 849 t	17.5			

Source: *Statistics South Africa and DTI*

Packaging is by far the largest product area, which absorbs almost 50 percent of all polymers, followed by building & construction, automotive & transport, and electrical & electronics. The share of packaging is much higher in South Africa than in other countries. For example, in the UK and Singapore the share of packaging is 35 percent and 25 percent respectively.

Figure 2. Markets for Plastics, 1997 (by weight)



Source: *Engineering News*, 5 February 1999

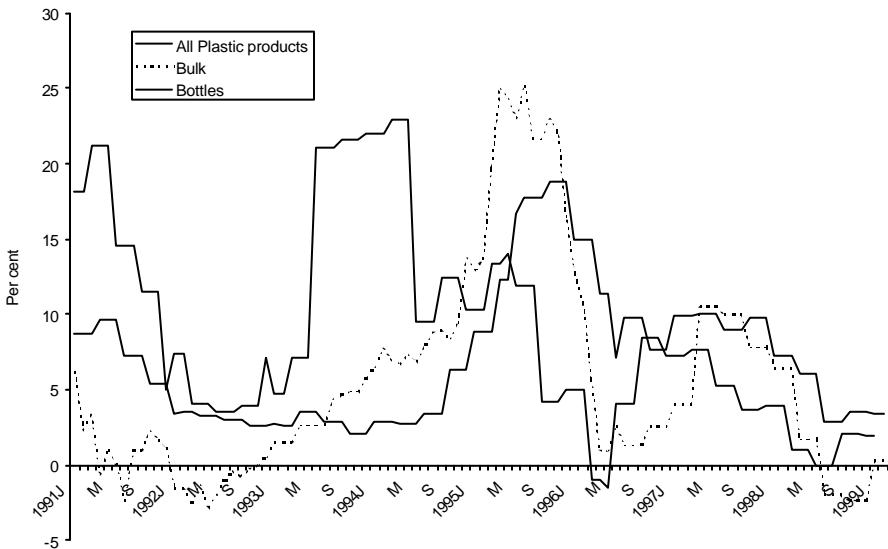
Product differentiation

In many of the above products there are also substitutes made of other materials, such as glass, metals and clays. The market definition therefore needs to take the end use or function of the product into account. For example, the market for plastic drinks bottles may be defined as beverage containers of less than or equal to two litres, and would include aluminium, glass and plastic containers.

3.4 Prices

According to reports on the sector which attempted international price comparisons, polymer prices in South Africa are on average significantly higher than in other countries with polymer production (Crompton, 1995; PARAS, 1998). For example, an examination of prices in 1997 found that domestic prices in South Africa have generally been over 10 percent greater for polypropylene and up to 20 percent greater for LDPE than those in Europe (PARAS, 1998: Section 8, p.18 and 19). South African prices have followed international commodity cycles, but with less severe fluctuations. This reflects participation of South African firms in international markets as exporters and importers, although in the past international prices have also been used as benchmarks by the dominant domestic producers.⁷

Figure 3. Twelve-month rates of increase in producer prices

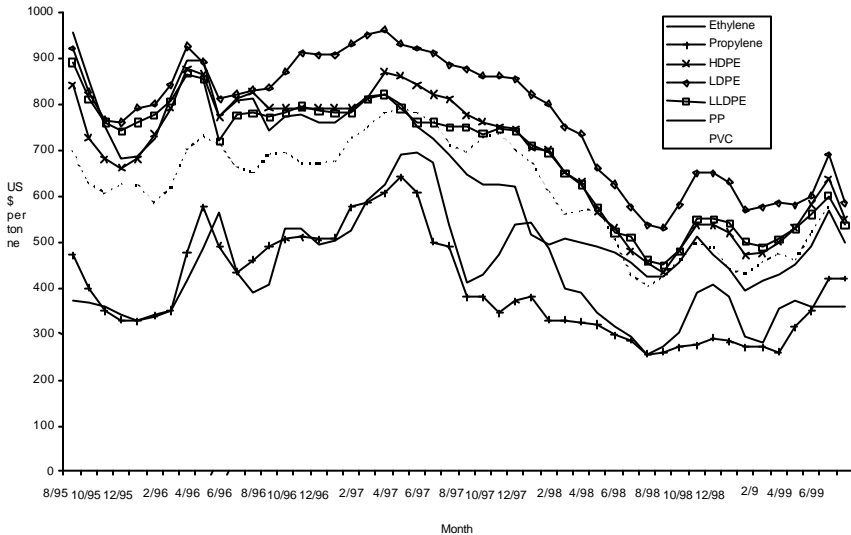


Source: Statistics South Africa

South African producer prices of polypropylene and other bulk polymers rose significantly in 1995 with annual rates of increase above 25 percent (Figure 3). Since this time there has been a decline in the rate of increase in South African

prices. Yet, over the entire period except a few months, the nominal rate of increase of average prices in South Africa has remained positive. International polymer prices have fallen significantly in US\$ terms from early in 1997 (Figure 4).

Figure 4. International spot polymer prices (Asia-spot)

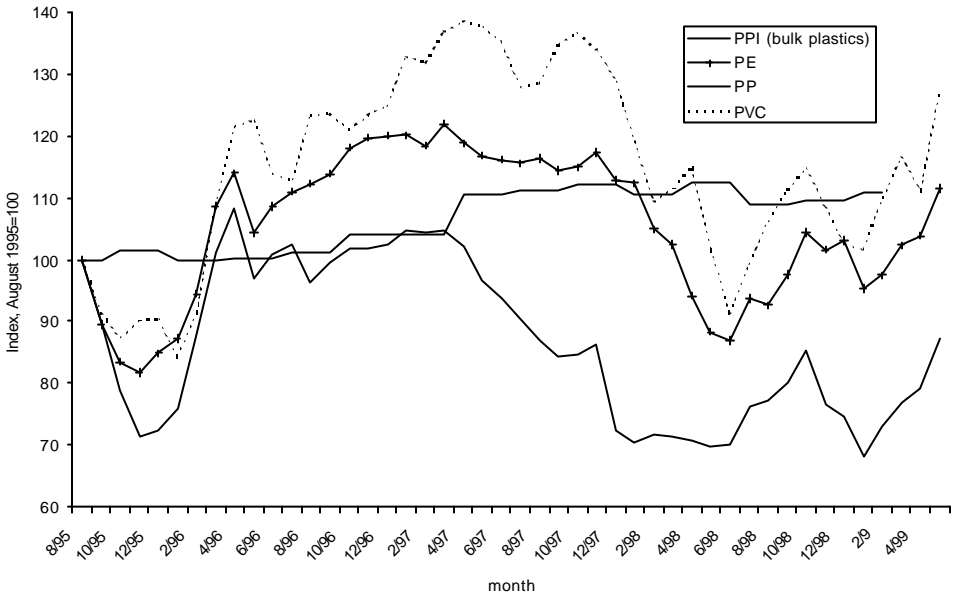


Source: *Bloombergs*

Note: Prices fell sharply in the last quarter of 1995 when China withdrew from the market (as a buyer).

Taking into account the depreciation in the Rand versus the US\$ over the period, the South African prices have not fully reflected the fall in international polymer prices, of more than 25 percent in some cases, since the peak in the first half of 1997. This is illustrated by indexing international prices (converted into Rand values) and comparing them with producer prices for 'bulk plastics', which is the term used by *Statistics South Africa* to cover polymers (Figure 5).

Figure 5. South African producer price index for bulk plastics and indices of international polymer prices



Source: Statistics South Africa and Bloomberg

Note: PE is a simple average of prices of LDPE, HDPE and LLDPE.

This is consistent with the findings of Crompton (1995) that the price-margin in South Africa increases in slumps in the commodity cycle. This has advantages in that it reduces the volatility of earnings and stabilises prices to customers, but it also suggests the existence of significant market power in that South African producers are able to maintain prices even when international prices decline.⁸

3.5 Concentration in the plastics sector

There is a high degree of concentration in upstream polymer production. In the 1993 manufacturing census, although there were 30 firms identified as producing plastics in primary form and of synthetic rubber, the four firm concentration index (CR4) was 0.82 in terms of sales and 0.80 in terms of gross output. This indicates that the four largest firms accounted for more than 80 percent of economic activity in the sub-sector. In contrast, downstream

manufacture of plastic products is one of the least concentrated, reflecting the low economies of scale. In 1993 there were 808 firms, and a CR4 of 0.19 in terms of both sales and gross output. However, despite the wide range of products which fall in this category and the large number of firms, the 10 largest firms (measured by the CR10) still account for one third of output and sales.

Changes in definitions of the subsector from the 1991 census mean strict comparisons are not possible. In 1991, the subsector defined as 'synthetic resins, plastic materials and man-made fibres' (which essentially covers upstream polymer production) consisted of 34 firms and in terms of gross output had a CR4 of 0.82. The sector defined as 'plastics products (not elsewhere classified)' consisted of 758 firms with a CR4 of 0.21 and a CR10 of 0.35. While trends cannot be identified, the 1991 data reinforces the concentrated nature of upstream manufacture of polymer inputs relative to downstream manufacture of finished products.

For concentration ratios to be a meaningful indicator of dominance and market power, they must be based on a market definition based on the substitutability of products. As discussed above, plastic products are highly differentiated and do not constitute one market. This implies that concentration will be considerable in particular product areas within plastics. In addition, concentration is also not divorced from the vertical relationships which are important to different stages of processing.

There are also significant levels of concentration in some of the sectors which account for a large proportion of plastic products, such as packaging and the automotive industry. For example, the CR4 for the auto sector in 1993 was 0.62, and the CR10 was 0.98. There are therefore high levels of concentration at the top of the production chain and, in some product areas, also at the bottom.⁹

4. Corporate structure and market structure in polymer manufacture

There are two main corporate groupings in the South African polymer and plastics industry which span processing of raw materials down to manufacture of finished products. This reflects the importance of vertical and horizontal linkages in the production of monomers and polymers. The relationships generally involve ownership but also encompass multiple directorships and cross-holdings which enable information flows and co-ordination. This is especially the case at the level of polymer processing and manufacture of intermediate products. The final conversion of polymer products into finished articles is a relatively easy sector to enter, as suggested by the very large number of firms at this level (in excess of 800).

4.1 Main corporate groupings

Sasol/AECI/Polifin

The largest corporate grouping is based around Sasol, AECI and their joint venture, Polifin. Polifin was formed in 1994 by merging Sasol's monomer and polymer businesses with AECI's plastics and chlor-alkali chemical businesses.¹⁰ Sasol produces a range of products as a result of processing coal in its synthetic fuels business. In particular, it produces propylene and, through Polifin, it is the sole producer of ethylene. Together with Total in the Natref refinery, Sasol also has additional capacity to produce monomers from the refining of oil. This refinery was commissioned in order to boost ethylene production in which there was a shortage in 1996.¹¹ Sasol is also the largest of all the companies in the chemicals sector due to its very large synthetic fuels facilities.

While AECI produced LLDPE and PVC, these interests were merged into Polifin which is now the sole producer of low- and medium-density polyethylene (LLDPE and LDPE) and the dominant producer of PVC.¹² Polifin is also the largest producer of polypropylene. Polifin dominates polymer production with vertical integration into monomer supply through ownership links with Sasol, large-scale

production and high levels of technology due to new investments. While Safripol also produces polyethylene and polypropylene, it relies on inputs of ethylene and propylene from Sasol.

In addition, Polifin is engaged in downstream manufacture, especially using PVC. Four subsidiaries (Vynide, DPI, PVC compounders and PPS Plastics Systems) manufacture PVC products (Table 4).

Table 4. Major subsidiaries of Polifin

PPS Plastic Systems (Pty) Ltd PVC compounders	Rigid PVC profiles for fabrication of windows, doors, skirtings Manufacture of PVC compounds used in cable, footwear a packaging industries
Vynide	Manufacture and distribution of foils, coated fabrics and self-adhesive materials from PVC
DPI (jt. venture with Everite Group 5)	Leading manufacturer and distributor of PVC piping

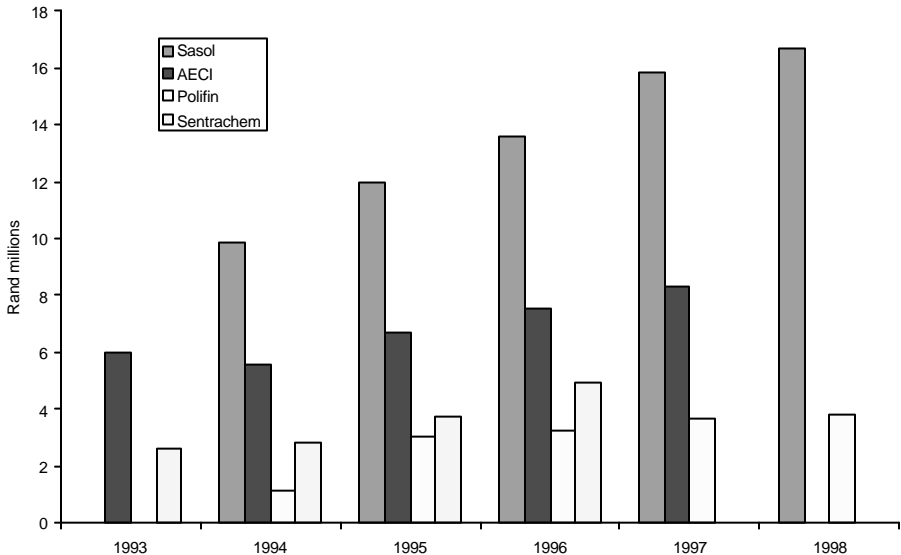
Source: *Polifin Annual Report, 1998*

Polifin has invested in increased polypropylene capacity far in excess of domestic demand and has been planning a major new investment in polyethylene production (Project 2003). This has since been postponed due to the poor performance of the South African economy, and Polifin has instead invested in a major production facility for ethylene and related polymers in Malaysia, in partnership with Petronas.

Sapref/Safripol/Dow Chemicals

The second grouping sources propylene from the jointly owned Shell/BP Sapref refinery and buys additional propylene and ethylene from Sasol/Polifin to produce high-density polyethylene and polypropylene in Safripol's facility.¹³ A major stake in the polymer manufacture and distribution businesses used to be owned by Hoechst, from which much of the technology was also licensed. The US multinational company Dow Chemicals has now bought out Hoechst and taken over Sentrachem and its polymer subsidiary Safripol. Dow Chemicals also owns Plastomark which distributes Safripol products in the plastics conversion industry. Dow Chemicals is the largest global producer of polyethylene and aims to be largest producer of polypropylene.¹⁴

Figure 6. Turnover



Source: *McGregors, 1999*

Note: Data for Sentrachem is from *McGregors 1998*

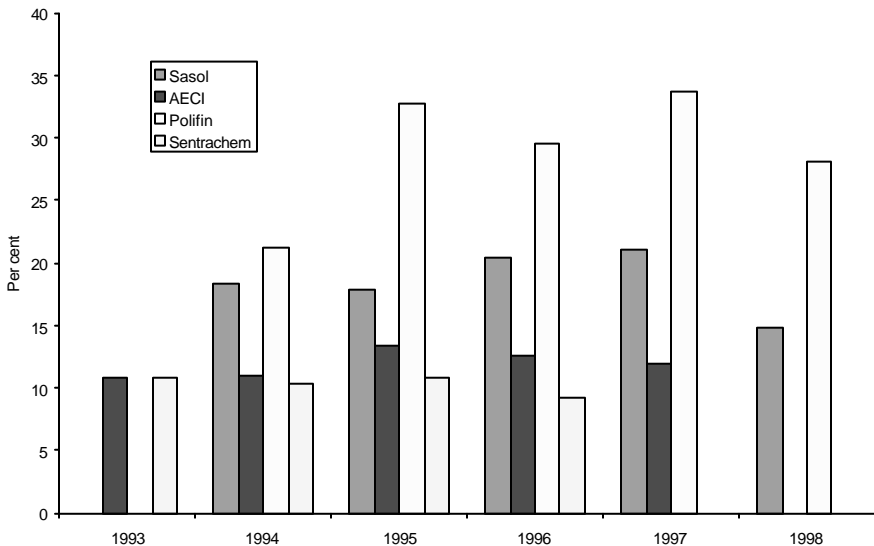
As illustrated in Figure 6, Sasol is by far the largest company measured in terms of turnover (this includes all of its operations, not only monomer and polymer manufacture). Although smaller, as discussed above, Polifin accounts for the great majority of polymer products and has a monopoly in several areas. In polyethylene, Polifin is the sole producer of LLDPE and LDPE and Safripol produces HDPE. Both companies produce polypropylene, while only Polifin produces PVC. Differentiation of products by grade and quality therefore means that the companies are not direct competitors at the level of polymer manufacture, except in polypropylene.

PET is manufactured by SANS (a subsidiary of AECI) and Hoechst SA. Again, there is product differentiation with only SANS manufacturing bottle grade PET and both companies manufacturing fibre grade.

The most profitable company by a significant margin is Polifin, with a return on assets around 30 percent, compared with rates around 20 percent and 10-15 percent for Sasol and AECI respectively (Figure 7). Until the takeover by Dow Chemicals, Sentrachem's profits were very poor, declining to below 10 percent.

Polifin's performance is even more significant given the slump in the international polymer cycle in recent years. Polifin has emerged from the international downturn in the sector having maintained high levels of profitability and being largely debt free.

Figure 7. Return on Assets



Source: *McGregors, 1999*

Notes: ¹ Data for Sentrachem from *McGregors, 1998*.

² The return on assets is taken from *McGregors*, and is calculated from pre-tax operating profits plus investment income plus interest received plus income from associated companies, as a percentage of total assets.

³ The return on assets for Polifin in 1998 was not given in *McGregors, 1999*, and so was calculated from pre-tax operating profits as a percentage of total assets. This understates the profit level relative to previous years.

4.2 Ownership and control relationships

In addition to vertical relationships through ownership, cross-directorships are common. These extend non-ownership linkages to provide information and possibilities for co-ordination. Through cross-directorships the main companies have relationships with a range of firms which utilise plastic products. Based on information in McGregors (1999), these include:¹⁵

Sasol to Tongaat-Hullelt (two shared Directors), Toyota SA (two shared Directors), Nampak, Barlow Rand (three shared Directors), CG Smith, SAB and Daimler-Benz.

AECI to other Anglo group companies including Tongaat Hullelt, LTA (construction), Daewoo electronics, Samancor, Consol, SAB and PGS.

Safripol/Sentrachem/Dow Chemicals to Consol, Malbak, Murray & Roberts, Nampak, Delta Motors and Volkswagen.

As might be expected, there are therefore particularly strong links with the major users of plastic products, namely the packaging, automotive and building sectors.

4.3 Vertical relationships: market power and efficiencies

The upstream production is dominated by Sasol's petrochemicals complex, including the Natref refinery which is a joint venture with Total. There is also a strong connection between Polifin and AECI's other subsidiary engaged in the production of PVC and PVC-related products, namely Chemserve Polymer Sciences (Chemserve, 1998 Annual Report: 16).

Although AECI and Sasol directorships are not directly interlocking, the two companies are integrated at the level of polymer production through Polifin, which creates a vertically integrated grouping.¹⁶ This yields a range of benefits for the companies. Given the economies of scale and the size of investments

required in monomer and polymer manufacture, these include the ability to rationalise production and plan new investments with greater certainty, through being able to exploit the returns more effectively.

The relationships yield potential efficiencies through internalising transaction costs and enabling co-operation. As such, the possible gains from vertical integration include the ability to compete with the large multi-national groupings which dominate the sector at the global level. However, vertical integration also enables collusion and the exertion of market power, which will earn profits but restrict downstream growth. Pressures for vertical integration arise out of the intrinsic nature of the sector - its economies of scale, capital intensity and technology requirements - and, as such, are neither desirable nor undesirable *a priori*. For a profit-maximising company, production capabilities and related strategies, such as vertical integration, are integral parts of developing and exploiting competitive advantages to the maximum.¹⁷ For example, the high levels of profit of Polifin suggest that it has effectively utilised and built on its competitive position. While it has undoubtedly developed its production capabilities, including reaping greater economies of scale through technological advancement and investment. The extent to which its profitability is due to the exploitation of market power will be discussed in Section 6.¹⁸ At issue are therefore the implications of production requirements for the behaviour of the companies and the extent to which firm behaviour impacts on downstream diversification and prospects for broad-based growth.

The various ownership and cross-directorships also ensure linkages to the major product markets in the packaging, construction and automotive sectors. But, while the various ownership and non-ownership links enable greater co-ordination of production along the polymer-plastics supply chain and imply a negative impact on competition, this does not preclude contestation for control within these structures, and shifts in influence over time. The point is not that the agencies involved do not come into conflict, but rather that the conflict is part of contesting control over production within narrow boundaries.

Liberalisation of the economy and companies' desire to list internationally have also impacted on the sector. Protection had enabled companies to operate at less than minimum efficient scale and to continue operating with out-of-date technology. Capital market liberalisation has stimulated companies to

focus on core operations. While in the economy as a whole this has implied a reduction in the concentration of ownership, it has occurred in conjunction with an increase in the concentration of control within sectors.

5. Barriers to entry and competition

Barriers to entry take many differing forms and may be viewed as an indicator of the ease of entry. They are a function not only of the immediate cost and other requirements of entry, but also of the ability to recoup this expenditure. This in turn depends on the position and response of the incumbent(s). The different factors affecting entry are grouped into three sub-sections.

5.1 *Economies of scale, and technology*

Polymer manufacture is generally very capital intensive with significant economies of scale, which are in most cases in excess of South African demand. Due to the history of the sector, firms have not necessarily reaped these economies and have produced a wide range of grades of polymers required by the domestic market, meaning additional time is lost in change-over from production of one grade to another.

The small size of the South African market combined with the lumpiness of major new investments in capacity mean that new investments only occur at relatively long intervals. This has the further implication that the technology being utilised in South African plants becomes progressively out-of-date relative to best international practice.

The production of many grades and the maintenance of old technologies of production have been viable under tariff protection, subsidies for the production of liquid fuels and the distance of South Africa from other manufacturers of polymers. Reduction of tariffs have forced firms to reduce the number of grades being manufactured, and to upgrade capacity, but do not reduce the intrinsic barriers due to scale considerations, given the dominance of the main incumbent. Instead, recent technical change adds to the pressure to achieve economies and, together, these factors entrench

the position of the monopoly producer in the manufacture of almost all polymers.

In terms of research and development, the top international chemicals firms spend over 5 percent of revenue on R&D, while it has been estimated that in South Africa R&D is less than one percent of revenue (Crompton, 1995:34). Given the smaller size of South African firms this translates into even bigger disparities in R&D expenditure in absolute terms. These considerations have meant that South African companies have licensed technology from multinational corporations. Sasol's polypropylene technology is licensed from BASF, while Safripol has older technology, sourced from Hoechst, and AECl's polyethylene plants used old ICI technology. The exception is Sasol, due to the need to develop technology specifically related to the processing of coal for liquid fuels. This technological strength adds to Sasol's and Polfin's position.

The importance of access to technology implies that any new entrant would have to be closely linked to one of the major multinationals, limiting the likelihood of entry. The behaviour and strategies of these international corporations are therefore more important than the number of companies, which is further illustrated by the acquisition of Sentrachem by Dow Chemicals. With this acquisition, the number of companies has not altered, nor has international participation in the South African market, as Dow effectively took over from Hoechst. Yet, there are signs in the investment that Sentrachem will play a role in Dow Chemicals' global strategy for expansion and, as a result, there may be greater contestation in the South African market.

5.2 Trade, transport costs and tariffs

While it is sometimes argued that with trade liberalisation the relevant geographic market is global, transport and other related costs increase the costs of imported polymers. As outlined in the discussion on import parity pricing below, duties, landing and wharf charges, insurance, forward cover and stockholding provisions must all be added to international freight costs. Although tariffs have been reduced (Table 5), these various costs taken together suggest significant barriers to imports.

Table 5. Tariff liberalisation programme for plastics (HS Ch. 39)

Area	Existing duty 6/94	Revised schedule					GATT binding
		Initial schedules 1/95	1/96	1/97	1/98	1/99	
Basic polymer (PP, PE, PVC)	10% + Formula	10% + formula to maximum level of: 45	36	27	18	10	15
Monofilament, Rods, Sticks, Shapes (of PE (other), PP, PS, other polymer)	30% + formula	27	24	21	18	15	20
Pipes, tubes, hoses (of PVC, PE, PP)	30% + formula	28	18	17	16	15	20
Floor coverings (of PVC, PE, PP, PS with various backings and additives)	20/25/30% + formula	20/2 4/28	18	17	16	15	20
Self-adhesive plates, sheet, film, foil, tape, strip (of PE, PVC)	25% + formula	24	18	17	16	15	20
Baths, basins, lavatory seats, covers, other plastic sanitaryware	30% (baths) 25% (basins)	30	20	20	20	20	30
Packing material, bags, boxes, sacks (various)	15/20/25/30%	15/2 0/ 24/2 8	18	17	16	15	30
Tableware, kitchenware, other household/toiletware made of plastics	30%	30	28	25	22	20	30
Buildersware not elsewhere specified, (tanks, doors, venetian blinds)	30%	30	20	20	20	20	30

Source: DTI Chemicals Directorate document 'Summary of the Tariff Rationalisation Process as

applicable to the Plastics Industry', 25 March 1997

Notes: The NEF schedule was submitted to the BTT as an application in June 1994, 70 percent of the schedule was implemented at the end of 1994, and the remaining 2500 lines republished for comment and then reinvestigated. This led to a revised schedule for all except the first two categories in the above table. This revised schedule was published in the Government Gazette of 5 February 1997 and implemented. In general the revised schedule reduced tariffs to lower levels than originally proposed. The tariff lines are grouped together by area on the basis of having similar phase-down schedules.

In addition, lead times for imported polymer supply are very high relative to the domestic market. While lead times locally are less than 30 days (and for half the companies are less than seven days), for imported polymers all companies stated lead times in excess of 60 days. This compares with significantly lower lead times for imported polymers in East Asia and Europe, emphasising the relative isolation of the South African market (PARAS, 1998).

The significance of barriers is illustrated by the price differential of PP and LDPE in the domestic market when compared to domestic price in the US and Europe. Prices have generally been over 10 percent greater for PP and up to 20 percent greater for LDPE than in Europe (PARAS, 1998: Section 8, p.18 and 19). It is also indicated by the separation of markets into domestic and foreign by companies themselves, with a different strategy pursued for the 'high value' (that is high returns) domestic market than for the international market.¹⁹

In addition, according to the Competition Board Report on the proposed acquisition of AECl by Sasol, Sasol argued that competition was greater at coastal areas. This correspondingly implies that inland transport costs to the major industrial markets around Gauteng are significant.

5.3 Vertical supply relationships and sunk capacity

One of the strongest deterrents to entry at the level of polymer manufacture is the importance of the vertical relationship from monomer production to polymers. With Sasol's acquisition of AECl's stake in Polifin and its de-listing, vertical integration has become complete in PP, LLDPE, LDPE and PVC. This follows from Sasol's strategy to diversify into higher value-added areas and its metamorphosis from a state-owned entity, run for strategic purposes focused on fuels, to a private corporation with a diversified chemicals complex, which

began in the late 1980s with the re-opening of polypropylene manufacturing capacity.

The other major South African polymer producer Sentrachem/Safripol only competes in one product area (PP) and, when it established production, was the only producer, sourcing its raw material from a state-owned corporation that at the time showed little interest in downstream production.

Sentrachem/Safripol has as far as possible tried to ensure alternative supplies, albeit of relatively small amounts from the Sapref refinery in Durban. It has also established a downstream cluster of industries in the Mega group to nurture and grow the domestic demand for their products.

In addition, the existing capacity in manufacture of most polymers relative to the size of the South African market means entry require building a major new production facility in advance of the necessary growth in domestic demand. The existing sunk capacity together with economies of scale therefore mean that entry is relatively unattractive. In addition, Polfin has already undertaken planning for a major new ethylene production facility (Project 2003) which would create an additional capacity of 500 000 to 600 000 tons per annum. Although this has now been postponed, and investment made instead in a new facility in Malaysia, Polfin's willingness to invest and the commitment in the form of planning by the incumbent is itself a form of deterrent, as it is unlikely that two new production facilities of this scale in South Africa will be profitable. Polifin has also invested in a new catalyst which will increase production of polypropylene from 140 000 tons to 220 000 tons during 1999 (Polifin Annual Report, 1998).

6. Market power, corporate strategies and growth of the sector

It has been demonstrated that the nature of the sector means that there is one overwhelmingly dominant group upstream in monomer and polymer production. In certain sectors which manufacture and utilise finished products of plastics, there are also very large firms, such as in packaging and the automotive sector. In between, there are many, relatively small, firms

converting polymers into plastic products using standard and easily available technology which can be bought 'off the shelf' embodied in machinery, with relatively low economies of scale. In general, the various barriers to entry (and exit) in the manufacture of plastics products are also low relative to upstream polymer manufacture. This is not, however, the case for all of the diverse areas in which plastics are manufactured, and there are product niches which produce specialised products using high-tech production methods. There are also product groups, such as PVC piping for construction, where there are only very few, relatively large, firms.

The dominance in polymer manufacture is reinforced by vertical integration, which has increased as part of corporate strategies to consolidate control and improve linkages along with production capacity in the sector. In addition, it is crucial for firms to have guaranteed supplies of polymers (which requires establishing long-term supply relationships). These considerations, together with Polifin's investment in capacity sufficient to supply the whole South African market, mean that it has an effective monopoly and possible entry is only a weak constraint on the extent to which it can exercise its market power.

From the factors influencing market power, it would be expected that relatively high profits would be made in polymer manufacture, relative to plastics conversion. This is born out by the very high rates of profits for Polifin, which have been maintained throughout the slump in the commodity cycle and suggest that, in addition to efficiency gains, profitability is also due to the exertion of market power. This is reinforced by the pricing behaviour, discussed below. In addition, a large proportion of Polifin's earnings has been ploughed back as investment to expand production capacity, while borrowings have been repaid. This means that profit rates will be considerably higher as the commodity cycle picks up. In contrast, firms in plastics conversion have recorded relatively low profit rates, both compared to polymer manufacturers and by international comparisons.²⁰

It may be argued that the market power of the dominant producer (a domestic monopolist in all but one polymer) is limited by imports, which have been recorded in all main product areas. However, there are a number of considerations in this respect:

1. Differentiation of products by grade and characteristics means that imports are in many cases not substitutes for South African produced polymers and serve particular product niches.
2. Products may be imported by the main domestic supplier to make up temporary shortfalls in production or to supply grades not produced in South Africa. In these cases the imports reflect the strength of vertical relationships with downstream firms and emphasise the lack of effective competition, rather than the reverse.
3. If the dominant South African producer is exerting its market power, it will be able to raise prices above costs up to the ceiling where, taking into account all the factors added to import costs, it becomes worthwhile for some downstream manufacturers to import their raw material. The existence of imports may therefore not be an indication that prices are related to costs, but instead suggests that import-parity pricing is being practised, as discussed below. Import prices in this case do not reflect the prices on international markets, but the opportunity cost for a South African customer to import. This includes tariffs and transport costs as well as other non-price factors related to the delivery time and responsiveness which may be affected by sourcing from a distant supplier.

Elasticity and substitutability

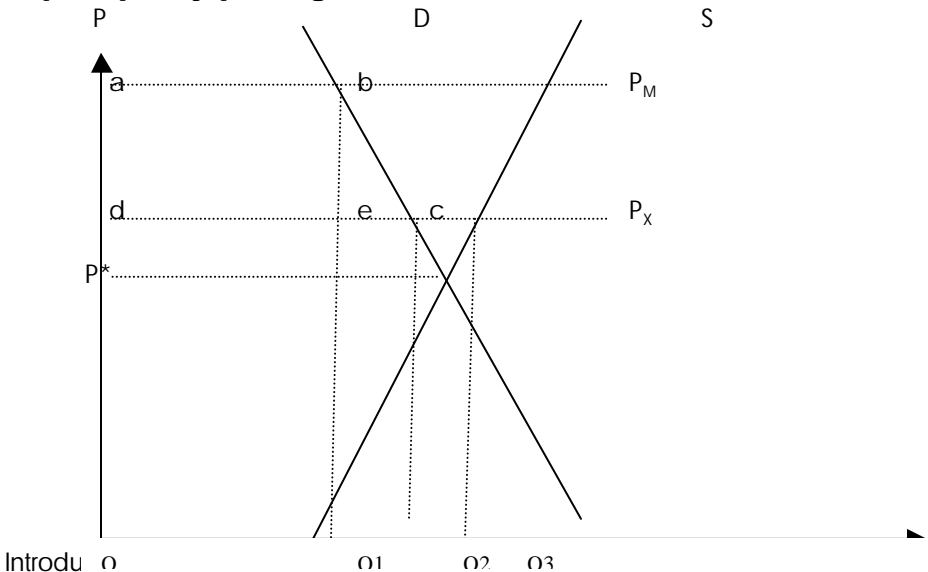
Polymer demand is essentially a derived demand, with producers relying on particular inputs once they have invested in production capabilities. This means that there are no close substitutes at the polymer level and that demand is relatively inelastic.²¹ Many downstream manufactured plastic products have substitutes made of other materials, with the substitutability varying from product to product depending on the function and the characteristics which are required. For example, in packaging, glass and tin cans may be relatively close substitutes for plastic bottles (for some products), but for auto parts such as dashboards, winders and coloured light covers, there is much less substitutability. In the short term the elasticity of demand for products such as polypropylene and polyethylene is therefore very low. In the longer-term it will depend on the response of manufacturers of the various products using the

polymers as inputs. In general, the lower elasticity of demand upstream reinforces the price-raising ability of polymer producers relative to downstream manufacturers which convert the polymers into finished products and which face competition from each other and products made from other materials.

Import-parity pricing

Import-parity pricing is reported to be widely practised, yet this is *de facto* evidence of the exercise of market power.²² Pricing at a par with imported products (including transport costs and tariffs) means that the price is not directly cost-related, and is only possible if the producer is a price-setter in the domestic market. By comparison, competition would reduce price to average cost and, in the extreme case of perfect competition, price would equal marginal cost. As illustrated in Figure 8, in the absence of international trade, the outcome consistent with allocative efficiency in a closed economy is P^* , and output is priced in such a way that price to consumers reflects the costs of production (including provision for a normal profit).²³ However, the monopoly power of the producer means that by reducing supplies to the domestic market it can achieve prices at different points on the demand curve (which, as discussed above, is depicted as being relatively inelastic).

Figure 8. Illustration of the static economic effect of import-parity pricing



Introdu... which South Africa has a competitive advantage), and including transport,

other related costs and tariffs, firms may export (earning P_x) and consumers can purchase imports (at P_M).²⁴ If the firm exploits its monopoly power to the fullest extent in the domestic market then it will supply Q_1 to domestic consumers at price P_M , with a marginal level of imports. At this price it just becomes worthwhile in price terms for consumers to purchase imported goods; although taking into account delivery times and other non-price factors, there may still be a disincentive to buy from international sources. If we include the possibility of export, with a lower price to producers of P_x , given tariffs and transport costs, then producers will export amount $Q_2 - Q_1$. Total domestic production will therefore be Q_2 with different prices being charged for export and for domestic consumers, reflecting the firm's market power in the domestic market.

With competition in the domestic market, price would be P_x , as this represents the opportunity cost of supplying the domestic market. Relative to this point, there is a reduction in consumer surplus of abcd, and a producer surplus gain of abed, with a net 'deadweight loss' of triangle bce. This loss reflects the exercise of market power by the monopolist or oligopolists. In the case of polypropylene, it appears as if using import-parity pricing is also an easy rule for the maintenance of similar prices by the two producers.

While the static efficiency effects of this practice are not necessarily large, especially if price discrimination is practised, this implies an assumption of neutrality between profits and consumer surplus. More importantly, the nature of polymers as inputs means that their price is a determinant of the competitiveness of downstream producers. With respect to exporting firms, this may be mitigated by the introduction of export-parity prices to these firms, although it may still represent a mark-up over marginal cost. But, it is not clear why exporting firms should be privileged in this way. In addition, the dynamic impacts through the changed incentives to invest in downstream production are potentially much greater than the static efficiency loss.²⁵

Development of the sector

Given the nature of the sector large, vertically integrated firms yield important production gains. Studies of export performance have found that success requires support from suppliers and the building of links between firms engaged in production at different levels.

But, one would have to assume that the firms do not seek to maximise returns if the positions achieved through these arrangements are not also exploited in terms of the ability to raise prices. While this may maximise short-term profits, it also fails to serve the sector in the longer term, where growth in domestic demand will depend on increasing use of polymers as part of a growing manufacturing sector.

Plastics is a particularly good example of where such a growth potential exists, given the existing production capacities in excess of demand in most polymer products and firms' capabilities to produce polymers at internationally competitive prices. But, the potential gains along the chain as a whole will not be realised if polymer manufacturers exploit their market-power in pursuit of short-term profits. Pricing at import-parity levels means that South African manufacturers of products from polymers will be paying prices which are greater (due to transport costs and tariffs) than manufacturers in many competing countries which can import polymers from a closer source or buy domestically at more competitive prices. It also implies that plastics manufacturers are in a better position from a price-competitiveness point of view if their main input is not produced by a domestic firm as, in this case, no import tariff would be charged. The impact of import-parity pricing on polymers is highlighted by the trade deficits in all but two of the main categories of intermediate and finished plastic products.²⁶

7. Conclusions: the relationships between structure and behaviour

The analysis of the different levels in the plastics production chain and the corporate structure which governs the value-added processes highlighted the inter-relationships between the market definition, product differentiation and market power. The high degree of differentiation among polymers, their nature as intermediate products and sizeable economies of scale mean that there is a monopoly in the production of all but one. By identifying product uses, the study found that substitutability is low for polymers (suggesting a low elasticity of demand) and, correspondingly, market power is high, while substitutability is much greater at the level of finished plastic products. These products

compete with those of different materials, for example, glass or metal. The particular case of plastics therefore illustrates that product and market definition need to draw on analysis of interactions along the supply chain.

The polymer and plastics sector production chain can therefore be characterised as imperfectly competitive, being a combination of monopolistic competition characteristics and concentration. However, the study also indicated that structural considerations must be extended to take into account institutional factors, the interdependence of firms and firms' decision-making within the wider context of the development of the sector over time. For example, in polymer manufacture vertical integration is an important part of a firm's competitive position, as it allows the firm to plan the large-scale investments required to co-ordinate production of inputs and outputs and to have an assured supply of raw material. The intrinsic factors related to the production technologies utilised therefore imply that the industry and market structure are going to remain very concentrated at the levels of polymer manufacture.

The study also found that barriers to entry are significant and are due to the intrinsic production characteristics referred to above. In addition, disincentives to potential entrants are significantly affected by the decisions of incumbents, including investments in sunk capacity and vertical integration. They are also increased by the costs to customers of switching suppliers given the importance of an assured supply and the provision of other technical services along with supply of the intermediate product. As such, the relationship between firms' decisions and the industry and market structure operates in both directions.

The concentration and vertical integration, which characterise the upstream levels of the plastics supply chain, both imply market power and yield important potential production gains. For example, the formation of Polifin and its success in terms of profitability and growth in turnover reflected the need to increase integration and to control a greater proportion of the production chain. The dominant position of upstream firms therefore enables them to generate profits from the exertion of market power, in addition to profits based on production efficiencies. Distinguishing between the two is difficult and the study has not attempted to separate the sources of profits into efficiencies and

market power. This would in a sense be artificial, as they are both integral parts of firms' corporate strategies when viewed in a dynamic context. It is, however, clear that profitability has been considerably higher in polymer manufacture (where concentration is greatest) than in the downstream conversion of plastics products.

The study also found suggestions of market power in setting price, as would be expected given the level of concentration that exists. These include the practice of import-parity pricing. In addition, price data suggest that polymer producers may be able to deviate from import-parity pricing to maintain South African prices and profitability through slumps in international commodity prices. While this means that South African prices have not been subject to the same degree of variability as international prices, the companies clearly have a motivation to use their price setting ability.

As plastic products are inputs into many other South African industrial sectors, maintaining import-parity prices for polymers has potentially far-reaching knock-on effects. It has both a static impact in raising the price of products using plastics, and a negative dynamic impact on growth and investment in downstream sectors.

Together, the study suggests the necessity of examining the inter-relationships between the industry and market structures, product characteristics, corporate strategies and the outcomes in terms of price and quantity decisions which impact on the economy. It further suggests that competition needs to be understood as a series of decisions in a dynamic context, where previous decisions determine the options in future periods. The study is, however, preliminary and there is much need for further research based on careful empirical analyses of market structure and corporate strategies, which examine the relationships between firm behaviour and structural factors in a dynamic context. Future research into polymers and plastics also requires detailed cost data, longer price series and closer international comparisons, although access to this data is a major research issue in itself. This study has succeeded to the extent to which it has explored the relationships and established a framework for further examination of competition issues.

Some implications for implementation of the provisions of

the new Competition Act

The case of polymers and plastics raises a number of issues for the application of the provisions in the Competition Act. Firstly, determining whether the outcomes are due to behaviour which constitute a prohibited practice will be very information and analysis intensive. It is much more difficult both to collect information and to undertake analysis on firm behaviour than on structure. This case illustrates a situation where the structure will remain concentrated and, if not vertically integrated through ownership, vertical relationships will remain very important due to the need to manage product flow through the levels of processing. The corporate strategies and behaviour of the dominant upstream firms will therefore to a large extent determine the development of the sector. As such, a major challenge for the new Competition Commission will be to evaluate this strategy and behaviour. In particular, in the absence of very detailed cost data, establishing what is an 'excessive price' will be challenging in situations where there are multi-product firms and markets with quite significant price fluctuations. Profits may be a useful indicator of the exertion of market power to abuse a dominant position.

Secondly, the study indicates that defining the product market is crucial to identifying the existence of market power, and this must take into account product uses or functions. These functions may differ due to apparently quite small changes in product specifications. Product differentiation is also an important factor which ties customers to suppliers.

Thirdly, if the institutions established by the Competition Act (the Competition Commission and Competition Tribunal) are to fulfil their mandate as set out in the Act, they must take into account the impact of anti-competitive behaviour on economic development. The study here clearly illustrates a case where the behaviour of the dominant polymer producers is an important determinant of the development prospects for downstream manufacturing.

Fourthly, the internationalisation of companies, evidenced by Polifin's decision to enter a major joint venture in Malaysia, implies the need to evaluate corporate strategy at an international level, although transport costs and other costs may mean that the market for many products is defined on a national basis. Again, this places great demands on the institutions in terms of

information collection and analysis. It also suggests the need for liaison between competition authorities in different countries, especially in the southern African region given the cross-border operations of many firms. The study also suggests a need to link competition concerns with trade policy, although these are distinct policy areas. However, although trade protection is one factor reinforcing market power over the domestic market, there are many other non-price constraints which enable companies to segregate the domestic and export markets, in such a way that trade policy is not a substitute for competition policy.

Notes

¹ Simon Roberts is a lecturer, Chris Malikane and Ndiadvha Sikhweni are postgraduate students in the Department of Economics at the University of the Witwatersrand. The paper was undertaken in the Department of Economics as part of a TIPS funded project on regulation, competition and market structure in South Africa. The comments of discussants and contributors to the 1999 TIPS Annual Forum are acknowledged.

² Basic organic chemical products are inputs for a wide variety of other products in addition to plastics, including fertilisers, pesticides, explosives and paints.

³ The schools of thought are sketched in the briefest of terms as the paper's main objective is to examine a range of factors in an applied analysis. The differing theoretical approaches may be judged to be over-simplified as a result.

⁴ According to Barnard Jacobs Mellet (1999: 48), imports of PVC are largely by Polifin, suggesting they are of different grades or due to short-term production shortfalls. During the shut-down of one of the main plants in September 1997 for maintenance, significant quantities were imported at low or zero margins to keep customers supplied (Polifin Annual Report, 1998).

⁵ Different categorisations for production and trade make direct comparisons impossible.

⁶ Based on the Harmonised System used in South Africa for classification of trade data, intermediate products are those from HS3917 to 3921, at the four-digit HS level.

⁷ Crompton (1995) refers to negotiations where there were no alternative sellers, and international prices were used as a reference point.

⁸ For example, Polifin increased prices to converters by 12-15 percent (and by up to 25 percent on some polymers) in May 1996 due to 'international prices' (*Financial Mail*, 31 May, 1996). According to Polifin's 1998 Annual Report, Polifin also reduced domestic polypropylene prices in the first half of 1998 (i.e. 12 months after the decline in the international price).

⁹ The packaging sector is more concentrated with approximately 36 companies, but there are no concentration ratios for packaging in the census data.

¹⁰ Polifin is now wholly owned by Sasol.

¹¹ It was also in anticipation of the expansion by Polifin of polyethylene production in 'Project 2003', which has since been postponed.

¹² A division of Chemsolve, a subsidiary of AECI, also produces some PVC, but of specialised grades.

¹³ Sapref also only supplies approximately one third of Safripol's propylene needs, with the remaining two-thirds being supplied by Sasol/Polifin.

¹⁴ According to an interview with M. Seleka, DTI.

¹⁵ Polifin's directors are drawn from AECI and Sasol, and so they are not treated separately here.

¹⁶ The 1995 Polifin Annual report summarises the main objectives in the formation of Polifin: "The merger of Sasol's monomer and polymer businesses with AECI's plastics and chlor-alkali chemical businesses in January 1994 created a focused, vertically integrated group of companies with the potential of becoming globally competitive." [p.7]. There has, however, been contestation for control of Polifin between Sasol and AECI, with Sasol bidding to buy out AECI's 40 percent stake and the other minority shareholders and delist Polifin.

¹⁷ In this respect, the prospective sale by Polifin of stakes in downstream manufacturers DPI and Vynide suggests that Polifin views its competitive position as based mainly on vertical integration upstream and not on building on potential downstream linkages.

¹⁸ In real terms, fixed costs per ton are reported to have fallen by 30 percent over the three years to July 1999 (Trevor Munday, Polifin MD, reported in *Business Day*, 30 July 1999).

¹⁹ Interview with senior managers of a polymer producer.

²⁰ In a recent survey (Roberts, unpublished) of the 36 firms reporting profit data, there was an

average pre-tax return on assets in 1997 of 14.1 percent (excluding one outlier who made very large losses). The PARAS cluster study (1998) also found low profit levels in conversion when compared to international benchmarks.

²¹ This is also born out by the observation that proportional fluctuations in price from year to year are much greater than changes in demand.

²² For example, it has been reported in PARAS, 1998; Crompton, 1995; Competition Board, 1998, and by the companies interviewed.

²³ Under the restrictive assumptions of the perfect competition model, this is where price equals marginal cost.

²⁴ Import parity prices were calculated in the PARAS report (Section 8, p.14) as follows:

Ruling fob polymer price in country of origin
+ Freight (varies depending on region)
+ Duty at 10%
+ Landing/wharf costs etc. at R120/tonne
+ Coastal transport at R25/tonne
+ Insurance, forward cover, stockholding provision at 3%
= Import parity price

²⁵ It may be argued that the size of the dominant firm yields efficiency gains, and the profits to be earned are an incentive to invest in new capacity. With regard to the first, the gains from scale are not being disputed, rather the behaviour of that firm. In terms of the incentive to invest upstream if profit levels were reduced, it is argued that, although profit per unit of output would be lower, normal profits would still be made covering the cost of capital and taking into account risk, while growing downstream manufacture would increase domestic demand and so stimulate growth and investment.

²⁶ In addition, the sub-group with the best trade performance in recent years, 'baths, showers, basins etc.' is based on imported raw material.

REFERENCES

AECI *Annual Report*, various years.

Barnard Jacobs Mellet (1999) *Polifin – Oh, for a bigger free float*, Johannesburg.

Best, M. (1990) *The New Competition: Institutions of industrial restructuring*, Polity Press, Oxford.

Coase, R. (1937) 'The Nature of the Firm', *Economica*, Vol.4, pp.386-405.

Competition Board (1998) *'Investigation Into the Transaction between SASOL Ltd. and AECI Ltd'*, Report No. 68.

Chandler, A., F. Amatori and T. Hikino (Eds.) (1997) *Big business and the wealth of nations*, Cambridge University Press, Cambridge.

Crompton, R. (1995) *An Industrial Strategy for the Commodity Plastics Sector*, UCT Press, Cape Town, South Africa.

Fourie, F.C.v.N. and A. Smith (1998) 'The Concentration-Profits Stalemate I: Causality and Interpretation Problems', *South African Journal of Economics* Vol. 66, No.4.

Fourie, F.C.v.N. and A. Smith (1999) 'The Concentration-Profits Stalemate II: Ideological rifts and methodological stress', *South African Journal of Economics* Vol. 67, No.1.

Hay, D. (1993) 'The Assessment: Competition Policy', *Oxford Review of Economic Policy*, Vol.9 No.2, pp1-26.

Hay, D. and J. Vickers eds. (1987) *The Economics of Market Dominance* Oxford: Basil Blackwell.

Industrial Development Corporation (IDC) (1998) *Sectoral Prospects, Sandton, South Africa.*

Krugman, P. (1990) *Rethinking International Trade*. MIT Press, Cambridge, Massachusetts.

McGregors (1999) *Who Owns Whom in South Africa?* 19th Edition, Purdey Publishing, Grant Park, South Africa.

McGregors (1998) *Who Owns Whom in South Africa?* 18th Edition, Purdey Publishing, Grant Park, South Africa.

PARAS (1998) 'Petrochemicals, Plastics and Synfibres Cluster Study'.

Polifin *Annual Report*, various years.

Republic of South Africa (1998) 'Competition Act, No.89', *Government Gazette* Vol.400, No. 19412.

Sasol *Annual Report*, various years.

Sentrachem *Annual Report*, various years.

Tirole, J. (1988) *The theory of industrial organisation* MIT Press, Cambridge, Massachusetts.

Williamson, O. (1986) *Economic Organisation: Firms, Markets and Policy Control*, New York: Harvester Wheatsheaf.