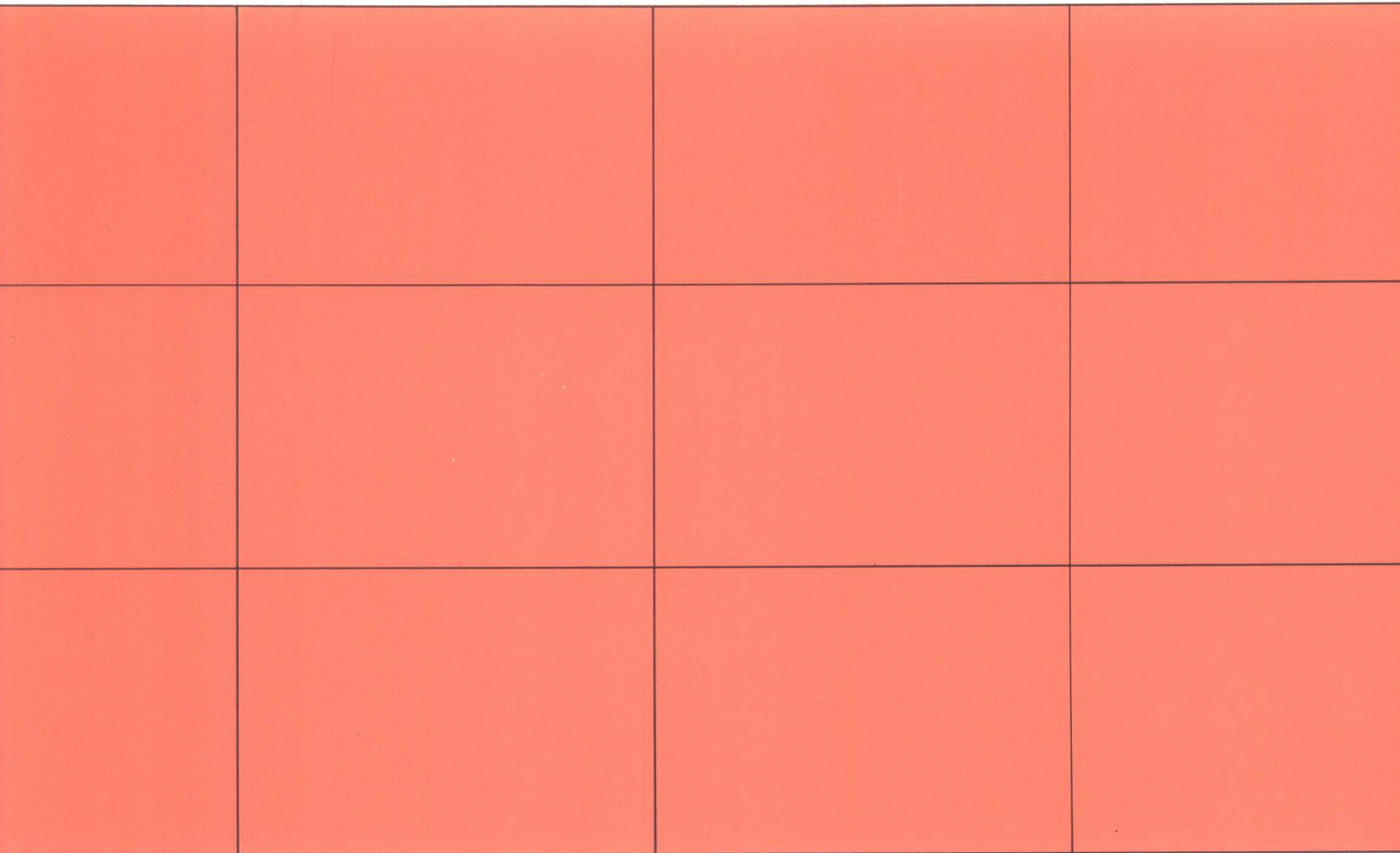


Petrochemical and Plastic Industry in Thailand



Petrochemical and Plastic Industry in Thailand

by

Linda E. Lucas, Researcher

Chayanit Wangdee, Research Assistant

Thailand Development Research Institute

Bangkok Thailand

October 1997

Table of Contents

	Page
I. Introduction	3
II. Petrochemical Industry Background	3
A. International Industry Development	3
B. Thai Petrochemical Industry Development	5
C. Industry Structure and Behavior	8
D. Industry Ownership	10
III. Plastic Product Industry	10
A. Market Structure	11
B. Policy Considerations	14
IV. Pattern and Trend of Trade	15
V. Firm Competitiveness and Interviews	17
A. Competitive Factors in Thai Industry	17
B. Summary Interviews	19
VI. Conclusion	21
A. Overview	21
B. Impact of AFTA	22
C. Competitive Issues	23
Bibliography	
Figures	1-18
Tables	1-23
Appendices	1-4

Petrochemical and Plastic Industry in Thailand¹

I. Introduction

Thailand will soon have the largest productive capacity of petrochemicals in Southeast Asia (Hagan, 1995) as well as a large and rapidly growing domestic market for petrochemicals and plastics. The upstream production of raw material (ethylene and propylene) is controlled by the quasi-public corporation, National Petrochemical Corporation Limited, NPC1, which was formed in the 1980s. NPC1 was initially 49% owned by the Thai government. This public involvement differentiates the Thai industry from those in other countries with complete private ownership (US, Germany) and from those which at least at one point had complete public ownership. (Mexico, Taiwan).

Since its inception, the petrochemical and plastic industry in Thailand enjoyed high tariff protection. Implementation of AFTA tariff reductions has begun to put external pressure on the industry. In response to the liberalization of the industry, the government has allowed more firms to produce a range of plastic pellets within a low to medium priced segment of the total resin market. Other firms are targeting the export market for their products. Some segments of the plastic fabrication industry are licensing technology and imitating from international companies while other Thai companies are product innovators and beginning to license their own technology abroad. This paper examines the history and development of the petrochemical and plastic industry in Thailand. The next section gives a description of the industry structure and price policy. The following section places the industry in a global and regional context. The conclusion assesses the competitiveness of the various segments of the Thai industry.

II. Petrochemical Industry Background

A. International Industry Development

The petrochemical industry includes several sectors or linked industries related to each other by the flow of raw materials.² Figure 1 gives the forward and backward linkages in the industry. Initially, oil and gas resources are processed into olefins and aromatics, the base chemicals. Some of these chemicals are sold directly to the chemical

¹ Since 1995, the global petrochemical industry went through drastic changes. As a result, the picture of the industry in ASEAN as presented in this paper has also changed remarkable. During 1996-1997 there has been a surge in investment in the industry both in ASEAN and outside ASEAN. These new investment are concentrated in China where local demand for petrochemical products for exceed the local supply. The petrochemical in Malaysia and Indonesia also went through rapid expansion of recent. The on-going economic crisis in Asia also has had a significant negative on the industry. In keeping with the changing economic environment, the TDRI is updating the relevant data.

² We use the following definition: A petrochemical is defined as a chemical compound or element which can be derived entirely or in part from petroleum or natural gas, or from petroleum or natural-gas hydrocarbons, and is intended for chemical markets. (Molle and Wever, 1984:17)

industry while others are converted into major product groups. This conversion process requires the addition of other chemicals which may be purchased or produced by the same firm. Products of this conversion process are then manufactured into a number of goods, both intermediate and final consumer goods. Figure 2 shows the flow of the principle petrochemicals and applications of these chemicals.

The end products and the industries which use the various petrochemicals in production processes can be broadly classified as: 1) plastic resins used by the fabricated plastics industry for such items as plastic bags, building materials, automotive parts, electronic equipment, packaging materials; 2) synthetic fibers which are used in textile mill production; 3) surface active agents which are made into soaps and detergents and other industrial chemicals; and 4) synthetic rubber which is processed into various rubber products. This paper focuses on plastic resins (and petrochemicals) which are processed into consumer and industrial products.

Historically, innovation and growth of the productive capacity in the petrochemical industry followed the patterns of early scientific knowledge about the polymer process. The theoretical basis of polymer science was laid by scientists in the US, UK and Germany in the period between the World Wars. The technology was developed in chemical companies (e.g. I.G. Farben of Germany) along with oil companies which moved into the chemical production field. The leading firms in the US included DuPont, Shell, Union Carbide and in the UK, ICI.

World War II provided the source of demand for the new petrochemical and plastic products which were substitutes for coal and oil. The technology to manufacture petrochemicals from natural gas developed rapidly in the US and Western Europe. The technology used for production of petrochemicals today varies by geographical region and feedstock source. The majority of petrochemical productive capacity today is held by oil and chemical companies in the US, Western Europe and Japan. (Fayad and Motamen, 1986:13)

After WW II global sales and transmission of technology radiated from the US, UK and Germany throughout the world. This pattern is reflected in 1988 data of Table 1 which shows Western Europe with over thirty five percent (125 \$US billion) of the total petrochemical sales followed by the US and Canada in North America with about 26% (100 \$US billion).

Although their exports are considerably less than the US and Germany, countries in Asia including China, South Korea and Japan are increasing production capacity rapidly. The evolution of these recent aggregate global patterns of trade, investment and technology for the years 1960, 1980 and projected to the year 2000 are shown in Figure 3. By the year 2000 every part of the globe will be involved in some level of trade in the petrochemical industry according to these estimates.

Establishment of a petrochemical industry has become, according to some industry experts, a status symbol for developing countries (Chapman:1991). It represents entry into the world of high technology and independence. An important limitation to success in this industry is the size of the plant capacity relative to domestic demand. Output of world class size plants may be as large as 600,000 tones per year. With small domestic markets some countries, such as Singapore must plan on exporting. Additionally, it may be critical for government to protect the industry from competitors during the start up stage.

The global demand for petrochemicals and plastics has been growing at rates that exceed the rates of growth of respective gross domestic products (GDPs) and indications are that by the year 2000, the Asia/Pacific region will have several major players in petrochemical and plastic markets. (Chapman, 1991:291; Vergara and Babelon, 1990:16) Table 2 shows historically predicted rates of growth in demand for basic petrochemicals according to category of development, from 1975-1990. By these estimates, petrochemical and thermoplastic demand in developing countries was expected to grow at about an average rate of over 6.5 % per annum from 1985-1990. Industry sources in Thailand say that domestic demand in 1996 exceeded 5-6% per annum and is expected to continue at that pace for at least another 6-8 years in Southeast Asia.

The world market for resins is segmented into commodity plastics (PP, PE, PVC, PS) and specialty plastics (e.g. for electronics). The market for commodity plastics has three relevant prices: US Gulf Coast price which is the highest because it is set by the most closely controlled supply network; Far East Asia price which is the lowest because of the smallest supply pool and least ability to supply long term contracts; Northwest Europe price which falls between the other two. Prices are determined by capacity expansion and supply production flows. The market is characterized by both contract and spot sales. Typically the long term contract price is higher than the spot price because producers using the resin inputs want a guaranteed supply to avoid stoppages which are very costly. They also contract for long term supplies instead of scrambling for possibly lower quality small lots. So when the supply increases, prices fall but then with increases in demand prices increase.

B. Thai Petrochemical Industry Development

Natural gas petrochemical reserves have been utilized in the Gulf of Thailand since the completion of the first pipeline in 1981. PTT (Petroleum Authority of Thailand) was set up in 1978 as the national oil company to manage the country's petroleum and petrochemical interests. PTT not only built the first natural gas pipeline from the Gulf of Thailand but built and operated the first gas separation plant. The gas separation plant produces feedstocks (ethane, propane) for the petrochemical industry. In 1997 feedstocks will be produced from naphtha which comes from oil refineries. The various processes used around the world for production of the feedstocks ethylene and propylene are shown in Table 3. The particular process used depends on available feedstock (gas or oil) as well as the technology either purchased or developed.

According to published interviews at the time, the vision for the establishment of the petrochemical industry in Thailand was that the industry would be basic in the country's economic development. The industry would receive tariff protection during the early high-cost years and be in a position for import substitution of petrochemicals and provision of low cost inputs to the downstream plastic fabrication industry as well as to other industries in the future (e.g. auto parts). Over the long term, Thailand would realize technological development, employment and other benefits from the basic industry. (Asian Business, 1988)

The first petrochemical production unit in Thailand which involved government investment was a unique combination of private and public enterprise where PTT, the public sector corporation, held a 49% share and private sector companies owned 51%. The new corporation was called National Petrochemical Public Company Limited (NPC1).

NPC1 was established to produce the basic feedstock chemicals from natural gas that would enable downstream production of plastic resins.

Before government participation in Thailand, the domestic petrochemical industry was relatively small and produced basic petrochemicals from imported materials. Many of the firms were established during the 1980s. Appendix 1 gives the age distribution of member firms of the Plastic Industry club, a trade association, in 1993. The pioneer firms in the resin segment of the industry in the 1970s and 1980s were: Thai Plastics and Chemicals (TPC) producing PVC; Eternal Resins Co. producing PS; Pacific Plastics, once a solely owned subsidiary of Dow Chemical, producing PS; Thai Petrochemical Industry (TPI) producing PE and ABS; Srithep Thai Plaschem producing PS. Some of these pioneers, TPC, Pacific Plastics (now a member of the Siam Cement Group), and TPI brought their expertise into the government-related petrochemical operations, NPC1 and NPC2. NPC1 and NPC2 were the initial step in building a completely integrated petrochemical industry with links from the natural gas to the plastic fabricators.

The original stockholders in NPC1 were PTT with a 49% share; Siam Cement Group with 15.9% share; Thai Petrochemical Industry (TPI) with 14.4% share; HMC Polymers with 10.1% share; Thai Plastic and Chemical Co. (TPC) with 5.4% share and the remaining shares held by the Royal Property Office (5.1%) and the International Finance Company (IFC) 0.7%. (NPC, 1993) The target rate of return was 15%. The downstream private sector participants were required to guarantee purchase of 80% of the output from NPC1. The ownership shares were based on percentage use of olefin production from NPC1 and commitments to purchase production. The remaining 20% was to be sold on the spot market.

NPC 1 was granted a relatively wide range of investment privileges from the Thai Board of Investment (BOI). These privileges included corporate income tax exemption from 1990 to 1998 and from 1998 to 2003 only half of the corporate tax is payable; dividends to shareholders are exempted from corporate income tax until 1998; imported machinery and equipment are exempted from import and business tax; exported products are exempted from relevant custom duties and business tax for five years starting from the first day of export. (NPC 1993) The shares of NPC1 are currently traded on the Thai stock exchange and by late 1995 the public held 22.4% of the total shares with PTT's share declining by 14.1%, TPE's share declining by 3.6%, HMC's share declining by 2.3% and TPC, CRP, IFC each declining by 2.4%. The distribution of shares before and after the public offering of NPC are shown in Figure 4.

Industry participants and government officials determined that each of the four basic petrochemicals not produced domestically or not produced in sufficient quantity to meet growing domestic demand, except for PE, should be produced by one of the companies in NPC1. Thus, TPE produced HDPE and LLDPE through NPC1 while TPI produced HDPE/LDPE and LLDPE with TPC producing PVC and VCM and HMC producing PP. The price of NPC1 output would be cost plus with a guarantee of a 15 % minimum return to equity investment.

Under a recent agreement negotiated within NPC1 (November 1993), requirements of participation include: a restatement of the contract provisions that require TPI, TPC, TPE and HMC to purchase a minimum of about 74% and a maximum of about 80% of total production of olefin feedstocks from NPC1. There are additional contracts which provide

for purchases from the expanded capacity of NPC1. The pricing formula was changed to US Gulf price plus 10% under the 1993 agreement.

There is another state upstream supported petrochemical plant in production, NPC2 which produces olefins under a company name of TOC and aromatics under a company name of TAC. TOC produces ethylene, propylene and intermediate monomers (VCM, SM, EG, PTA, PA) as well as downstream products (PP, PE, PVC, EPS/PS, ABS/SAN and SBR). TOC is owned 49% by PTT, 13% by Siam Cement (TPP, TPE) and 13.76% by Bangkok Polyethylene, 6.86% by TPI, 5.29% by Vinythai, 5.0% by BST, 4.77% by SSMC and 2.0% by NPC1. The output of feedstock is priced at US Gulfcoast price plus 10% and has contractual buying agreements similar to NPC1. TAC, fully owned by PTT at this time, will be offered to the private sector and produce a mix of benzene, toluene and other products. NPC 2 is NAPTHA -based production using domestic refinery capacity.

When production of NPC1 began, the focus of sales was the domestic market which was growing as high as 7-8% per year and expected to continue for several years. Petrochemicals contribute about 5.5% of GDP value with a 1994 current value of 45,495,000 baht and the rubber and plastic industry contributes slightly over 2% of GDP with a 1994 current value of 20,942,000 baht. (NESDB, 1995) Income elasticities of demand for chemicals in the US and Western Europe between 1956 and 1966 were 1.81 and 2.05 respectively, falling to 1.1 and 1.4 during the 1980s. (OECD, 1968,12 and Storck, 1986 cited in Chapman 1991, 91) If the Thai economy follows this pattern then, as the Thai national income expands we would expect that demand for petrochemicals and plastic products would continue to grow.

Stimulation from NPC1 and NPC2 led to the announcement of plans by two private producers to begin upstream production toward the end of the century as well as the entry of several more domestic firms into the production of intermediates and downstream petrochemical products. Industry observers estimate that Thailand now has existing or planned capacity to produce over 1.5 million tones per year of ethylene. ASEAN as a whole is estimated to have capacity of over 5 million tones per year. Thailand, Malaysia (1.1 million tones/year) and Indonesia (1.0 million tones/year) have the highest capacities in Southeast Asia. (Hagen, 1995b) Table 4 shows the firms in the Thai industry by capacity, start up cost, licenser and product as of December 1995.

C. Industry Structure and Behavior

The petrochemical industry in Thailand is characterized by monopoly or duopoly in the feedstock and resin sectors and monopolistic competition in the plastic product segment. Entry upstream has been strictly controlled by the government. In 1992 the minister of industry permitted expansion of production of PP, PVC, PE and VCM. The industry responded with announcements of plans to expand capacity by the year 2000. The products are from the low to medium priced ends of the market.

The industry structure including NPC1 and NPC2 and the announced expanded production by product is given in Table 5. Certain companies had monopoly situations after the establishment of NPC1 in 1989 -some because of the structure of NPC1 and others because they were sole producers before NPC1 began and maintained that status. Only producers of PS and PE had competition from other domestic producers in the early years of the industry. The producers of PVC, PP and ABS had no domestic competitors at the time

NPC1 went into production. By the year 2000, there will be considerable domestic competition across several product lines from ethylene and propylene feedstocks to specialty plastic resins such as ABS/SAN. The state enterprise (e.g. TOC) has announced plans to expand even after private companies have announced plans in similar product lines.

In order to understand the competitiveness of the industry structure, ten price determination points are identified in Figure 5. Point 1 represents the negotiated price between PTT and the concessionaire who supplies natural gas from fields in the Gulf of Thailand, currently UNOCAL. This price is a weighted average of the Singapore price for fuel oil, the Thai wholesale price index and the US export price index. Price point 2 is the price negotiated between PTT and NPC1, for the feedstocks, ethylene and propylene. This price is now determined by a combination of world market price and cost of production. This arrangement is referred to as cost-plus pricing where the downside risk is completely shifted to the buyer under contract. Price point 3 is the international price of imported feedstocks bought by resin producers including NPC1. All ethylene and propylene imports must go through NPC1. Industry sources say there is no problem getting any necessary imports. Price points 4-6 are the various prices at which the output of NPC1 (ethylene and propylene) are sold to the producers of plastic resins who are also shareholders of NPC1. These prices are set depending on the source of the output—that is, whether it was produced in the first 75-80% of NPC1 capacity or from the last 20-25% of the capacity, which is destined for the spot market. The strategy for this pricing is that the first 75-80% of capacity is contracted for purchase by the shareholders which means that fixed and variable costs are included in that price. Spot prices may not include fixed costs. Price point 7 is the export price received by resin producers most often on the spot market. Export prices are determined by global supply and demand conditions as well as product quality. Price point 8 is the listed price at which the plastic resins are sold to plastic fabricators. This price is the c.i.f. price of the resin in Bangkok plus the tariff. The actual sales price is discounted. Point 9 represents the price to plastic fabricators from resin producers in Thailand who import their inputs in contrast to the price at point 8 which is the price to fabricators of resins produced from domestic raw materials. There is a related price not included in Figure 5 which is the price from plastic fabricators to both export and domestic markets of products produced from imported materials. If the plastic product is exported, the tariff is refundable to the producer. The last price, point 10, is the price to the domestic consumer of plastic products produced with domestically produced plastic resins. This price is currently based on world price plus 45% tariff.

The price in Thailand follows the world price trends for all the commodity plastics with slight deviations across months. Figures 6 to 11 show the apparent two year cycle for 1994 and 1995 for the major commodity plastics. There is wide fluctuation in the prices across the cycle. Contract prices are typically set for three month periods. Inventory is costly to hold and stoppages are expensive as the machinery must be reheated and restarted for a new production run. When the Thai producers export excess supply, they have to take the lower spot market prices. This phenomena explains why the prices in Bangkok are consistently lower than world price. Import prices will include tariff.

A comparison between c.i.f., c.i.f. plus tariff and domestic transaction prices for commodity resins, PP, HDPE, LLDPE, LDPE, PS and PVC are also shown in Figures 6-11. The tariff in these calculations is the MFN rate for 1995 (40%) and the AFTA rate for 1995 (30%). These data reflect the most recent year and indicate that the Thai industry is

selling resins domestically at about 20-25% above the c.i.f. price depending on the commodity. The average observed mark up rates for plastic resins calculated as transactions price minus c.i.f. price divided by c.i.f. price are given in Table 6. The average mark up over c.i.f. price for PP is 20%; while that for PS is 14 %, the markup for HDPE is 26%, LDPE and LLDPE are 29%, PVC is 42 % and ABS/SAN is 36 % .

The mark up over c.i.f. price varies by product and according to industry sources is driven by both demand and supply factors as well as quality differences. The buyers of plastic resins are contacted at intervals by the producer representative and offered resin at a discount off the international price. Depending on their demand needs, the firms will decide whether or not to buy at the “sale” price. The lowest mark ups during 1995 were given by firms producing PP and PS which have the relatively largest numbers of producers. Although not definitive, this indicates some degree of competitiveness amongst those domestic firms producing a particular product. The product lines with fewer firms producing are able to charge a higher price.

The reduction of tariffs under the AFTA agreement will force the domestic industry to compete with imports particularly from ASEAN countries such as Malaysia, Indonesia and Singapore. The plastic pellets (resin) are almost homogeneous products and so this competition may lessen the oligopolistic power. But since most ASEAN members export only a small proportion of their production, the impact on industrial structure in Thailand will not be as strong as the impact on domestic prices. Reduction of the tariff alone may not induce any new entrants since most Thai firms are expanding with plant sizes which produce economies of scale. By 2000, Thai firms will have not only the widest range of products but excess capacity to meet domestic and foreign demand. Additionally, the competitive forces will be mitigated by tariff rates of MFN (30%) and AFTA (5%).

D. Industry Ownership

The Thai industry is unique in ASEAN in that it is almost entirely Thai owned. Although many firms have bought technology from abroad, few joint ventures exist in the petrochemical industry in Thailand. Foreign ownership is minimal where it exists. The Thai ownership enables the firms to know their market well but it also excludes them from the benefits of partnership with a large chemical company. In these partnerships, technology is easily transferred at low cost and feedstocks are often purchased at volume discounts. The Thai industry has been able to develop their own recipe for application of the technology in the Thai market. This ability to adapt the technology to particular situations has been called “tacit technology.” Firms in the industry believe that one of their competitive strengths is acquisition of tacit technology which reduces their costs of production.

III. Plastic Product Industry

The plastic fabrication sector of the industry in Thailand has been in place for over thirty years producing plastic products for the domestic market. As industrialization proceeded, the level of sophistication of both domestic and global plastic product demand increased. This increase in sophistication has two implications. The first is that the plastic

fabrication industry needed in many cases to expand production, improve production processes with respect to quality and develop or buy new technology. The second implication is that this demand generated a market for additional products from the petrochemical industry.

A. Market Structure

Currently the US and Western Europe demand over 50% of the world's plastic production from ethylene and propylene. Domestic demand for plastics and plastic products typically grow at tremendous rates as industrialization proceeds. The demand for plastic products in Thailand is estimated to be growing at over 11.5% per year. (Fayad et. al: 21). The demand for plastics is driven by a variety of sources. Plastic is used as a material substitute for steel, aluminum and copper in capital machinery. (Considine, 1991) It is also produced and exported to markets all over the world and lastly, plastic is demanded domestically for use as an intermediate and a final good. Domestic demand for plastic products comes from substitution away from older technologies or development of new product demands. The most expensive input in plastic production is raw material inputs.

Plastic materials fall into three major categories: 1) commodity plastics which are comprised of olefin resins, styrenic resins and polyvinyl chloride; 2) engineering plastics which withstand higher temperatures and are used predominantly in electronic equipment; and 3) super engineering plastics which are still in early stages of development. (Japan Plastics Industry Annual, 1993) Plastics are used in automobile parts, office equipment, audio visual machinery, food packaging, building materials and simple bags. Production processes are injection molding, extrusion, blow molding, inflation molding, calendering, vacuum thermal forming, completion molding and rotational molding. Each piece of machinery has a specific process associated with it and each process may produce a broad range of products. The molding processes involve certain raw material inputs being molded into specific shapes. The molds for these shapes (or parts) may be imported or may be developed domestically.

The products from the plastic processing industry in Thailand can be generally divided into the a) industrial parts sector (electrical parts, transportation sector, machinery, construction), b) the packaging sector (containers, bags, and packaging materials); and c) the household and other sector (housewares, toys and artificial flowers). The total number of plastic fabrication factories (over 2600) registered with the Thai Ministry of Industry is given in Table 7. The vast majority of these, about 75%, are small one room one machine shops producing sacks and bags for domestic use. More than half of these firms are located in Bangkok. Of the rest, about 100 are involved in exporting high quality electronic parts, houseware, or automobile parts.

In 1994, 83% of LLDPE went into production of bags, product containers and film; 64% of HDPE went into production of bottles, containers and plastic bags; 87% of PP went into production of household goods, bags and film; 76% of PS went into production of electric ignitions, tape and bowls and other containers; 92% of ABS/SAN went into production of vehicle parts, electronic parts, sports equipment and toys. Overall this amounted to about 1.58 million tons of raw material inputs across all types of polymers. Of this, about 1.27 million tons was produced from domestic capacity while .431 million tons was imported and .121 million tons was exported. (ASEAN Federation of Plastic Industries, undated)

The plastic industry in Thailand comes closest to the textbook case of a monopolistically competitive industry where individual firms compete in market segments characterized by level of product differentiation. In plastics, though, the firms associate and identify themselves with each other on the basis of using a common set of inputs (petrochemicals). Typically we observe firms associating with each other for public policy purposes, to share information or marketing on the basis of final market product sales. The plastic industry in Thailand can be generally classified into three segments based on level of technology used for production and differing quality of input material.

Market segment 1: The largest production segment by number of firms but certainly not by value is that producing plastic bags. The Thai industry has developed a large export market for plastic bags and continues to satisfy the growing domestic market for plastic bags of various sizes and types. Plastic bags are relatively homogeneous and produced with little technological sophistication or specification. In Thailand there may be as many as 2,000 small firms producing for this segment of the market. Entry and exit is easy requiring an investment of 250,000 baht (\$10,000) or less. These small firms buy domestically produced or imported raw material to use in their small factory with one machine making the bags. The factory typically operates 24 hours a day with one or two workers who tend the machine. The workers are unskilled and profit margins in this segment of the market are relatively narrow. Graphically, we might envision this market as facing a horizontal or almost horizontal demand curve. In this type of market any change in technology, labor conditions or other factors which resulted in a cost increase would cause the firm to go out of business. The firm essentially has no market power and is a price-taker. Imports and exports of plastic sacks and bags from 1988 through 1994 is given in Tables 8 and 9. Both imports and exports have dramatically increased during this time period. Most of the exports are to countries outside of ASEAN while exports to ASEAN countries are increasing each year. Import and export trends of another group of products that probably falls into this market segment are shown in Tables 10 and 11, household and toilet articles. These products are relatively homogeneous and require little innovation or capital equipment. Exports of these articles have begun to increase substantially since 1992.

Market segment level 2: This segment is characterized by a more sophisticated level of production embodying a higher level of technology in the machines or process. This may include for example, the use of imported molds for the products. At this level we also see use of licensing or other contracts between the producing firms and purchasing firms. Firms producing for automobile manufacturers would fall into this segment of the market. In this case, the auto manufacturer contracts with the Thai plastic fabricator firm for a particular type of part (e.g. seat cover, seat belt, bumper) made with certain specifications. These contracts or licenses may include prohibitions on resale by the producer to any other buyer. The value added in this segment is higher than that of segment one.

Licensing is a type of vertical integration but in this case, the integration is driven by the economics of the buying firm rather than by the producing firm. The products from this segment are differentiated but in fact could be made by any firm that purchased, leased or was licensed or contracted to use the technology. Although the Thai firms in this segment may enjoy a slightly higher profit margin and produce higher value added than that in segment one, the firm's sales may be restricted to a single buyer which creates some uncertainty.

In this segment of the industry the firm might be considered an imitator—in the sense that there is no innovation going on within the firm itself. Some of the firms are weak

imitators in the sense that they license the technology. There are firms which might be called strong imitators who have purchased the technology and are free to sell wherever they wish. The degree of imitation is most likely determined by the concentration in the buying market rather than by the particular product. The more concentrated the buyer's market (closer to monopsony) the weaker the level of imitation. The weak imitator may face what Martin (1988,231) calls "small-number bargaining problems" wherein the contracts or licenses make it difficult to switch from one buyer to another without incurring substantial costs. The level of cost would depend on what adjustment was made to accommodate a particular buyer's contractual specifications. Many of the products in this segment are exported.

In segment three we observe a higher value added to the product. There is perhaps niche marketing, exporting freely to international markets, higher level of capital investment in machines which may require specialized input raw material (e.g. melamine) or a larger scale of production. These firms are actually undertaking product innovation and may be licensing to other firms. They will be producing almost any product which can be differentiated. These firms extract larger amounts of consumer surplus by selling similar products under different product names and capturing any returns to consumer brand loyalty. Melamine tableware is such an example. Import and export trends for melamine and other plastic kitchenware are given in Tables 12 and 13. Exports outside of ASEAN of these products have increased almost 15 fold since 1990, while imports have shown a steady decline over the same period.

B. Policy Considerations

The international environment for the industry changed with the ASEAN free trade agreement (AFTA). It was agreed in September, 1994 that under AFTA the import duties for petrochemical feedstocks and intermediate products such as ethylene, propylene, butadiene, styrene, and acrylonitrile be cut from 20% to 12% while tariffs for all polymers be reduced from 40% to 30% with additional cuts within 10 years. (*ChemicalWeek*, 2/15/95:43) Plastic products (fabrication) have the highest level of protection beginning at 60%. This has since fallen to 30% and will continue to fall. The recent declines in tariffs have been brought about by agreement of the ASEAN Free Trade Area (AFTA). Thailand has also begun to reduce tariffs to conform with the GATT regulations. The tariffs under AFTA decline more sharply than those under GATT.

A key policy dilemma for the Thai government in establishing the upstream petrochemical production units was how to protect petrochemical industry development without damaging downstream plastic fabricators with either high domestic prices for raw materials or high import prices for raw materials. The former results when the petrochemical industry produces under tariff protection while the latter happens when the plastic fabricators are faced with tariffs on their raw material imports. The plastic industry has had to buy more expensive imports as the domestic production has come on line and achieved economies of scale. The plastic industry however, has had an advantage of having domestic demand for plastic products growing at least 12 % per year along with the overall Thai economy. These firms that produce for the domestic market have been able with tariff protection to pass this cost increase along to domestic buyers. Firms which produce bags and sacks take advantage of relatively low wages in Thailand to remain competitive in international markets and receive a rebate on any tariff paid when the product is exported.

Market segment 1 of the plastic fabricators are particularly vulnerable as tariff rates decline. They have operated in a protected market for many years and will need to reduce costs in order to compete with imports. One method of cost reduction is adoption of new more efficient technology. According to a recent study by the Japan International Cooperation Agency (JICA), the plastic fabrication segment of this industry has not modernized its machinery in many cases because of “the lack of precision machine tools and human skills” necessary to operate the machinery. (JICA, 6-3-13) The main problems are obtaining suitable molds in the sector that produces low cost products. Specifically the report says that the low cost producers use old machines which have “die plates with varying thickness, with an insufficient number of cooling water pipes; parting lines are not well formatted probably due to variation of hardness of steel mold and uneven structure; poor finishing accuracy in the mold manufacturing process.” The authors cite problems with understanding of basic plastic processes on the part of the operators. This lack of training results in incorrect temperature controls, inappropriate cycle times, and longer molding time with poorly made molds. The machine/mold making industry uses old technology, low standards and needs training to improve workers’ understanding of the production process and quality standards necessary to compete internationally.

Segment 2 of the industry often obtains molds from the company which has ordered the parts and so is producing to international standards already. These companies will remain competitive and plan to respond to AFTA through service and other non-price competition. This segment is a supporting industry to the automobile and motorcycle industries which are experiencing large growth rates in Thailand. Segment 3 has been competing on an international level for many years and will benefit from the reduction in tariffs in other ASEAN countries by increasing exports to those countries.

All segments of the industry will benefit from having a high quality petrochemical industry available domestically. If domestic petrochemical prices fall to competitive levels, the plastic fabricators will be able to buy domestically and import input material more cheaply from ASEAN neighbors when the industries begin to focus on exports.

IV. Pattern and Trend of Trade

The emergence of Japan, China and South Korea as global traders in plastic resins is shown in Table 14 which gives selected country imports and exports. Thailand by comparison is a relatively small trader in this global market still importing almost five times what is exported. Global imports and exports of plastic products for 1979-93 are given in Figures 12 and 13. With plastic products as well as plastic resins, although Thailand is a large producer in Southeast Asia, the dominant global producers remain the US and Germany.

Resin exports and imports to and from Thailand for 1995 are given in Tables 15 and 16. For several resins, levels of imports are higher in 1995 than in 1990 indicating that even as domestic production increased, demand increased relatively more. The imports and exports are not always the same quality product which isn’t reflected in the customs commodity codes. Imports and exports of selected petrochemicals by quantity for 1989-94 is given in Appendices 3 and 4. Demand is growing rapidly outdistancing domestic production in some product lines while other products appear to be in excess supply relative

to domestic demand. At any given time, there may be shortages of a particular product for a short period. The imports or exports are generally products required by buyer specifications or for which there is no domestic market in Thailand. This occurs for example, when Japanese auto manufacturers or European frozen food producers specify that producers use a particular quality of plastic for the part or use plastic from a particular firm. The industry in Thailand is not yet producing many of the top end plastics used by domestic plastic fabricators for exports. The price differentials between imports and exports for selected resins are shown in Figures 14 to 18.

Trade with ASEAN countries in plastic resins, plastic products and other petrochemicals is a relatively insignificant portion of the total Thai trade. ASEAN trade in petrochemicals is shown in Table 17. Production in ASEAN countries has continued to expand even as the Thai industry has. Table 18 gives a comparison of production capacities for Thailand, Singapore, Malaysia, the Philippines and Indonesia for various plastic resins. It seems that there is some degree of specialization occurring across the countries. Thailand is producing the widest range of products with Singapore as second. This table includes estimates of planned capacity.

The major conclusion from examination of exporting and importing trends for feedstocks of petrochemicals is that the trends reflect a market which has not yet fully formed. That is, the only clear pattern is that demand is outstripping the ability of the domestic petrochemical industry to meet supply in the domestic market. Additionally, it appears that bottlenecks in domestic production flows are intermittently being solved with imports while exports reflect oversupply of certain lower quality products. The largest category of petrochemical imports to Thailand for this industry in 1995 were intermediate products such as vinyl chloride, styrene, P-Xylene, Ethylene Glycol. These products are used as feedstocks for the downstream resin producers. These imports came from the US, Norway, Japan, Canada, S. Korea, Saudi and Taiwan. They are listed by year for the past five years in Table 19. These imports should decline in the next five years as domestic production of the same products comes on line.

The largest category of petrochemical exports were polyester, HDPE, PP and PVC of various forms. These exports for 1990-95 are shown in Table 20. Except for Hong Kong and Taiwan, all the major destination countries are considered to be less industrialized than Thailand: Indonesia, Pakistan, China, Vietnam, Malaysia.

The obvious trend for plastic products is that Thailand is exporting to less industrialized countries and importing from more industrialized countries. Trade with ASEAN countries is a relatively small proportion. The top ten destination countries for plastic products from Thailand are Singapore, Japan, Hong Kong, US, UK, Pakistan, Australia, Malaysia, Poland and Sri Lanka. Value of exports to these countries by year for 1992-95 are given in Table 21a. The major countries from which imports of plastic products come into Thailand are Japan, Taiwan, Singapore, US, Malaysia, Germany, Hong Kong, South Korea, China and France. Value of these imports by are given for 1992-95 in Table 21B.

The major plastic products that are exported, shown in Table 22, are 1) articles of apparel (e.g. gloves) exported to Singapore, Sri Lanka and Bangladesh; 2) sacks and bags of polyethylenes going to UK, Japan and Singapore; and 3) Other articles of plastic to the US, Japan and Singapore. The top ten plastic products imported to Thailand by country and for the years 1990, 1993 and 1995 are given in Table 23. The major category is "other" which

comes from Japan, Singapore and Taiwan. Most of the imports of plastic products are from arch more industrialized countries.

V. Firm Competitiveness and Interviews

A. Competitive Factors in Thai Industry

The research team for this project conducted 17 lengthy interviews with petrochemical industry representatives. Three interviews were with resin producers, nine were with producers of plastic products such as vehicle parts, dinnerware, housewares, water treatment tanks, packaging, large and small woven sacks, toys, and small plastic bags and film, two were with supporting firms to the industry such as machinery producer and natural gas processor as well as three interviews with industry trade associations. Interviews were in almost every case with the Managing Director or Chief Financial Officer of the corporation or company. These interviews were supplemented with telephone interviews and mail out questionnaires. Most of the interviews were conducted between November, 1995 - January 1996 in Bangkok and surrounding provinces. Each interview was unique and in order to show this diversity, several are summarized below. The interviewees were asked directly about their company's response to AFTA and what factors determined the competitive edge for Thai producers in this new economic environment.

Analysis of the interviews reveals that important factors for success cited by the interviewees are all related to management and government policy. They considered shortages of skilled workers, rising labor costs and access to cheap raw materials as the limiting factors for the industry in the future. The resin producers and exporting plastic fabricators were concerned that Thai business remain competitive with respect to the cost of funds. As the industry plans rapid expansion, they are worried that interest rates may be a constraint to this expansion. Interest rates are relatively high in Thailand at this time but the government has recently expressed concern over this issue. Electrical flow problems also present a significant and sometimes costly problem for resin producers who need constant flow electricity for their production process. Unplanned interruptions in electric flow result in costly stoppage. Labor costs are beginning to increase in Thailand. Producers are concerned that Thailand remain competitive with both skilled and unskilled labor. Plastic material fabricators who import machinery have difficulty getting spare parts cheaply as these parts are subject to tariff. The industry generally was willing to work with BOI for promotions but looks to the future for an adequately educated workforce.

The following list categorizes the factors that were cited several times in the interviews:

a) *Knowledge and established capacity.* Resin producers and plastic fabricators for export in particular believed that economies of scale and established know-how gave the Thai industry a comparative advantage over ASEAN countries with respect to their product markets. They noted that they had overcome early difficulties in implementation of the technology and were farther along the learning curve than competitors in Southeast Asia. They also have a knowledge of the domestic market conditions and needs.

b) *Long term economic relationships.* Plastic fabricators believe that service and long term economic relationships with their customers in domestic and international markets, including ASEAN, will advantage them as tariffs are reduced under AFTA. They have already established trade and expect to continue to deal with the same customers as long as they maintain competitive service and price. Technology has already been transferred through some of these relationships implying that they would continue in the future to avoid costs of changing suppliers.

c) *Innovation and Heterogeneity of Product.* The plastic fabricators supplying the high end of the market believe that in order to stay competitive they must continually innovate and improve their product as well as reduce costs. Innovation includes development of technology, manufacture of their own molds and further refinements of processes. Improved service as well as product differentiation were often cited as responses to AFTA.

d) *Market Growth.* Almost all interviewed in this industry expect a continuing tremendous growth of demand both in the Thai domestic market as well as in Asia. They recognize that both India and China are developing capacity and will be major competitors but Thai producers believe that this capacity cannot keep up with the growth of demand as industrialization proceeds. There is a sense that new firms should be able to serve (and defend) domestic markets before attempting to export. Many Thai firms already have this exporting experience and are considering developing joint ventures to export that expertise within the region. The market growth will enable the resin producers to achieve economies of scale in world size plants.

e) *Natural Resources.* The firms believe that there is abundant cheap natural gas available in the region to support the input needs of their industry. There is some concern that post-AFTA tariff reductions will give exporting advantage to other industries with already cheap inputs (e.g. Indonesia, Korea). Thai producers plan to take advantage of these cheaper resources if they are available in ASEAN after AFTA.

f) *Government Policy.* Firms almost universally support the program of rebating tariffs paid on materials imported for production that is exported. They also supported the protective tariff structure currently in place for the resin-plastic product industry. The same firms expressed concern over limitations for their industry in the future. These concerns fall into these general categories:

1) Skilled labor. The Thai resin and plastic fabricators believe the Thai labor force is losing its competitive edge not entirely because of cost. Low end market producers complained about increasing labor costs while high end producers identified a lack of vocationally trained workers needed for example, to operate computerized equipment. Some of these firms have internal training programs while others have no labor training beyond initial probationary periods.

2) Government Policy. Firms complain about the lack of solid waste disposal in the industrial estates and the requirement that they treat their own waste water—(since the interviews took place, a new company, named GENCO, has been established to manage the solid and toxic waste disposal within industrial estates); they also say that customs procedures are time consuming and expensive; they are hampered by tariffs on imported machine

parts (35%) when these machines cannot be produced in Thailand; and electricity flows which interrupt the production process, jam machines and delay delivery schedules.

B. Summary Interviews

A resin producer said they were setting up several joint ventures for new product development as well as dramatic expansion scheduled to come on line in 1997 for VCM production. He gave an example of a venture with the Japanese in order to develop products for medical applications, another with a US company which would produce PVC paste beginning in 1997 and another with a Vietnamese company to produce PVC compound. They were looking to expand into Vietnam and capture as much as 60% of the PVC market share there. This same company said it had no close competitors in ASEAN and was importing whatever materials it needed from South Korea, Europe and the US and exporting to Japan, Vietnam, China, Bangladesh and India. They expect a 15% per annum growth in their market for building materials and post-AFTA they plan to compete on both service and price. As far as ASEAN is concerned this producer says that some Thai firms see ASEAN countries as another province of Thailand and that this attitude is beneficial or no one would seriously consider these markets because of their small populations or low demand. He thinks that for resin production there should be at least a 30-40 million population so that the production can totally supply the domestic market. Otherwise the firm needs to produce for export.

A producer of auto parts from PVC material. This producer is licensed to produce on order for a Japanese auto manufacturer. They may only use materials which are licensed by the Japanese ordering company and often Thai resin companies do not have these licenses. The producer also produces for the local market but says local production has lower standards and does not need long term planning and specifications like that needed for the export market. Indonesia is his main competitor because they have the raw material - oil. This producer used Mitsui as an example of long term economic relationships that have paid off. Mitsui has invested in Thailand for 50 years and now it is benefiting Mitsui when they needed to find new locations for production.

A producer of toys for export under a UK name for sale in Europe. The production was for a US toy company but the Thai company sold to an agent who resold in Europe. The production arrangement allowed the Thai company to sell in the domestic market. This company had taken advantage of the government's promotion to locate the factory in the provinces outside the Bangkok area. The production process is labor intensive (pouring plastic into molds, trimming, painting, inspecting, packing) and this firm would be hurt by any increase in the minimum wage or by competition from imports using cheap labor sources.

A producer of dinnerware has about 55% of the dinnerware market in Thailand and 12% market share of household plastic products. He is expecting 15% domestic growth rate per year, relying on increases in income as industrialization proceeds and people move from using paper products to plastic.

A producer of housewares (about 5% domestic share), vehicle parts for motorcycles, automobiles (about 20% market share) and electrical appliances. This firm is a contractor for Japanese brands: Honda, National, Sharp. This firm is the largest

motorcycle plastic part producer (e.g. fenders, side covers, hand grips) within ASEAN. The firm uses PP and ABS and competes with other Thai companies for contracts to produce electrical appliances and housewares. The firm acknowledged that an advantage of Thailand is that Thai firms can market the older design to Vietnam and China as that industrialization proceeds. These designs are no longer produced in Japan and Thai firms have the expertise in this area.

Premier Products is one company within a larger corporate structure producing water tanks, house water treatment systems, bathtub liners, city water tanks and institutional water tanks for hospitals, condos, schools. The other firms in the premier corporate group produce plastic products for construction and electronics as well as participate in food processing, real estate development, and a car dealership. The company has had its own R&D for over 20 years. It exports bathtub liners to Germany and expects to see that market continue to grow. The water tank demand boomed in response to a recent Thai law requiring housing developers to provide water treatment in the developments (outside Bangkok). Premier has developed a biologically based system that will treat household waste and provide recycled water for lawns and for safely dumping into public waterways. Premier estimates they have a 60% market share but there are about 30 competitors now in Thailand producing water tanks.

Sri Thai Superware is the acknowledged leader in the production of melamine dinnerware and other plastic housewares. Sri Thai sells domestically through a direct sales force of over 40,000 women as well as exporting to the UK, Hong Kong, Japan and the US. They also have a 12% share of institutional dinnerware demand. Sri Thai attributes their success within both ASEAN and world markets to quality and innovation of product design and cost reduction. Local demand has been growing so much that that is where they focus expansion although they may consider going into the Indochina area with new plants.

A producer of poly bags which are used for shipping and packaging cement, chemicals, agriculture products, fertilizer, grain, and sugar sells both domestically and exports to Japan, Europe and the US. The bags use PP, PE and HDPE as inputs. There are about four competitors in Thailand producing the large bags. and about 50 firms producing the small bags. They compete on quality and service especially on delivery time. They consider the machine operators to be their skilled labor which is about 60% of the total labor force. They are able to use some recycled material but it is costly to clean the material (with water) before re-use. Recycled material cannot be used for food product packaging. Their machinery is imported from Japan, Austria and Germany.

A producer of plastic containers for shampoo, soaps and an array of personal hygiene and household products. This company produces several colors and grades of bottle and container mostly specifically ordered by the particular company which intends to fill and ship the bottles. They can specially design packages and bottles to order. Their comparative advantage is in their trained workforce and their ability to respond to design requests.

A producer of plastic bags from LLDPE predominantly for the frozen food sector. These bags have 5 kg or less volume and are used for vacuum packing of vegetable oil, sausages as well as rice and toilet tissue. This firm produces for the domestic market only and estimates they have 70% share of the market for pasteurized milk and vacuum packing frozen foods in Thailand. About 50% of their input material is imported and about 50% is bought domestically. They compete on service and need to use higher qualities of resin for

strength and transparency—some of which is not produced in Thailand. The managing director is an engineer and developed some of the formulas for the bags now being marketed. They foresee input materials (e.g. nylon, LLDPE) being produced in Thailand and therefore being cheaper in the future.

VI. Conclusion

A. Overview

By the year 2000, Thailand will have the largest plastic resin production capacity in South East Asia. Thai companies are producing commodity plastics used in low and medium end market products such as sacks and bags, packaging materials, packaging for agro-products, vehicle parts and electronic parts. There are a number of high end plastic product producers who develop their own approach to the market, fund their own research and product innovation and export regularly all over the world. The resin segment of the industry is very concentrated because of high capital costs to entry and early government restriction on entry. There are two firms (NPC, TOC) which produce Olefins with at least two more scheduled to come into production within the next four years. New aromatics plants are currently under construction and expected to begin production within three years. There are five firms (TPC, TPI Polyol, Pacific Plastics, BST, Tuntex Petrochemical) producing intermediate products with more producers including a state enterprise which announced plans to expand or begin producing intermediate petrochemicals in the next five years. There are 16 firms producing downstream resins which supply raw material for the plastic products, automotive, vehicle parts, garment and fabric industries. (TPE, TPI, BPE, TPC, VNT, HMC, TPP, Thai Polyacrylate, BST, Siam Srithepthai Plaschem, Thai ABS). The plastic product segment of the industry is very competitive. There are several hundred small plastic product producers serving the domestic market for bags and sacks and about 100 larger firms which have differentiated products targeted for the high end of the domestic market or for export markets.

Within ASEAN, Thailand has the capacity to produce across the widest range of products of any country with the exception of Singapore which is producing higher end products. Thailand's main competitors are South Korea, China, Taiwan, Malaysia, Singapore and Indonesia. Trade with ASEAN has been a small portion of total trade in Thai resins and plastic products. Thailand historically imported resins from more developed countries and exported plastic products and commodity resins to less developed countries. Most of the Thai resin production is used for domestic consumption with oversupply of low quality resin exported. In order to support the growing automobile and electronic parts industries, resin producers and plastic fabricators will probably continue to move into production of more sophisticated types of plastics. Within ASEAN, Singapore is leading other countries in these high end plastic applications.

B. Impact of AFTA

The resin producers in Thailand may be much stronger than competitors in other ASEAN countries even after imposition of AFTA . Although there may be some imports

from time to time of specialized products, most of the time the Thai resin industry will be exporting to other ASEAN markets. The economic crisis in Thailand has caused some of these firms to cancel or postpone expansion plans which may alter these outcomes. Plastic fabricators in the high end and middle segment of the market will be little affected by AFTA and may find additional markets within ASEAN countries. They are already producing for the international market with international product standards. They have invested in innovation and development of technology. They manufacture their own molds and create refinements to the technology which they have purchased on international markets. They plan to compete after AFTA with improved service and continued product differentiation. The low end plastic fabricators (e.g. sacks and bags) are more vulnerable because their product is homogeneous. These producers compete on costs and prices. After AFTA they will have to either differentiate their product or compete on quality in service such as with delivery time. Many of these producers have not invested in new machinery or training and will be disadvantaged relative to firms which have made these investments.

C. Competitive Issues

1. *Established Capacity of Resin Producers.* Thai resin producers have developed capacity in the low and medium market commodity plastics and supply domestic industry and countries in early stages of industrialization (e.g. Laos, Vietnam, China). Existence of the supply capacity advantages the industry over the long run because it discourages new entrants. Thai producers focus on the domestic vehicle market and plastic fabrication market. No other country in ASEAN has this particular focus combined with large scale capacity and relatively new technology. Thai producers are prepared and in some cases already moving into Laos, Vietnam and China. Thai firms are creating and maintaining market share by setting up joint ventures in these countries which capitalize on long term economic relationships between Thailand and her neighbors.

2. *Thai Ownership.* The resin and plastic products industry in Thailand is almost entirely owned by Thai entrepreneurs. This pattern has allowed for orderly development of the industry through consultation between firms and government. Tariff protection has served this development for several years and enabled the resin producers time to reduce some of the capital debt and move toward realizing economies of scale in production. Tariffs on plastic products have protected the end fabricators from foreign competition and allowed them to supply to the domestic market at relatively high cost. Because the firms are not in joint venture with large chemical companies to provide new technology, this ownership pattern may disadvantage the Thai firms in the future. Joint ventures receive technology developed by the parent company sooner and more cheaply than competitors. The Thai firms may be able to retain market share, particularly in ASEAN by continuing to supply the low end of the market where technological improvements are not so critical.

3. *Knowledge and Adaptation of Process and Market.* Thai resin producers have learned how to create their own recipe for production which they believe enables them to increase productivity. They reduce their cost of technological acquisition by modifying the recipe to suit the capabilities of their capital. They also have strategic knowledge of their domestic market as well as other markets in which they have established long term relationships. For the domestic buyer of resins, it is less costly to retain a domestic supplier. For the domestic seller, it is more profitable to develop and maintain a sales relationship with a domestic buyer.

4 *Market Growth.* The single most important factor cited for the success of the Thai industry is the expected growth in demand for petrochemicals and plastic products of every type. This demand is tied to the increase in incomes associated with increased industrialization. Thai producers recognize that both India and China are developing petrochemical capacity and will be major competitors in Asia. They plan to compete vigorously to defend their domestic market as well as capture a share of these growing markets. As market demand expands many firms will be trying firstly to supply domestically while leaving exporting for later. The Thai firms have acquired valuable experience in exporting and supplying domestically and will be ahead of firms just entering the industry, for example those in other ASEAN countries.

5. *Limitations on the Industry.*

a) Skilled labor. The Thai resin and plastic fabricators believe the Thai labor force is losing its competitive edge not entirely because of cost. Low end market producers complained about increasing labor costs while high end producers identified a lack of vocationally trained workers needed for example, to operate computerized equipment. Some of these firms have internal training programs while others have no labor training beyond initial probationary periods.

b) Government Policy. Firms complain about the lack of solid waste disposal in the industrial estates and the requirement that they treat their own waste water (this has been taken care of by government contract); they also say that customs procedures are time consuming and expensive; they are hampered by tariffs on imported machine parts (35%) when these machines cannot be produced in Thailand; and electricity flows which interrupt the production process, jam machines and delay delivery schedules.

c) Natural Resource Availability. Cheap feed stock, particularly subsidized by a foreign government, would pose a threat to the Thai industry by giving firms in that country a distinct cost advantage. Aware of this possibility, Thai producers continue to pressure their own providers (e.g. PTT) to reduce prices on ethylene, propylene and other feed stocks. All of the Thai producers said they would prefer a stable, domestic source of good quality feed stock if it were available. The resin producers see AFTA reductions in tariffs as a positive force. They intend to import if necessary to meet domestic demand and will turn to ASEAN sources whenever possible if they are competitively priced. Plastic fabricators also see AFTA tariff reduction as a positive force for their segment of the industry. They will be able to purchase imports more cheaply and the cheaper imports will put pressure on domestic firms to reduce prices. This will in turn increase their own competitiveness in both domestic and foreign markets.

Bibliography

- Alperowicz, Natasha. 1994. "Thai Petrochemical awards cracker contract to Linde." *Chemical Week* 155 (15): 26.
- Alperowicz, Natasha. 1995. "Thailand's two PVC makers plan major capacity hikes." *Chemical Week* 156 (7): 20.
- Arom Suwansapap, 1993. "Effects of AFTA on The Thai Petrochemical Industry." *Bangkok Bank Monthly Review* 34: 9-13.
- ASEAN Federation of Plastic Industries. 1995. *Country Report from Indonesia*. AFPI Council, Kuala Lumpur.
- Banzon, Cesar P. 1994. *Synthetic Resin and Plastic Industries: Impact of Trade Policy Reform on Performance, Competitiveness and Structure*. Research Paper Series No.94-03. Philippine Institute for Development Studies.
- Changorn, Pichaya. "HMC Polymers secures US\$37.5 million to double capacity." *The Nation*. Sept. 22, 1995. p. B10. Bangkok.
- Chapman, Keith. 1991. *The International Petrochemical Industry: Evolution and Location*. Oxford: Basil Blackwell Ltd.
- Chemical Marketing Reporter*. 1994. "West Europe could return to propylene import status." 245: 7, 20.
- Chemical Week*. 1994a. "Thai Groups vie to build third petrochemical complex." 154 (10): 18.
- Chemical Week*. 1994b. "Thailand's Open Door." 154 (19): 49.
- Chu, Wan-Wen. 1994. "Import Substitution and Export-led Growth: A Study of Taiwan's Petrochemical Industry." *World Development* 22 (5): 781-794.
- Considine, Timothy J. 1991. "Economic and Technological Determinants of the Material Intensity of Use." *Land Economics* 67 (1):99-115
- David, Paul. 1982 "Clio and the economics of QWERTY." *American Economic Review* 75 (2).
- De Golyer and Mac Naughton. 1993. *Twentieth Century Petroleum Statistics*. Dallas.
- Doshi, Tilak. 1989. *The Singapore Petroleum Industry: Houston of Asia*. Singapore: Resource Systems Institute East-West Center, Honolulu and ASEAN Economic Research Unit Institute of Southeast Asian Studies.

- Fayad, Marwan and Homa Motamen. 1986. *The Economics of the Petrochemical Industry*. London: Frances Pinter Pub.
- Federation of Thai Industries. 1993. "The Development of the Plastics Industry in Thailand." Technical Department. Bangkok.
- Forster, Christine. 1995. "Thai Petrochemical in explosives JV." *Chemical Week* 156 (10): 23.
- Friel, Patrick C. 1991. "The International Competitiveness of Thailand's Petrochemical Industry" *Journal of Southeast Asia Business* 7 (1): Winter.
- Fukase, Emiko. 1995. (Draft Document) Development of the Plastic Product Industry: Selected Countries. Bangkok: Sectoral Economics Program, Thailand Development Research Institute.
- Hagen, Ronald E. 1995 a. "Thailand's Petrochemical Sector: A New Focus for Southeast Asian Growth." Energy Advisory. East-West Center Program on Resources: Energy and Minerals, No. 161. August 11.
- Hagen, Ronald E. 1995 b. "Asia/Pacific Ethylene Capacity to More Than Double by 2000." *Oil & Gas Journal* 3 (19): 50-54.
- Hagen, Ronald E. 1995 c. Unpublished lecture notes.
- Handley, Paul. 1993. "Stepping on the Gas: Charoen Polphand Eyes Thai, Chinese Ventures." *Far Eastern Economic Review* 156 (31): 1.
- Hill, Hal. 1994. "ASEAN Economic Development: An Analytical Survey-The State of the Field." *The Journal of Asian Studies* 53(3): 832-866.
- Hydrocarbon Asia*. 1995. "A Competitive Cost Review of Asian Petrochemical Projects." 1(1): 32-40.
- Industrial Finance Corporation of Thailand (IFCT). 1991. *Industrial Development in Thailand*. Bangkok: IFCT.
- Janssen, Peter. 1988. "Petrochemicals fuel new NIC." *Asian Business* 24 (10): 22-24, 26, 28, 30.
- Janssen, Peter. 1994. "New wave for petrochemicals." *Asian Business* 31 (4): 19-20.
- Japan International Cooperation Agency (JICA). 1995. Draft Study on Industrial Sector Development-Supporting Industries in the Kingdom of Thailand.
- Japan Plastics Industry Annual. Various Years (1990-93). Tokyo: Plastics Age Co., Ltd. Pub.

- Jirapongphan, Siri. 1993. "Analysis of Investment in Petrochemical Plants." *Technology Journal* (Technological Promotion Association Thai-Japan) 19 (110) Unpaginated.
- Katiporn Makroodtong. 1983. "Industry Focus: The Plastic Pellet Industry." *Bangkok Bank Monthly Review* 34 (6): 27-30.
- Kessel, Georgina and C. Kim. 1993. "The Mexican Petrochemical Sector in the NAFTA Negotiations." *The Energy Journal* 14 (3): 201-215
- Lucke, Matthias. 1993. "The Diffusion of Process Innovations in Industrialized and Developing Countries: A Case Study of the World Textile and Steel Industries." *World Development* 21 (7): 1225-1238.
- Markusen, A.R. 1985. *Profit Cycles, Oligopoly and Regional Development*. Cambridge, MA: MIT Press.
- Martin, Stephen. 1988. *Industrial Economics: Economic Analysis and Public Policy*. New York: Macmillan Pub.
- Molle, Willem and Egbert Weaver. 1984. *Oil Refineries and Petrochemical Industries in Western Europe*. London: Gower Pub.
- National Economic and Social Development Board (NESDB). 1993. *National Petrochemical Corporation Investor Presentation*. November.
- OECD. 1968. *The Chemical Industry 1967-1968*. Paris: OECD
- Oil & Gas Journal*. 1995. "Thailand Rapidly Developing into World Class Petrochemical Producer." 93 (14): 23-27.
- Peaff, George. 1994. "Thai Petrochemicals called a boom market." *Chemical Marketing* 245 (17).
- Pezeshki, Shiva and Fereidun Fesharaki. 1995. "Asia-Pacific LNG market: outlook to 2010." *OPEC Review* XIX (2): 89-115.
- Pimmas Hongrittiant. 1994. "The Petrochemical and Plastic Industry." *Bangkok Bank Monthly Review* 35 (6): 18-23.
- Preeyalak Thonawam. 1987. "Plastic Parts: Bright Prospects." *Bangkok Bank Monthly Review* April: 144-147.
- Pipittanabunp, Vasana. 1987. "The Plastics Industry." *Bangkok Bank Monthly Review*. September: 381-385. Trans: Rosit Samithisawad.

- Ratanakomut, Somchai and Samart Chiasakul, Shigeru Itoga (editors). 1995. "Manufacturing Industry in Thailand-A Sectoral Analysis" Institute of Developing Economies. Tokyo.
- Rhodes, Anne K and David Knott. 1995. "Ethylene capacity tops 77 million mt." *Oil & Gas Journal* 93 (16): 33-34.
- Rungfapaisarn, Kwanchai. 1995. "Mitsubishi eyes Thai base for hi-tech Resins." *The Nation* p.B2. Bangkok.
- Snyder, Merle R. 1994. "Global hotspots fuel machinery shipments." *Modern Plastics* 71 (11): 42-45.
- Stiglitz, Joseph E. and G. Frank Mathewson (editors). 1986. *New Developments in The Analysis of Market Structure*. MIT Press, USA.
- Stobaugh, Robert. 1988. *Innovation and Competition: The Global management of Petrochemical Products*. Boston: Harvard Business School Press.
- Stobaugh, Robesh. 1968. *The Product Life Cycle, United States Exports and International Investment*, Ph.D. dissertation Harvard University. Boston.
- Storck, W.J. 1986. "U.S. Chemical Industry in Midst of Major Restructuring." *Chemical and Engineering News* 7 April, 8-10.
- United Nations. 1985. *Environmental Considerations Relating to the Petrochemical Industry*. UNIDO/ESCAP Project on Industrial Progress of Selected Sectors in the Developing ESCAP region. Sectoral Working Paper Series No.40.
- United Nations. 1985. *Tariff and Non-Tariff Measures in the World Trade of Petrochemical Products*. UNIDO/ESCAP Project on Industrial Progress of Selected Sectors in the Developing ESCAP region. Sectoral Working Paper Series No.37.
- United Nations. 1985. *The Petrochemical Industry in Developing Countries: Prospects and Strategies*. Sectoral Studies Series. Vol. I No.20. UNIDO Division for Industrial Studies.
- United Nations. 1985. *The Petrochemical Industry in the Developing ESCAP Region: Past Review and Future Prospects*. UNIDO/ESCAP Project on Industrial Progress of Selected Sectors in the Developing ESCAP region. Sectoral Working Paper Series No.41.
- United Nations. 1985. *The Petrochemical Industry: The Sector in Figures*. Sectoral Studies Series. Vol. II No.20. UNIDO Division for Industrial Studies.

- United Nations. 1986. *Techno-Economic Study of Natural GAS Production and Use*. Bangkok: ESCAP.
- Vergara, Walter and Dominique Babelon. 1990. *The Petrochemical Industry in Developing Asia: A Review of the Current Situation and Prospects for Development in the 1990s*. The World Bank Technical Paper Series Number 113. Industry and Energy Series. Washington DC.: The World Bank.
- Vergara, Walter and Donald Brown. 1988. *The New Face of the World Petrochemical Sector: Implications for Developing Countries*. The World Bank Technical Paper Number 84. Washington, DC.: Industry and Energy Series.
- Vergara, Walter. 1993. *The Materials Revolution: What does it mean for Developing Asia?* World Bank Tech. Paper No. 202.
- Vernon, R. 1966. "International investment and international trade in the product cycle." *Quarterly Journal of Economics* 80, 190-207.
- Vernon, R. 1979. "The Product Cycle hypothesis in A New International environment." *Oxford Bulletin of Economics and Statistics* 41, 255-68.
- Wichit Sirithaveeporn. 1996. "Customs wants lower-price PVC for leather makers." *Bangkok Post* July 8.
- Wood, Andrew. 1995. "Rising Star on the Chemical Stage." *Chemical Week*. 156 (6): 36.
- Young, Ian. 1995 "Thailand: Cracker projects vie for supremacy." *Chemical Week*. 156 (6): 42-43.

**Table 1: World sales of the Petrochemical Industry
by Region, 1988 (\$US billion)**

Region	Sales in US\$ (billion)
Western Europe	125
U.S. and Canada	100
Japan	70
Asia	27
Middle East and Africa	13
Latin America	7
Other	43
Total	385

Source: Vergara and Babelon,1990:1

Table 2: Growth of Demand for Selected Petrochemicals for 1975-1990 (% per annum)

	<i>World Total</i>			<i>Industrialised countries*</i>			<i>Developing countries</i>		
	1975-1979	1980-1985	1985-1990	1975-1979	1980-1985	1985-1990	1975-1979	1980-1985	1985-1990
<i>Basic petrochemicals</i>									
Ethylene	11.20	1.50	3.70	10.40	1.00	2.80	24.00	7.50	7.40
Propylene	11.80	3.00	3.70	8.70	2.70	3.40	26.00	7.00	6.30
Butadiene	8.80	2.90	5.10	7.80	2.40	4.70	18.90	7.50	7.80
Benzene	11.00	1.80	2.30	10.80	1.40	2.00	12.80	7.20	5.90
Xylene	11.80	2.70	2.60	9.30	2.00	1.70	41.40	9.50	8.50
Methanol	10.70	3.10	4.40	10.10	2.80	3.80	22.90	7.40	10.00
<i>Thermoplastics</i>									
LDPE^	10.30	4.30	5.00	11.30	3.50	4.80	19.10	8.40	5.70
HDPE	17.90	5.90	5.10	16.90	5.50	5.00	24.40	8.30	5.40
PP	20.40	6.40	6.60	19.00	6.00	6.50	28.70	8.20	7.40
PVC	11.40	4.00	3.90	10.60	3.30	3.40	16.10	7.80	6.30
PS	11.90	3.60	3.50	11.20	3.10	3.20	18.10	6.70	5.20

Compiled from UNIDO, ID/WG.336/3 May 1981, p 54; UNIDO, IS. 427, Dec. 1983;

* Includes Eastern Europe and the USSR

^ Includes LLDPE

Source: Table 1.5 in Fayed and Motamen, 1986 :30.

Table 3: Process for Production of Ethylene and Propylene by Global Region, 1995

Region	Ethylene	Propylene
Europe/E.Asia	Naphtha Cracking	Naphtha Cracking FCCU
North America	Ethane Cracking	FCCU
Middle East	Ethane Cracking	Rare
Southeast Asia	Naphtha or Ethane Cracking	Naphtha or Ethane Cracking FCCU
China	Gasoil Cracking	Gasoil Cracking or FCCU

(a) FCCU-Fluid Catalytic Cracking Unit

Source: Hagen,1995c p.2.

Table 4: Thailand petrochemical industry status as of December 1995

Product	Company	Location	Capacity ('000 t/y)		Start up Year	Start Up Cost (Million \$US)	Licensor	Engineering	Contactor
			In Production	Planned					
Olefins									
Ethylene	NPC	Rayong	401		1989/1995	372*	Lummus Crest	TEC, Lummus Crest	TEC, Daelim
	TOC	Rayong	350		1994	714*	S&W	Daelim/S&W	Daelim/S&W, Sumitomo
				(35)	1997				
	TPI	Rayong		350	1998	1310*	Linde	Linde	Samsung
Propylene				360	2000				
	PTT Petrochemical	Rayong		350	1999	1002*			
	Rayong Olefins (ROC)	Rayong		600	1999	680*			
	NPC	Rayong	172		1989/1995	372*	UOP, Lummus Crest	TEC, Daelim	TEC, Daelim
	TOC	Rayong		190	1994	714*	S&W	Daelim/S&W	Daelim/S&W, Sumitomo
	TPI	Rayong		140	1998	1310*	Linde	Linde	
Mixed C4				270	2000				
	PTT Petrochemical	Rayong		250	1999	1002*			
	Rayong Olefins (ROC)	Rayong		300	1999	680*			
	TOC	Rayong	120		1994	714*	S&W	Daelim/S&W	Daelim/S&W, Sumitomo
	TPI	Rayong			1998	1310*			
	Rayong Olefins (ROC)	Rayong		180	1999	680*			
Aromatics									
Benzene	TAC	Rayong		200	1997	632*	UOP	FW	Asia Badger/Sunkyoung/Nissho Iwai
Toluene	TAC	Rayong		55	1997	632*	UOP	FW	Asia Badger/Sunkyoung/Nissho Iwai
P-Xylene	TAC	Rayong		320	1997	632*	UOP	FW	Asia Badger/Sunkyoung/Nissho Iwai
	Thai-Oil	Sriracha-Chonburi		300	1999	120			
O-Xylene	TAC	Rayong		30	1997	632*	UOP	FW	Asia Badger/Sunkyoung/Nissho Iwai
Mixed-Xylene	TAC	Rayong		16	1997	632*	UOP	FW	Asia Badger/Sunkyoung/Nissho Iwai
	Thai Oil	Sriracha-Chonburi		300	1996				
Intermediates									
EDC (DC)	TPC	Rayong	33				Mitsui Toatsu	TEC	TEC
				85					
VCM	TPC	Rayong	140		1990	132*	Mitsui Toatsu	TEC	TEC
				300	1998	136			
	VNT	Rayong	140		1996	490*	Solvay/BF Goodrich	CTIP/CTCI/FOCHI	CTIP/CTCI/FOCHI
VAM	TOA	Rayong					Union Carbide		
EG	PTT Petrochemical	Rayong		250	1999	230*			
EO	PTT Petrochemical	Rayong		30	1999	230*			
Isopropanol (IPA)	Birla Group	Rayong		30	1999	20			
2-EH	PTT Petrochemical	Rayong		100	1999				
Acrylic Acid	PTT Petrochemical	Rayong		60	1999				
Acrylic Acid	Lenso + Mitsubishi Chemical	Rayong		60	1998	159*	Mitsubishi Chemical		
Acrylic Ester	Lenso + Mitsubishi Chemical	Rayong		95	1998	159*	Mitsubishi Chemical		
Polyol	TPI Polyol	Rayong	15		1992		Bayyer	Uhde	Local

Product	Company	Location	Capacity ('000 t/y)		Start up Year	Start Up Cost (Million \$US)	Licensor	Engineering	Contactor			
			In Production(1995)	Planned								
Butene 1	Pacific Plastics BST	Rayong	22	(10)	1993		Dow Chemicals UOP	UOP/Samsung	Samsung			
		Rayong	10		1993							
				27	1995	68*						
					1998	82*						
	TPI	Rayong										
Butadiene	BST	Rayong		140	1998	82*	Ube Dow Chemicals	TEC/Hitachi Eng. Dow Chemicals Eng.	TEC/Hitachi Eng. FW			
	TPI	Rayong		70	1998	1310*						
Caprolactam SM	Thai Caprolactum	Rayong		100	1996							
	SSMC	Rayong		200	1996	239						
				200	1999							
				180	1998	1310*						
Maleic Anh. PTA	Mr.Supat Srivaampai	Rayong		10	1997	23	Lummus Crest	Lucky Eng.	Lucky Eng.			
	Tuntex Petrochemical	Rayong	350		1995	440	Tecnomont	Hitachi Eng.	China Technical Consultant			
				(100)	1997							
				(900)	2000	480						
Phthalic Anh.	CCC + Mitsui	Rayong		350	1999	320						
	Eternal Petrochemical	Samutprakarn	30		1990							
	Thai Phthalic	Rayong		30	2000							
Downstream												
LDPE	TPE	Rayong	70		1995	68	ICI,Mitsui P Imhausen	Staff Uhde	Staff Uhde,TPI			
	TPI	Rayong	158		1982	120						
HDPE	BPE	Rayong	200	(15)	1996		Mitsui Petrochemical	Lurgi/Mitsui E&SB	Mitsui E&SB			
					1994	188						
	TPE	Rayong	120	(100)	1998	50						
					1989	128*						
HDPE/LLDPE	TPI	Rayong	152	200	1997	100	Mitsui Petrochemical	Mitsui E&SB	Mitsui E&SB Staff			
					1993		Mitsui Petrochemical					
	PTT Petrochemical	Rayong		190	1999							
	BPE	Rayong		200	1998	87						
PVC	TPE	Rayong	70		1990	128*	BP	Mitsui E&SB	Staff			
				(30)	1996		Hoechst Dow Chemicals Mitsui Toatsu	Uhde	Uhde			
	TPI	Rayong		200	1998	1310*						
	Dow Chemicals + SCC	Rayong		300	1999	190						
TPC	Samuthprakarn	140		1971	132*							
		Rayong	135		1990							
				(62)	1996							
				(30)	1997							
				(84)	1998	60						
				(60)	1999							
	VNT	Rayong	135		1992	490*	Solvay	Tractebel	Sino-Thai			
	Apex Plastics	Rayong		100	1997	120	Chisso	Chisso Eng.	Chisso Eng. and others			
				(100)	1999							
PP	TPC Oxy (plate PVC resin)	Rayong		23	1997	50	Oxychem	CTCI	CTCI			
	HMC	Rayong	100		1990	88	Himont	Technimont/Kobe Steel	Technimont/Kobe Steel			

Product	Company	Location	Capacity ('000 t/y)		Start up Year	Start Up Cost (Million \$US)	Licensor	Engineering	Contactor
			In Production(1995)	Planned					
Acrylic Resin Acrylic Fibre	TPI	Rayong	220	(60) 160	1996 1997	96 144	Technipol BASF	Uhde	Technimont/CTCI Uhde
	TPP	Rayong	100	(250) (20)	1998 1997	95	Mitsui Petrochemical	Daelim	Staff
	Siam Chemical Ind.	Rayong	10	140	1997	82	Mitsui Petrochemical		
	Thai Acrylic Fibre	Rayong	37						
	PMMA	Rayong	10	(20)	1997				
	PU	Rayong	25		1994				
	Siam Chemical	Rayong	5						
	Thai Polyurethane	Rayong	15						
	MTBE	Rayong	55		1995	68*	UOP	UOP/Samsung	Samsung
	TPI	Rayong		220	1997	1310*			
BR	BST Elastomer	Rayong		40	1998	92			
SBR	BST Elastomer	Rayong		60	1998	98			
SBL	Siam Synthetic Latex	Rayong	30		1993				
PS	Eternal Plastics	Samutprakarn	30		1989				
	HMT Polystyrene	Rayong	25		1992	29	Huntsman Chemical	Chisso Eng.	Taisei
				(20)	1998				
	Pacific Plastics	Samutprakarn	25		1987		Dow Chemicals	Dow Chemicals	PAE
	Siam Polystyrene	Rayong	100		1995		Dow Chemicals	Dow Chemicals	Daelim
	Srithepthai Plaschem	Samuthprakarn	20		1990		Cosden Tech./FINA	SECL	
				(30)	1996				
EPS	Thai ABS	Rayong		29	1996	11	Sunpor Kunststoffe	Uhde	Uhde
	Mingh Dhi Chemical	Rayong	4						
	Siam Chemical Ind.	Rayong	7						
	Srithepthai Plaschem	Samutprakarn	3		1987		Loyal		
	Thai Polystyrene	Samutprakarn	4		1982	2			
	TPI	Rayong	25		1992	9	Sunpor Kunststoffe	Uhde	Uhde
ABS/SAN	Grand Pacific (Eternal Chem. In	Rayong	12						
	Monsanto Premier Kasie	Rayong	70		1995				
	Thai ABS	Rayong	20		1991	41	Sumitomo	Sumitomo Chem. Eng	Uhde
				(60)	1998	41			

Notes: 1) Numbers in brackets mean expansion.

2)*Total cost of the project.

3)Shaded areas indicate future or predicted.

Source: PITI.

Table 5: Number of Domestic Firms Producing Selected Plastic Feedstocks and Resins in 1989, 1996 and Projected to 2000 in Thailand

Product	Number of Domestic Producing Firms		
	1989	1996 (a)	Projected 2000
Ethylene	0	2	5
Propylene	0	2	5
<i>Aromatics</i>	0	0	2
VCM	0	2	2
SM	0	1	2
PTA	0	1	2
PA	0	1	2
<i>Other Intermediates</i>	0	4	9
PP	1	3	3
PE (LDPE,HDPE,LLDPE)	2	3	5
PVC	1	2	4
PS	2	6	6
ABS/SAN	0	2	3
Total	6	29	50

(a) Some of this capacity may not be realized in 1996.

Source: Industry interviews,1995.

Table 6 : Monthly mark-up over C.I.F. price by plastic resin and month, 1995

Product	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Average
PP	0.35	0.10	0.22	0.17	0.16	0.16	0.16	0.31	0.25	0.18	0.21	0.20
LDPE	0.43	0.32	0.30	0.29	0.26	0.24	0.28	0.31	0.28	0.18	0.25	0.29
LLDPE	0.44	0.35	0.35	0.27	0.24	0.24	0.26	0.27	0.22	0.22	0.27	0.29
HDPE	0.35	0.28	0.26	0.23	0.23	0.20	0.24	0.27	0.29	0.24	0.25	0.26
PS	0.17	0.48	0.15	0.09	0.10	0.10	0.14	0.25	0.22	0.13	0.03	0.14
PVC	0.46	0.36	0.34	0.37	0.48	0.43	0.48	0.52	0.60	0.50	0.25	0.42
ABS/SAN	0.34	0.50	0.45	0.37	0.24	0.26	0.33	0.43	0.50	0.29	0.29	0.36

Source: Calculated from data in figures 6-11 based on unpublished Plastics Industry Club data, The Federation of Thai Industries

Table7: Plastic Fabrication Factories Registered with Thai Ministry of Industry, 1993

Year	Bangkok	Regional	Total
1987	1,013	242	1,255
1988	1,059	285	1,344
1989	1,184	352	1,536
1990	1,330	463	1,793
1991	1,437	590	2,027
1992	1,532	702	2,236
1993	1,796	737	2,533
1994	1,934	753	2,687

Note: This number may not include the factories which registered with The Industrial Estate Authority of Thailand, The Board of Investment (BOI) and which were granted permission by provincial governments.

Source: Ministry of Industry.

Table 8: Plastic Products : Imports to Thailand of Sacks and Bags, of Polymers, Ethylene or other plastics by country and year 1988-1994

Quantity: Ton
Value: Million Baht

Countries	1988		1989		1990		1991		1992		1993		1994	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Extra-ASEAN														
Japan	57	14.42	111	28.72	162	38.70	258	69.40	344	114.10	424	170.41	419.58	187.98
Australia	10	2.23	48	11.32	220	46.61	311	63.88	320	71.09	240	47.92	343.98	76.83
Taiwan	33	3.28	43	6.03	81	8.51	190	22.20	235	28.80	147	27.23	130.41	15.07
U.S.	87	14.16	53	14.72	113	28.00	55	11.33	110	25.03	103	26.76	122.07	28.49
S.Korea	5	1.01	3	1.07	28	4.36	18	2.35	76	16.60	110	22.34	243.88	33.39
Hong Kong	112	9.89	115	13.64	119	12.77	106	10.98	110	12.24	38	10.31	311.28	22.53
Germany	5	1.03	75	5.33	48	3.53	6	1.34	5	1.83	14	3.36	32.69	3.7
Others	40	7.03	81	14.04	77	15.40	86	19.22	122	26.27	431	41.34	184.86	35.5
Extra-ASEAN total imports	349	53.05	529	94.87	848	157.88	1,030	200.70	1,322	295.96	1,507	349.67	1788.75	403.44
Intra-ASEAN														
Indonesia	-	-	-	-	-	-	6	1.54	9	1.77	2	0.71	8.56	2.09
Malaysia	147	19.28	177	24.06	237	29.27	188	23.44	276	33.37	291	30.48	374.93	44.77
Philippines	-	-	*	*	-	-	*	0.21	1	0.02	*	0.10	-	-
Singapore	22	3.24	22	3.62	13	4.58	26	5.43	73	17.25	81	27.46	140.92	42.82
Brunei	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Intra-ASEAN total imports	169	22.52	199	27.68	250	33.85	220	30.62	359	52.41	374	58.75	524.41	89.68
Total imports	518	75.57	728	122.55	1,098	191.73	1,250	231.32	1,681	348.37	1,881	408.42	2313.16	493.12
Imports from ASEAN	32.63	29.80	27.34	22.59	22.77	17.66	17.60	13.24	21.36	15.04	19.88	14.38	22.67	18.18
as percent of total imports														

* less than 1 ton

Source: Thai Department of Customs,Bangkok. Custom Code 3923.21 and 3923.29.

Table 8

Table 9 : Plastic Products : Exports from Thailand of Sacks and Bags, of Polymers, Ethylene or other plastics by country and year 1988-94

Countries	1988		1989		1990		1991		1992		1993		1994	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Extra- ASEAN														
Japan	2,898	132.86	8,050	368.47	9,159	366.89	13,410	549.05	14,142	525.78	20,215	697.06	30701.25	1199.18
UK	6,447	301.46	7,842	359.61	11,006	453.72	14,748	566.75	16,658	562.25	18,721	532.65	16929.42	534.86
U.S.	2,271	107.46	3,256	166.38	3,121	149.20	2,971	142.88	3,948	160.44	6,099	229.73	7052.99	266.81
Australia	6,857	303.99	6,978	317.18	5,940	235.85	6,646	251.00	7,221	223.59	6,332	176.39	7921.70	209.81
France	3,655	166.33	2,229	93.85	3,613	157.99	5,409	222.75	11,909	217.94	4,284	129.99	6112.84	174.80
Germany	3,881	171.84	2,177	97.99	3,528	162.20	3,622	174.04	3,934	153.86	3,412	108.07	3923.48	131.82
Others	8,155	413.35	9,079	421.56	9,661	411.37	11,777	469.08	11,914	496.02	14,980	697.27	20356.58	654.85
Extra-ASEAN total exports	34,164	1,597.29	39,611	1,825.04	46,028	1,937.22	58,583	2,375.55	69,726	2,339.88	74,043	2,571.16	92998.26	3172.13
Intra-ASEAN														
Indonesia	2	0.03	6	0.23	13	0.26	22	0.57	15	0.54	5	1.70	4.76	2.62
Malaysia	72	2.12	127	4.51	805	25.11	52	2.12	7	0.60	501	13.79	2457.97	53.04
Philippines	14	0.81	2	0.37	4	0.38	8	0.66	3	0.53	6	0.80	24.08	6.47
Singapore	5,441	207.92	13,009	419.13	10,138	306.23	7,187	228.21	18,569	468.78	27,297	1,494.06	27223.80	564.44
Brunei	2	0.15	1	0.10	*	0.02	5	0.54	3	0.20	1	0.04	*	*
Intra-ASEAN total exports	5,531	211.03	13,145	424.34	10,960	332.00	7,274	232.10	18,597	470.65	27,810	1,510.39	29710.61	626.99
Total Exports	39,695	1,808.32	52,756	2,249.38	56,988	2,269.22	65,857	2,607.65	88,323	2,810.53	101,853	4,081.55	122708.87	3799.12
Exports to ASEAN as percent of total exports	13.93	11.67	24.92	18.86	19.23	14.63	11.05	8.90	21.06	16.75	27.30	37.01	24.12	16.50

* less than 1 ton

Source: Thai Department of Customs, Bangkok. Custom Code No.3923.21 and 3923.29.

Table 10: Plastic Products: Imports to Thailand of Household and Toilet Articles of Plastics by Country and Year 1988-1994

Countries	Quantity : Ton Value : Million Baht													
	1988		1989		1990		1991		1992		1993		1994	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Extra-ASEAN														
Taiwan	25	1.74	25	1.97	26	2.01	27	2.10	34	3.31	53	4.72	53.05	4.62
U.S.	7	1.29	14	2.10	16	3.56	27	4.86	47	6.92	45	6.93	155.85	17.05
Hong Kong	6	0.41	6	0.37	22	1.84	24	1.38	11	0.79	29	0.96	8.43	1.03
Germany	4	0.91	4	0.85	4	1.00	4	0.79	6	1.39	25	1.33	3.74	0.59
Japan	16	4.19	6	2.04	13	2.71	27	5.35	31	5.28	23	6.75	17.26	6.05
UK	*	0.13	1	0.63	14	3.61	4	0.63	11	1.83	9	1.25	20.55	2.56
Others	4	0.82	6	1.04	14	3.14	19	5.09	37	5.02	68	3.84	49.89	5.06
Extra-ASEAN total imports	62	9.49	62	9.00	109	17.87	132	20.20	177	24.54	252	25.78	308.77	36.96
Intra-ASEAN														
Indonesia	3	0.80	1	0.36	-	-	1	0.34	4	1.18	1	0.28	0.26	0.11
Malaysia	3	0.10	8	0.48	3	0.69	6	0.33	2	0.10	10	0.49	24.74	1.43
Philippines	12	0.99	-	-	-	-	-	-	-	-	-	-	1.62	0.11
Singapore	*	0.09	2	0.17	2	0.27	7	1.47	5	0.36	4	0.86	0.42	0.05
Brunei	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Intra-ASEAN total imports	18	1.98	11	1.01	5	0.96	14	2.14	11	1.64	15	1.63	27.04	1.7
Total imports	80	11.47	73	10.01	114	18.83	146	22.34	188	26.18	267	27.41	335.81	38.66
Imports from ASEAN as percent of total imports	22.50	17.26	15.07	10.09	4.39	5.10	9.59	9.58	5.85	6.26	22.50	5.95	8.05	4.39

* less than 1 ton

Source: Thai Department of Customs, Bangkok. Custom Code 3924.90.

Table 10

Table 11: Plastic Products: Exports from Thailand of Household and Toilet Articles of Plastics by Country and Year,1988-94

Countries	Quantity : Ton Value : Million Baht													
	1988		1989		1990		1991		1992		1993		1994	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Extra-ASEAN														
Japan	216	21.76	595	63.19	875	80.63	1,496	127.95	1,578	129.96	2,204	183.03	3623.15	343.83
Hong Kong	567	38.85	104	7.32	580	10.74	754	9.93	140	11.03	185	57.98	417.8	25.88
United Arab Emirates	65	4.92	20	1.75	21	2.06	186	9.92	255	11.53	142	41.42	33.6	3.18
U.S.	88	6.28	201	19.36	222	17.37	126	10.21	76	6.37	175	21.32	330.06	24.36
Germany	12	0.92	29	2.25	86	6.44	103	8.30	109	10.32	149	11.50	39.4	3.54
U.K.	75	6.40	123	10.46	143	11.20	159	11.71	176	15.04	143	9.97	101.34	6.59
Saudi Arabia	64	5.29	60	4.03	57	3.24	142	12.06	194	7.73	130	9.91	61.38	2.48
Australia	26	2.16	43	2.87	74	5.56	51	3.61	91	4.58	126	8.62	100.04	7.43
Netherlands	15	1.25	11	1.02	27	2.12	39	3.05	27	2.41	57	5.35	64.13	5.21
Others	284	23.17	298	23.75	353	26.18	554	45.44	848	66.88	1,432	173.20	1160.86	50.2
Extra-ASEAN total exports	1,412	111	1,484	136	2,438	166	3,610	242.18	3,494	266	4,743	522.30	5931.76	473.1
Intra-ASEAN														
Indonesia	3	0.36	*	0.11	4	0.53	9	0.39	5	0.37	154	58.16	0.34	52.96
Malaysia	106	5.24	32	1.07	25	0.92	20	0.54	36	2.28	37	3.50	95.69	5.65
Philippines	11	1.37	15	1.18	17	1.22	14	0.82	34	2.75	66	5.54	60.56	5.05
Singapore	147	10.59	108	6.91	83	5.50	190	12.05	229	9.48	1,495	803.49	2262.75	1930.9
Brunei	4	0.49	2	0.13	1	0.12	4	0.47	6	0.22	17	1.04	6.66	0.25
Intra-ASEAN total exports	271	18.05	157	9.40	130	8.29	237	14.27	310	15.10	1,769	871.73	2426	1994.8
Total exports	1,683	129.31	1,641	145.80	2,568	173.83	3,847	256.45	3,804	280.95	6,512	1,394.03	8357.76	2467.9
Exports to ASEAN as percent of total exports	16	13.96	10	6.45	5	4.77	6	5.56	8	5.37	27	62.53	29.02	80.83

* less than 1 ton

Source: Thai Department of Customs,Bangkok. Custom Code 3924.90.

Table 12: Imports to Thailand of Tableware and Kitchenware of Melamine and Other Plastics by Country and Year,1988-1994

Country	Unit Quantity : Ton Value : Million Baht													
	1988		1989		1990		1991		1992		1993		1994	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Extra - ASEAN														
Japan	51	4.49	274	24.01	320	35.10	286	33.20	90	13.11	83	16.60	28.65	4.91
U.S.	25	3.31	257	24.18	406	39.46	61	8.14	106	15.58	58	7.78	56.04	8.96
Taiwan	21	0.98	34	1.46	50	2.24	39	1.91	62	3.57	132	5.62	77.07	3.82
Germany	2	0.72	3	0.86	3	1.00	3	0.83	8	2.94	10	3.35	10.13	3.33
Hong Kong	3	0.30	1	0.20	5	1.42	2	0.30	10	1.22	12	1.60	21.75	2.36
U.K.	2	0.26	2	0.32	5	0.94	8	1.23	2	0.29	6	1.12	2.8	0.34
Australia	262	21.22	260	25.01	227	28.05	54	6.97	60	8.26	6	0.56	1.22	0.42
France	4	3.30	3	0.53	25	3.34	1	1.07	8	3.75	*	0.07	2.47	0.21
Others	6	0.88	803	3.13	84	10.48	24	2.75	49	3.72	36	3.06	58.57	5.91
Extra-ASEAN total imports	376	35.46	1,637	79.70	1,125	122.03	478	55.40	395	52.44	343	39.76	258.7	30.26
Intra-ASEAN														
Indonesia	-	-	-	-	-	-	-	-	3	0.16	1	0.11	4.75	0.57
Malaysia	-	-	*	0.01	-	-	-	-	1	0.12	*	0.07	7.71	0.48
Philippines	265	23.82	67	6.72	26	2.67	16	1.85	13	1.72	8	0.72	-	-
Singapore	*	*	*	0.03	3	0.25	2	0.10	10	1.27	14	1.73	19.33	2.62
Brunei	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Intra-ASEAN total imports	265	23.82	67	6.76	29	2.92	18	1.95	27	3.27	23	2.63	31.79	2.62
Total imports	641	59.28	1,704	86.46	1,154	124.95	496	57.35	422	55.71	366	42.39	290.49	32.88
Imports from ASEAN as percent of total imports	41.34	40.18	3.93	7.82	2.51	2.34	3.63	3.40	6.40	5.87	6.28	6.20	10.94	7.96

Source: Thai Department of Customs,Bangkok. Custom code 3924.100-107 and 3924.100-904.

Table 12

Table 13: Exports from Thailand of Tableware and Kitchenware of Melamine and Other Plastics by Country and Year,1988-1994

Unit Quantity : Ton
Value : Million Baht

Country	1988		1989		1990		1991		1992		1993		1994	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Extra - ASEAN														
U.S.	834.00	73.92	1,338.00	111.30	2,009.00	168.90	2,805.00	197.58	3,805.00	249.75	3,055.00	197.06	3,436.41	175.81
U.K.	450.00	58.52	542.00	74.37	612.00	74.43	849.00	88.76	1,091.00	121.55	1,359.00	133.46	1,518.16	142.01
Netherlands	241.00	24.02	179.00	20.00	374.00	37.76	377.00	39.38	330.00	33.18	810.00	76.50	738.24	63.41
Hong Kong	494.00	47.51	625.00	56.99	458.00	50.27	600.00	58.53	548.00	62.51	504.00	65.96	438.59	50.55
Germany	178.00	18.09	216.00	26.57	306.00	33.26	447.00	48.04	454.00	44.36	619.00	51.57	79.64	9.74
United Arab Emirates	292.00	38.01	197.00	28.23	244.00	35.39	422.00	63.19	254.00	35.53	345.00	50.68	463.27	55.14
Australia	598.00	48.33	691.00	57.83	652.00	56.94	758.00	56.74	858.00	56.93	679.00	49.08	478.84	33.68
Saudi Arabia	449.00	37.25	370.00	40.08	180.00	18.69	546.00	56.61	529.00	48.20	555.00	40.62	522.06	44.22
Japan	677.00	78.68	556.00	72.13	206.00	33.66	354.00	42.64	282.00	41.06	253.00	36.25	265.95	41.27
Others	2,996.00	279.75	3,105.00	366.23	4,050.00	298.98	5,538.00	460.11	6,577.00	562.31	3,639.00	620.34	4,693.43	642.93
Extra-ASEAN total exports	7,209.00	704.08	7,819.00	853.73	9,091.00	808.28	12,696.00	1,111.58	14,728.00	1,255.38	11,818.00	1,321.52	12,634.59	1,258.76
Intra-ASEAN														
Indonesia	14.00	1.39	30.00	5.01	32.00	5.36	29.00	3.59	10.00	0.96	11.00	1.11	11.69	1.51
Malaysia	179.00	11.88	192.00	12.72	73.00	6.10	70.00	8.20	102.00	13.85	146.00	18.73	163.20	24.61
Philippines	48.00	4.58	73.00	6.23	25.00	1.90	37.00	3.45	64.00	5.28	90.00	10.19	149.04	13.53
Singapore	623.00	55.20	494.00	42.21	501.00	41.45	474.00	42.48	536.00	39.22	1,396.00	884.24	1,614.87	1,129.88
Brunei	27.00	1.99	7.00	0.60	14.00	0.99	25.00	2.27	18.00	1.51	37.00	2.87	24.74	3.11
Intra-ASEAN total exports	891.00	75.04	796.00	66.77	645.00	55.80	635.00	59.99	730.00	60.82	1,680.00	917.14	1,963.54	1,172.64
Total exports	8,100.00	779.12	8,615.00	875.05	9,736.00	909.53	13,331.00	1,171.57	15,458.00	1,316.20	13,498.00	2,238.66	14,598.13	2,431.40
Exports to ASEAN	11.00	9.63	4.76	7.63	6.62	6.14	4.76	5.12	4.72	4.62	12.45	40.97	13.45	48.22
as percent of total exports														

Source: Thai Department of Customs,Bangkok. Custom code 3924.100-107 and 3924.100-904.

Table 14: Global Value of Imports and Exports of Selected Plastic Resins by SITC number by country, 1993

(In Thousand US Dollars)

Product	US		Germany		Japan		China		S.Korea		Thailand		World Total	
	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
Polyethylene (PE) (SITC 5831)	645,525	1,345,684	1,134,281	1,145,545	131,672	371,388	770,192	28,564	61,301	538,015	94,997	18,346	10,736,674	11,101,556
Polypropylene (PP) (SITC 5832)	311,802	509,148	460,765	571,082	18,868	299,968	433,834	7,906	29,416	4,662	36,390	12,710	5,462,681	5,361,734
Polystyrene (PS) (SITC 5833)	265,539	659,627	626,836	728,874	87,389	501,039	1,207,804	20,129	48,029	389,063	124,994	31,678	6,972,051	6,324,890
Polyvinyl Chloride (PVC) (SITC 5834)	459,137	637,277	568,104	1,347,053	60,823	343,277	547,108	38,979	74,085	125,701	49,762	41,817	7,244,526	6,741,669

Source: Fukase (1995) Annex 9, from United Nations International Trade Statistics.

Table 15: Value of Imports of Plastic Resin: 1990-1995

Unit: Million Baht

Type of Plastic	Year					
	1990	1991	1992	1993	1994	1995
LDPE	1122.81	1101.02	1309.65	1406.02	2110.49	2038.28
HDPE	1370.62	1086.13	1054.36	819.33	1465.01	1365.36
PP	2623.08	798.33	961.85	712.47	741.97	1006.42
FOAM (PS)	248.06	195.07	162.5	89.82	156.65	260.45
PS	782.67	925.01	1196.23	1144.81	1440.42	2020.28
SAN	187.67	253.05	333.14	397.34	293.92	424.83
ABS	995.73	1016.77	1163.25	1195.55	1677.53	2870.29
PVC	1286.28	1588.06	1589.62	1094.16	2838.24	1420.26

Source: The Customs Department, Ministry of Finance, Bangkok.

Table 16: Value of exports of plastic resin : 1990-1995

Unit: Million Baht

Type of Plastic	Year					
	1990	1991	1992	1993	1994	1995
LDPE	9.39	46.4	26.31	73.51	41.16	554.61
HDPE	250.66	584	592.39	380.29	469.97	2123.24
PP	97.87	941	4.92	103.21	674.79	1931.47
FOAM (PS)	3.98	19.6	12.23	18.25	62.68	29.85
PS	211.43	256.51	254.18	293.68	390.6	352.8
SAN	16.02	0.59	0.6	0.45	0	3.09
ABS	22.9	479.01	139.45	236.65	290.12	448.76
PVC	282.58	275.4	431.34	487.6	417.97	1350.98

Source: The Customs Department, Ministry of Finance, Bangkok.

Table 17: Trade in Plastic Resins between Thailand and Other ASEAN Countries 1991-1994

Resins	Imports from ASEAN to total imports (%)				Exports to ASEAN to total exports (%)			
	1991	1992	1993	1994	1991	1992	1993	1994
LDPE	9.43	5.86	6.52	7.39	39.41	74.21	62.61	20.56
HDPE	24.81	20.07	23.41	19.37	41.89	40.99	36.84	16.17
PP	20.48	13.47	30.02	25.38	46.14	49.26	59.29	16.95
PVC	2.19	3.58	5.12	1.04	20.68	37.43	29.56	41.89
PS	3.52	7.65	5.77	17.72	8.84	2.23	2.05	5.67
ABS	0.48	1.21	2.45	3.36	18.16	27.91	6.03	3.82

Source: Department of Customs, Bangkok.

Table 18: Estimated Petrochemical Production Capacities for Thailand, Singapore, Malaysia Philippines and Indonesia

Products	Production capacity (ton/year)				
	Thailand	Singapore	Malaysia	Indonesia	Philippines ^{a)}
Ethylene	751,000(1,695,000)	800,000	320,000	510,000	
Propylene	172,000(1,150,000)	45,000	80,000	420,000	
PE	770,000(1,235,000)	215,000	280,000	500,000	
		245,000			
PP	420,000	296,000	200,000	485,000	
EDC	33,000(85,000)	-	-	119,900	
VCM	280,000	-	-	150,000	
PVC	410,000	25,000	102,000	258,000	102,500
SM	(580,000)	-	200,000	100,000	
PS	200,000(79,000)	55,000	156,000	74,300	32,608
EPS	43,000	-	55,000		
ABS/SAN	102,000(60,000)	-	80,000	15,000	
PTA	350,000(1350,000)	-	500,000	475,000	
IPA	(30,000)	-	-	-	
Polyester	-	-	-	-	
Aromatics			-		
Benzene	(200,000)	510,000	-	120,000	
Toluene	(55,000)	40,000	-	-	
P-Xylene	(620,000)		-	270,000	
O-Xylene	(30,000)		-	-	
M-Xylene	(316,000)		-	-	
Mixed C4	120,000		-	-	
Butene-1	10,000(27)		-	-	
MTBE	55,000(220,000)	50,000	300,000	-	
MEK		-	-	-	
Caprolactum	(100,000)	-	-	-	
PET resin		-	60,000	166,000	
PMMA	10,000	-	-	-	
POLYOLS	37,000	-	-	26,000	
PO		-	-	-	
Condensate splitter		-	-	-	
Butadiene	(210,000)	50,000	-	-	
Acetylene black	-	10,400	-	-	
EO	-	40,000	-	-	
EG	-	92,700	-	120,000	
Etoxylates	-	18,000	-	-	
MBS		16,000	-	-	

a) These estimates are for 1990 and 1991 and represent only a small part of the actual industry capacity.

Source: Somchai Ratanakomut, 1995 : 152 -153.; Lim,J. (1996 : Table 2).

Table 19: Petrochemical Intermediate Product Imports to Thailand by Highest Value and by Major Source Country in 1990-1995, Value in Baht

Commodity Code			Year									
			1990		1991		1992		1993		1994	
2903210-002 Vinyl Chloride	1.Saudi	180,930,520	1.U.S	105,711,070	1.Neherlands	325,316,174	1.Norway	533,696,228	1.U.S.	1,428,586,147	1.U.S	2,227,933,271
	2.U.K.	153,319,489	2.Norway	76,872,512	2.Saudi	184,693,048	2.U.S.	418,787,219	2.Norway	534,980,416	2.Norway	734,731,390
	3.Netherlands	119,248,013	3.Netherlands	46,951,978	3.Japan	155,980,607	3.Saudi	243,970,839	3.Netherlands	464,234,095	3.Belgium	718,484,237
	4.France	111,530,814	4.Japan	44,136,672	4.Norway	108,122,720	4.Netherlands	241,732,601	4.Saudi	266,695,552	4.Saudi	264,095,581
Total		752,219,628		503,461,134		1,101,763,828		243,970,839		3,333,519,301		4,359,667,063
2902500001 Styrene	1.Japan	1,144,582,737	1.Japan	744,951,936	1.Japan	445,799,855	1.Japan	591,699,994	1.Japan	1,420,051,482	1.Japan	2,056,403,963
	2.Australia	282,243,099	2.Saudi	215,558,446	2.Saudi	417,479,069	2.Saudi	380,405,339	2.Canada	424,478,272	2.Canada	594,952,483
	3.Saudi	175,143,770	3.Canada	207,095,793	3.Korea	401,090,257	3.Korea	350,249,788	3.Saudi	393,516,971	3.S.Korea	547,226,911
	4.Korea,Rep	117,749,094	4.Korea,Rep	157,305,800	4.Canada	160,205,431	4.Canada	202,516,021	4.Korea,Rep	161,395,652	4.Saudi	337,906,613
Total		1,982,566,508		1,422,067,075		1,498,511,709		1,530,412,723		2,509,205,356		3,604,282,646
2902430002												
P-Xylene	1.U.S.	37,821	1.Singapore	245,494	1.Switzerland	3,404	1.U.S	20,772	1.Switzerland	5,658	1.Netherlands	714,388,411
	2.Switzerland	877	2.U.S.	16,940	-	-	2.Italy	10,939	2.U.S.	2,890	2.Japan	514,906,205
	3.Germany	581	3.Japan	9,276	-	-	3.U.S.	6,521	3.Germany	1,456	3.S.Korea	451,217,097
	-	-	4.Switzerland	2,759	-	-	4.Switzerland	2,037	-	-	4.Indonesia	408,091,298
Total		39,279		274,632		3,404		20,772		10,004		2,912,030,323
2905310005												
Ethylene Glycol	1.Saudi	250,613,951	1.Saudi	381,000,430	1.Canada	340,686,918	1.Canada	514,849,273	1.Canada	610,246,811	1.Saudi	887,247,692
	2.Singapore	193,923,380	2.Singapore	343,825,425	2.Saudi	306,201,802	2.Singapore	451,179,221	2.Singapore	485,182,057	2.Canada	865,284,696
	3.Japan	171,191,915	3.Switzerland	216,988,941	3.Singapore	262,535,125	3.Saudi	262,357,095	3.Saudi	458,258,789	3.Singapore	652,897,683
	4.Canada	114,498,374	4.Japan	170,630,586	4.Japan	178,066,280	4.Japan	193,718,523	4.Japan	167,254,568	4.Japan	363,031,807
Total		734,706,086		1,143,240,059		1,103,493,291		1,458,831,516		1,735,964,190		2,885,801,356
3903300004												
ABS	1.Japan	672,574,485	1.Japan	729,429,002	1.Japan	370,459,460	1.Japan	745,078,819	1.Japan	940,138,845	1.Japan	1,588,601,355
	2.Taiwan	174,867,241	2.Taiwan	125,720,118	2.U.S.	84,777,502	2.U.S.	200,482,225	2.Taiwan	326,025,979	2.Taiwan	540,648,706
	3.U.S.	58,076,559	3.U.S.	119,683,220	3.Taiwan	66,255,817	3.Taiwan	139,231,458	3.U.S.	155,785,435	3.U.S.	322,421,992
	4.Korea	41,884,414	4.Korea	24,317,106	4.Korea	8,699,599	4.Korea	78,535,684	4.Korea	129,865,738	4.Singapore	147,466,416
Total		995,729,024		1,016,766,013		536,240,698		1,195,546,782		1,677,541,138		2,870,295,713
2905390002												
Other Diols	1.Japan	21,526,703	1.Japan	15,942,197	1.Japan	25,224,211	1.Japan	23,774,504	1.Japan	24,997,708	1.Taiwan	221,985,433
	2.Germany	7,855,627	2.Germany	5,550,060	2.Germany	6,068,192	2.U.S.	5,596,714	2.Germany	7,860,549	2.Singapore	150,451,692
	3.U.K.	1,049,128	3.U.S.	741,311	3.U.S.	5,752,941	3.Germany	4,386,776	3.U.S.	5,873,557	3.Netherlands	87,844,543
	4.U.S.	28,443	4.France	167,394	4.France	1,820,606	4.Taiwan	2,385,933	4.France	2,490,428	4.Germany	34,544,461
Total		30,483,198		22,442,179		39,709,228		38,759,246		42,324,014		2,020,286,877

Source : Department of Customs Ministry of Finance, Bangkok.

Table 20 : Petrochemical Exports from Thailand by Highest Value and by Major Destination Country in 1990-1995, Value in Baht.

Commodity Code	Year											
	1990		1991		1992		1993		1994		1995	
3907990000	1.China	95,388,359	1.China	316,685,879	1.Nigeria	80,407,393	1.Nigeria	95,552,665	1.China	319,252,910	1.Hong Kong	588,224,119
Saturated polyallyl	2.Singapore	267,418	2.Hong Kong	24,516,190	2.China	43,379,845	2.China,PE	94,174,664	2.Hong Kong	298,407,476	2.Indonesia	491,551,161
eater and other	3.Japan	93,879	3.Ireland	7,505,454	3.Kenya	19,516,604	3.Australia	8,954,566	3.Pakistan	233,650,873	3.Pakistan	374,023,490
unsaturated polyesters	4.Malaysia	92,790	4.Malaysia	463,571	4.Hong Kong	6,400,046	4.Malaysia	7,115,663	4.Nigeria	114,155,039	4.China	340,561,783
Total		95,819,958		349,978,270		160,994,658		219,008,429		1,310,449,648		2,197,341,963
3901200007												
HDPE	1.Hong Kong	43,811,814	1.Indonesia	156,387,658	1.Malaysia	149,693,963	1.Indonesia	25,374,063	1.India	79,199,586	1.Hong Kong	600,967,959
	2.Malaysia	41,605,663	2.Hong Kong	70,840,888	2.Indonesia	89,505,254	2.Japan	24,834,726	2.Hong Kong	69,003,530	2.China	317,473,816
	3.Indonesia	34,133,547	3.Taiwan	64,473,684	3.China	81,316,384	3.Singapore	19,176,459	3.Netherlands	47,736,275	3.Taiwan	223,260,399
	4.Netherlands	25,186,357	4.Malaysia	55,507,683	4.Pakistan	46,637,800	4.Hong kong	15,820,556	4.Japan	28,213,242	4.Indonesia	143,839,549
Total		250,664,740		584,425,205		593,579,192		156,327,146		469,974,794		2,123,246,582
3902100000												
PP, in primary forms	1.Malaysia	79,654,265	1.China	239,634,498	1.Malaysia	44,226,462	1.Philippines	3,946,556	1.India	139,346,293	1.India	610,561,884
	2.Hong Kong	7,359,570	2.Indonesia	233,625,201	2.India	24,522,429	2.Malaysia	3,593,982	2.Hong Kong	125,225,548	2.Hong Kong	311,140,958
	3.Indonesia	7,085,064	3.Malaysia	160,658,779	3.Myanmar	9,256,554	3.China	1,609,232	3.Pakistan	86,626,110	3.China	230,589,086
	4.Philippines	1,878,201	4.Hong Kong	104,768,328	4.Sri Lanka	8,142,585	4.Japan	1,377,075	4.Philippines	68,121,633	4.Pakistan	198,203,321
Total		97,868,348		940,996,322		109,026,640		13,405,084		674,791,728		1,931,479,870
3904100001												
PVC, not mixed with	1.Viet Nam	59,615,173	1.Japan	113,748,613	1.Viet Nam	174,230,128	1.Viet Nam	59,428,909	1.Viet Nam	112,039,465	1.Malaysia	296,689,397
any other substance in	2.Japan	45,520,316	2.Malaysia	39,051,157	2.Malaysia	87,034,289	2.Malaysia	58,764,020	2.Malaysia	111,215,469	2.Viet Nam	253,634,782
primary foams	3.Taiwan	41,843,012	3.Viet Nam	28,559,192	3.Singapore	49,923,210	3.Banglades	25,930,166	3.Singapore	44,659,166	3.Pakistan	122,298,757
	4.Singapore	36,280,510	4.Singapore	24,700,229	4.Banglades	45,703,631	4.Hong Kong	19,713,925	4.Banglades	35,251,130	4.Indonesia	111,885,472
Total		281,288,642		272,267,443		431,690,429		210,931,196		416,231,313		1,350,985,516

Source: Department of Customs Ministry of Finance , Bangkok.

Table 21-A : Major Sources for Exported Plastic Products from Thailand, 1992-95

Unit : Million Baht

Country	1992	1993	1994	1995
1.Singapore	1,214.2	12,193.9	8,166.1	20,191.3
2.Japan	1,525.1	2,021.0	2,958.4	3,758.3
3.Hong Kong	1,729.6	3,915.9	2,553.6	3,337.5
4.U.S.A.	2,003.9	2,393.2	2,445.8	2,702.2
5.U.K.	1,133.3	1,148.2	1,167.2	1,455.6
6.Australia	806.4	771.3	812.4	1,448.4
7.Malaysia	629.0	869.8	983.8	1,132.3
8.Germany	481.2	699.3	509.8	974.0
9.Philippines	66.2	103.6	240.9	578.1
10.Indonesia	47.3	206.8	194.7	441.0
Total 10 Countries	9,636.7	24,323.6	20,033.5	36,019.5
Others	4,508.7	12,449.8	6,030.9	16,671.3
All Countries	14,145.0	36,773.4	26,064.4	52,690.8

Source: Department of Business Economics.

Table 21-B : Major Sources for Imported Plastic Products from Thailand, 1992-95

Unit : Million Baht

Country	1992	1993	1994	1995
1.Japan	4,673.6	5,167.9	6,068.6	7,207.2
2.Taiwan	1,578.7	1,734.9	2,810.4	2,600.3
3.Singapore	1,521.9	1,702.8	1,777.5	2,618.7
4.U.S.A.	1,500.5	1,417.0	1,633.3	1,986.6
5.Malaysia	214.4	533.3	1,217.0	1,495.8
6.Germany	356.0	430.2	512.4	717.7
7.Hong kong	482.2	380.2	481.0	526.1
8.S.Korea	309.3	314.8	467.0	566.4
9.China	74.8	88.7	141.2	295.4
10.France	111.6	77.5	137.0	217.6
Total 10 Countries	10,823.3	11,847.8	15,245.9	18,232.3
Others	655.5	764.2	1,161.9	1,458.1
All Countries	11,478.9	12,612.1	16,407.8	19,690.5

Source: Department of Business Economics.

Table 22: Top 10 Plastic Products: Exports from Thailand by Country, Value and Year 1990, 1993 and 1995

Value: Baht

Commodity Code	Year								
	1990			1993			1995		
	Country	Value	Share(%)	Country	Value	Share(%)	Country	Value	Share(%)
1). 3926200009 Articles of apparel and clothing accessories (incl.gloves) of plastics or other materials of headings Nos.3901 to 3914	1.Nigeria 2.U.S. 3.U.K. ASEAN -Brunei -Indonesia -Malaysia -Philippines -Singapore	45,330,363 13,467,224 11,006,078 919,475 123,227 5,153,675 552,825 6,704,463	30.91 9.18 7.51 9.17 0.63 0.08 3.51 0.38 4.57	1.Singapore 2.Hong Kong 3.Poland ASEAN -Brunei -Indonesia -Malaysia -Philippines -Singapore	2,023,092,597 938,531,824 757,938,436 3,335,549 73,649 7,020,949 3,594,062 2,023,092,597	31.18 14.46 11.68 31.40 0.05 0.00 0.11 0.06 31.18	1.Singapore 2.Sri Lanka 3.Bangladesh ASEAN -Brunei -Indonesia -Malaysia -Philippines -Singapore	1,005,080,435 575,153,796 529,459,218 16,753,751 33,614,925 29,775,718 10,210,840 1,005,080,435	20.20 11.56 10.64 22.03 0.34 0.68 0.60 0.21 20.20
All Countries		146,630,225	100		6,488,590,048	100		4,975,798,016	100
2). 3923210003 Sacks and bags (including cones), of polymers of ethylene	1.U.K. 2.Japan 3.Singapore ASEAN -Indonesia -Malaysia -Philippines -Singapore	429,721,887 327,420,724 291,083,286 10,872 6,698,907 60,522 291,083,286	20.59 15.69 13.95 14.27 0.00 0.32 0.00 13.95	1.Japan 2.Singapore 3.U.K. ASEAN -Brunei -Indonesia -Malaysia -Philippines -Singapore	670,281,381 548,759,747 513,177,657 30,348 247,532 12,511,235 747,929 548,759,747	25.27 20.69 19.35 21.20 0.00 0.01 0.47 0.03 20.69	1.Japan 2.U.K. 3.U.S. ASEAN -Malaysia -Philippines -Singapore	1,483,730,717 804,018,996 318,754,595 42,842,464 1,151,494 227,205,081	34.73 18.82 7.46 6.35 1.00 0.03 5.32
All Countries		2,087,307,383	100		2,652,649,619	100		4,271,964,144	100
3). 3926900904 Other articles of Plastics or Other Materials of headings Nos. 3901 to 3914	1.U.S. 2.Japan 3.Singapore ASEAN -Brunei -Indonesia -Malaysia -Philippines -Singapore	212,375,344 132,037,283 71,157,971 1,864,591 7,648,204 23,741,286 3,200,333 71,157,971	26.12 16.24 8.75 0.23 0.94 2.92 0.39 8.75	1.U.S. 2.Singapore 3.Japan ASEAN -Brunei -Indonesia -Malaysia -Philippines -Singapore	532,781,863 394,504,871 2,124,402,488 15,208,284 14,130,082 69,460,214 18,753,311 394,504,871	19.07 14.12 76.03 0.54 0.51 2.49 0.67 14.12	1.Singapore 2.Japan 3.U.S. ASEAN -Brunei -Indonesia -Malaysia -Philippines -Singapore	1,128,107,438 691,486,946 377,534,125 7,937,500 66,493,920 87,105,644 37,553,720 1,128,107,438	26.78 16.42 8.96 0.19 1.58 2.07 0.89 26.78
All Countries		813,026,097	100		2,794,045,414	100		4,211,745,430	100
4). 3926100007 Office or school supplies of Plastics or Other materials of headings Nos.3901 to 3914	1.U.S. 2.Singapore 3.Hong Kong ASEAN -Brunei -Indonesia -Malaysia -Philippines -Singapore	12,059,495 1,884,506 1,336,267 676 707,701 49,663 377,091 1,884,506	52.04 8.13 5.77 0.00 3.05 0.21 1.63 8.13	1.Poland 2.USSR. 3.Singapore ASEAN -Brunei -Indonesia -Malaysia -Philippines -Singapore	132,839,920 50,686,940 25,045,144 1,699 361 922,435 275,605 25,045,144	49.35 18.83 9.30 0.00 0.00 0.34 0.10 9.30	1.Singapore 2.Japan 3.U.S. ASEAN -Brunei -Indonesia -Malaysia -Philippines -Singapore	3,312,234,129 119,105,673 48,382,857 0 7,489,523 1,128,883 338,672 3,312,234,129	86.13 3.10 1.26 0.00 0.19 0.03 0.01 86.13
All Countries		23,174,415	100		269,184,653	100		3,845,821,011	100
5). 3926900203 Tablecloths, curtains of plastics or other materials of headings Nos.3901 to 3914	1.U.S. 2.Saudi Arabia 3.Singapore ASEAN -Brunei -Singapore	9,996,787 7,469,351 2,086,847 5,543 2,086,847	46.81 34.98 9.77 0.03 9.77	1.Singapore 2.Hong Kong 3.Poland ASEAN -Brunei -Indonesia -Malaysia -Singapore -Vietnam	1,160,716,324 625,756,080 416,977,728 0 59,339,469 45,971,796 1,160,716,324 605,760	37.47 20.20 13.46 0.00 1.92 1.48 37.47 0.02	1.Singapore 2.Sri Lanka 3.Bangladesh ASEAN -Brunei -Indonesia -Malaysia -Singapore	1,457,623,828 298,987,300 206,558,040 49,943,931 33,980,379 18,926,184 1,457,623,828	39.00 8.00 5.53 1.34 0.91 0.51 39.00
All Countries		21,354,453	100		3,097,940,204	100		3,737,841,597	100
6). 3926900405 Rain coats of Plastics or Other Materials of headings Nos. 3901 to 3914	1.U.S. 2.Japan 3.Canada ASEAN -Brunei	85,480,134 22,738,370 1,975,535 0	75.12 19.98 1.74 0.00	1.Singapore 2.Poland 3.Napal ASEAN -Brunei	3,092,545,128 588,257,984 330,949,626 2035086	55.99 10.65 5.99 0.04	1.Singapore 2.Sri Lanka 3.Pakistan ASEAN -Brunei	1,052,197,321 527,005,629 374,749,333 14,958,000	30.41 15.23 10.83 0.43

Table 22: Top 10 Plastic Products: Exports from Thailand by Country, Value and Year 1990, 1993 and 1995

Value: Baht

Commodity Code	Year								
	1990			1993			1995		
	Country	Value	Share(%)	Country	Value	Share(%)	Country	Value	Share(%)
	-Malaysia	0	0.00	-Malaysia	53823983	0.97	-Malaysia	189049069	5.46
	-Indonesia	0	0.00	-Indonesia	359923	0.01	-Indonesia	8100871	0.23
	-Philippines	0	0.00	-Philippines	11308500	0.20	-Philippines	0	0.00
	-Singapore	45,440	0.04	-Singapore	3,092,545,128	55.99	-Singapore	1,052,197,321	30.41
	All Countries	113,797,249	100		5,523,467,674	100		3,459,863,518	100
7). 3924100904	1.U.S.	137,748,452	34.87	1.Singapore	814,477,346	46.78	1.Singapore	304,483,480	16.23
Tableware and	2.Australia	35,554,548	9.00	2.Poland	222,303,410	12.77	2.U.S.	156,616,710	8.35
Kitchenware of	3.Singapore	26,510,656	6.71	3.U.S.	173,781,333	9.98	3.Senegal	110,927,988	5.91
Other Plastics	ASEAN		8.78	ASEAN		47.61	ASEAN		19.37
	-Brunei	806,212	0.20	-Brunei	2,871,501	0.16	-Brunei	3,002,877	0.16
	-Indonesia	4,827,496	1.22	-Indonesia	844,975	0.05	-Indonesia	27,873,828	1.49
	-Malaysia	1,888,891	0.48	-Malaysia	5,624,743	0.32	-Malaysia	14,210,690	0.76
	-Philippines	684,380	0.17	-Philippines	5,183,534	0.30	-Philippines	13,667,125	0.73
	-Singapore	26,510,656	6.71	-Singapore	814,477,346	46.78	-Singapore	304,483,480	16.23
All Countries		395,011,323	100		1,740,981,172	100		1,876,301,980	100
8). 3923100000	1.U.S.	76,021,089	22.73	1.Malaysia	370,540,868	25.53	1.Singapore	483,765,204	29.37
Boxes,Cases,	2.U.K.	32,406,469	9.69	2.U.S.	188,620,035	12.99	2.U.S.	161,906,956	9.83
Crates and	3.Singapore	29,281,469	8.76	3.Singapore	164,522,527	11.33	3.Ghana	102,077,582	6.20
similar articles	ASEAN		12.85	ASEAN		38.37	ASEAN		39.66
of plastic	-Brunei	425,516	0.13	-Brunei	1,710,183	0.12	-Brunei	3,759,253	0.23
	-Indonesia	399,558	0.12	-Indonesia	10,866,129	0.75	-Indonesia	730,509	0.04
	-Malaysia	11,572,703	3.46	-Malaysia	370,540,868	25.53	-Malaysia	87,800,321	5.33
	-Philippines	1,278,631	0.38	-Philippines	9,324,579	0.64	-Philippines	77,230,368	4.69
	-Singapore	29,281,469	8.76	-Singapore	164,522,527	11.33	-Singapore	483,765,204	29.37
All Countries		334,447,937	100		1,451,485,549	100		1,647,001,840	100
9). 3924900000	1.Japan	80,629,738	46.39	1.Singapore	803,505,310	57.61	1.Japan	373,839,951	34.33
Other household	2.U.S.	17,368,226	9.99	2.Japan	183,701,750	13.17	2.Singapore	233,224,322	21.42
articles and toilet	3.U.K.	11,195,259	6.44	3.Indonesia	158,160,642	11.34	3.Ghana	62,050,556	5.70
articles,of plastic	ASEAN		4.70	ASEAN		62.43	ASEAN		25.68
	-Indonesia	527,713	0.30	-Indonesia	58,160,642	4.17	-Indonesia	1,363,672	0.13
	-Malaysia	920,427	0.53	-Malaysia	3,498,542	0.25	-Malaysia	29,170,098	2.68
	-Philippines	1,215,748	0.70	-Philippines	5,538,172	0.40	-Philippines	15,833,017	1.45
	-Singapore	5,503,100	3.17	-Singapore	803,505,310	57.61	-Singapore	233,224,322	21.42
All Countries		173,826,030	100		1,394,630,677	100		1,088,990,783	100
10). 3923300004	1.U.S.	62,079,164	25.13	1.Singapore	66,253,775	13.30	1.U.S.	353,752,234	35.28
Carboys,Bottles,	2.U.K.	50,609,226	20.49	2.U.K.	64,308,493	12.91	2.U.K.	119,896,693	11.96
Flasks and similar	3.Japan	36,716,268	14.87	3.Netherlands	47,799,276	9.59	3.Australia	35,058,230	3.50
articles, of plastic	ASEAN		9.08	ASEAN		17.02	ASEAN		7.17
	-Brunei	17,913	0.01	-Brunei	27,797	0.01			
	-Indonesia	4,614,625	1.87	-Indonesia	-	-	-Indonesia	6,477,371	0.65
	-Malaysia	2,176,711	0.88	-Malaysia	13,104,336	2.63	-Malaysia	10,001,973	1.00
	-Philippines	4,753,686	1.92	-Philippines	5,358,300	1.08	-Philippines	20,453,166	2.04
	-Singapore	10,856,046	4.40	-Singapore	66,253,775	13.30	-Singapore	34,872,208	3.48
All Countries		246,989,998	100		498,182,944	100		1,002,692,036	100

Source: Department of Customs, Bangkok.

Table 23: Top 10 Plastic Products: Imports to Thailand by Country, Value and Year 1990, 1993 and 1995

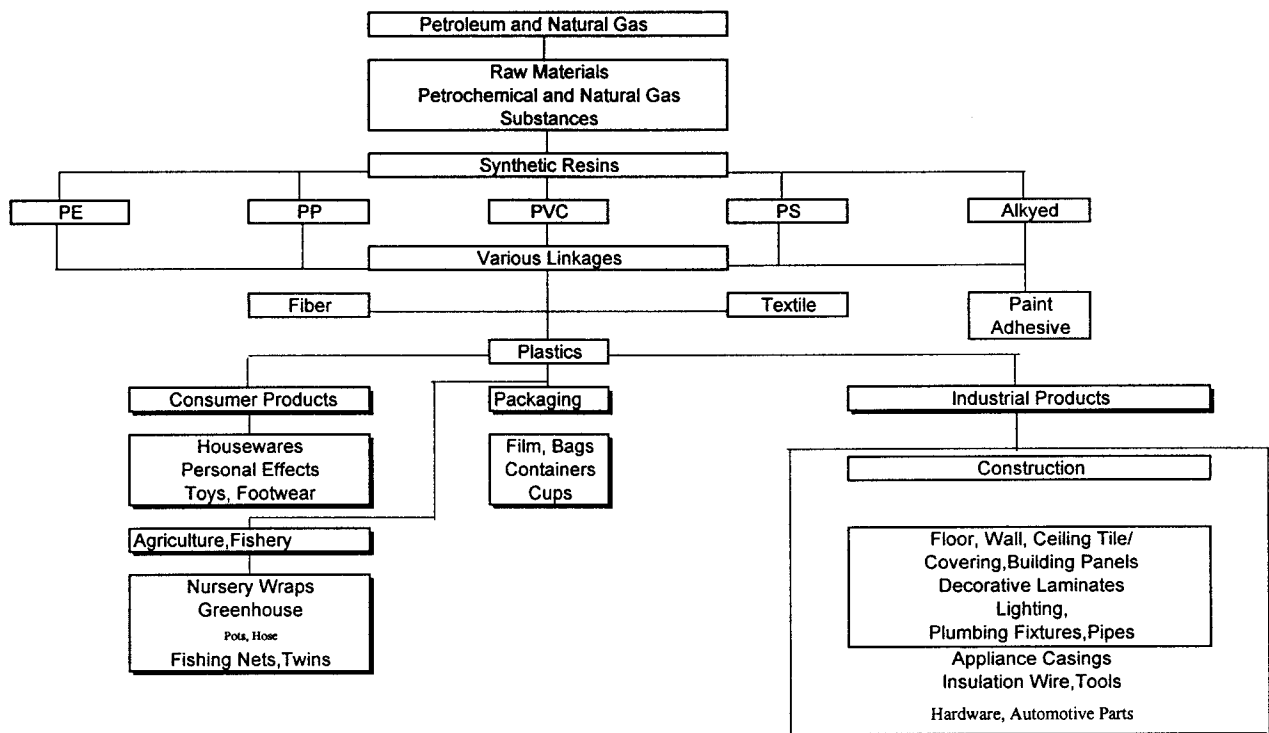
Value: Baht

Commodity Code	Year								
	1990			1993			1995		
	Country	Value	Share(%)	Country	Value	Share(%)	Country	Value	Share(%)
1). 3926900904 Other articles of plastics or of other materials of headings Nos.3901 to 3914	1.Japan	2,019,540,228	42.38	1.Japan	4,013,218,231	41.33	1.Japan	5,809,018,936	36.49
	2.Singapore	721,985,652	15.15	2.Singapore	1,582,221,285	16.30	2.Singapore	2,405,362,162	15.11
	3.Taiwan	648,063,438	13.60	3.Taiwan	1,428,046,588	14.71	3.Taiwan	2,265,650,077	14.23
	ASEAN		15.93	ASEAN		19.03	ASEAN		24.01
	-Brunei	0	0.00	-Brunei	110,358	0.00	-Brunei	0	0.00
	-Indonesia	1,720,080	0.04	-Indonesia	35,435,379	0.36	-Indonesia	187,198,862	1.18
	-Malaysia	32,541,131	0.68	-Malaysia	227,846,066	2.35	-Malaysia	1,214,181,442	7.63
	-Philippines	2,992,507	0.06	-Philippines	2,311,692	0.02	-Philippines	14,435,780	0.09
	-Singapore	721,985,652	15.15	-Singapore	1,582,221,285	16.30	-Singapore	2,405,362,162	15.11
All Countries		4,765,628,325	100		9,709,100,952	100		15,917,517,887	100
2). 3923900005 Other Articles for the Conveyance or Packings of Goods, of Plastic	1.Japan	61,176,640	26.03	1.U.S.	185,248,986	38.20	1.Japan	238,085,904	34.03
	2.Taiwan	47,193,568	20.08	2.Japan	136,880,694	28.23	2.Malaysia	113,941,472	16.29
	3.U.S.	32,323,438	13.76	3.Taiwan	42913486	8.85	3.U.S.	82,394,710	11.78
	ASEAN		15.58	ASEAN		3.45	ASEAN		28.33
	-Indonesia	4,379,040	1.86	-Indonesia	637,275	0.13	-Indonesia	3,319,406	0.47
	-Malaysia	19,687,822	8.38	-Malaysia	15,576,314	3.21	-Malaysia	113,941,472	16.29
	-Philippines	63,146	0.03	-Philippines	528,245	0.11	-Philippines	14,626	0.00
	-Singapore	12,472,878	5.31	-Singapore	0	0.00	-Singapore	80,950,555	11.57
All Countries		234,990,160	100		484,931,311	100		699,649,347	100
3). 3923290000 Sacks and Bags (including cones) of Other Plastics.	1.Australia	46,612,574	26.26	1.Japan	154,792,689	41.22	1.Japan	168,649,116	35.43
	2.Japan	34,874,539	19.65	2.Australia	47,918,460	12.76	2.Austria	67,082,619	14.09
	3.U.S.	27,233,559	15.34	3.Singapore	27,327,650	7.28	3.Malaysia	52,220,383	10.97
	ASEAN		17.64	ASEAN		13.79	ASEAN		6.16
	-Indonesia	0	0.00	-Indonesia	710,634	0.19	-Indonesia	6,442,896	1.35
	-Malaysia	26,786,272	15.09	-Malaysia	23,627,010	6.29	-Malaysia	5,220,380	1.10
	-Philippines	0	0.00	-Philippines	27,327,650	7.28	-Philippines	15,779	0.00
	-Singapore	4,522,563	2.55	-Singapore	100,025	0.03	-Singapore	17,662,376	3.71
All Countries		177,476,935	100		375,519,448	100		475,988,775	100
4). 3923100000 Boxes,Cases, Crates and similar articles of Plastic	1.Japan	34,951,490	42.20	1.Malaysia	232,224,970	63.89	1.Japan	123,526,934	41.16
	2.Malaysia	23,235,983	28.06	2.Japan	97,812,555	26.91	2.Singapore	50,908,597	16.96
	3.Germany	1,990,605	2.40	3.Taiwan	10,387,492	2.86	3.U.S.	47,478,220	15.82
	ASEAN		31.93	ASEAN		65.32	ASEAN		26.15
	-Indonesia	0	0.00	-Indonesia	1,323,808	0.36	-Indonesia	797,156	0.27
	-Malaysia	23,235,983	28.06	-Malaysia	232,224,970	63.89	-Malaysia	26,769,308	8.92
	-Philippines	0	0.00	-Philippines	0	0.00	-Philippines	5	0.00
	-Singapore	3,203,333	3.87	-Singapore	3,906,066	1.07	-Singapore	50,908,597	16.96
All Countries		82,821,480	100		363,481,844	100		300,089,648	100
5). 3923400006 Spools,Caps, Bobins and Similar Supports, of Plastic	1.Japan	47,077,502	76.04	1.Japan	129,859,988	60.68	1.Japan	146,127,889	57.17
	2.Korea	5,770,835	9.32	2.Taiwan	16,768,902	7.84	2.Taiwan	49,765,586	19.47
	3.Italy	1,558,640	2.52	3.Germany	16,788,902	7.84	3.Germany	13,948,041	5.46
	ASEAN			ASEAN		1.63	ASEAN		7.42
	-Indonesia	0	0.00	-Indonesia	454,140	0.21	-Indonesia	0	0.00
	-Malaysia	0	0.00	-Malaysia	0	0.00	-Malaysia	12,087,937	4.73
	-Philippines	0	0.00	-Philippines	0	0.00	-Philippines	0	0.00
	-Singapore	0	0.00	-Singapore	3,046,403	1.42	-Singapore	6,883,220	2.69
All Countries		61,911,091	100		214,009,748	100		255,584,367	100
6). 3923500008 Stoppers,Lids, Caps,other Closure of Plastic	1.Japan	15,971,821	31.33	1.Japan	87,711,318	55.67	1.U.S.A.	43,064,600	26.51
	2.U.S.	11,109,159	21.79	2.Singapore	21,274,261	13.50	2.Japan	31,222,004	19.22
	3.Germany	6,005,960	11.78	3.U.S.	20,581,814	13.06	3.Germany	15,744,405	9.69
	ASEAN		5.53	ASEAN		17.73	ASEAN		16.09
	-Indonesia	0	0.00	-Indonesia	1,228,303	0.78	-Indonesia	74,591	0.05
	-Malaysia	818,032	1.60	-Malaysia	5,258,981	3.34	-Malaysia	10,190,508	6.27
	-Philippines	91,812	0.18	-Philippines	170,607	0.11	-Philippines	567,103	0.35
	-Singapore	1,912,088	3.75	-Singapore	21,271,261	13.50	-Singapore	15,296,968	9.42
All Countries		50,979,836	100		157,546,019	100		162,416,974	100
7). 3926900102 Baskets,Sieve ranks and the like, of Plastics or Other Materials of headings Nos. 3901 to 3904	1.Japan	4,064,657	36.48	1.Japan	35,089,475	64.53	1.Japan	87,456,087	79.70
	2.Taiwan	2,244,751	20.14	2.Singapore	5,447,017	10.02	2.France	4,558,485	4.15
	3.U.S.	1,211,505	10.87	3.Taiwan	4,091,969	7.53	3.Taiwan	3,995,199	3.64
	ASEAN		2.86	ASEAN		11.54	ASEAN		1.16
	-Indonesia	0	0.00	-Indonesia	0	0.00	-Indonesia	57	0.00
	-Malaysia	6,713	0.06	-Malaysia	826,175	1.52	-Malaysia	162,628	0.15
	-Philippines	0	0.00	-Philippines	0	0.00	-Philippines	118,238	0.11
	-Singapore	311,603	2.80	-Singapore	5,447,017	10.02	-Singapore	990,030	0.90
All Countries		11,143,592	100		54,375,962	100		109,737,622	100
8). 3925200003 Doors,Windows and Thresholds for Doors, of	1.Japan	42,067,189	95.00	1.Japan	51,847,148	94.86	1.Japan	95,350,672	91.47
	2.Italy	957,366	2.16	2.Italy	2,351,724	4.30	2.Taiwan	6,060,643	5.81
	3.Germany	446,603	1.01	3.Taiwan	308,364	0.56	3.Italy	1,591,637	1.53
	ASEAN		0.28	ASEAN		0.13	ASEAN		0.00

Commodity Code	Year								
	1990			1993			1995		
	Country	Value	Share(%)	Country	Value	Share(%)	Country	Value	Share(%)
Plastic.	-Singapore	126,190	0.28	-Singapore	71,617	0.13	-	0	0.00
All Countries		44,279,081	100		54,656,470	100		104,246,875	100
9). 3923300004	1.Japan	4,372,723	32.25	1.Japan	55,257,415	60.25	1.Japan	59,294,922	57.86
Carboys,Bottles,	2.U.S.	3,928,362	28.97	2.U.S.	21,111,532	23.02	2.Malaysia	22,412,363	21.87
Flasks and Similar	3.Australia	2,154,167	15.89	3.Malaysia	5,291,955	5.77	3.U.S.	4,849,608	4.73
Articles of Plastic	ASEAN	3.62		ASEAN	6.92		ASEAN	23.37	
	-Indonesia	0	0.00	-Indonesia	205,967	0.22	-Indonesia	542,143	0.53
	-Malaysia	339,520	2.50	-Malaysia	5,291,955	5.77	-Malaysia	22,412,363	21.87
	-Philippines	0	0.00	-Philippines	844,579	0.92	-Philippines	126,423	0.12
	-Singapore	152,194	1.12	-Singapore	11,895	0.01	-Singapore	868,569	0.85
All Countries		13,558,812	100		91,713,901	100		102,487,545	100
10). 3926300000	1.Japan	8,022,041	38.09	1.Japan	17,522,722	41.88	1.U.S.	20,895,173	29.03
Fittings for	2.German	5,743,503	27.27	2.German	12,044,897	28.79	2.Japan	19,749,006	27.43
Furniture,Coachwork	3.Taiwan	4,249,734	20.18	3.Taiwan	6,599,799	15.77	3.Germany	12,770,131	17.74
or the like, of	ASEAN	0.97		ASEAN	0.42		ASEAN	1.15	
Plastic or Other	-Malaysia	29,052	0.14	-Malaysia	0	0.00	-Malaysia	709,744	0.99
Materials of headings	-Singapore	174,232	0.83	-Singapore	177,298	0.42	-Singapore	112,512	0.16
Nos. 3901 to 3904		0.00			0.00			0.00	
All Countries		21,063,341	100		41,841,830	100		71,989,084	100

Source: Department of Customs, Bangkok.

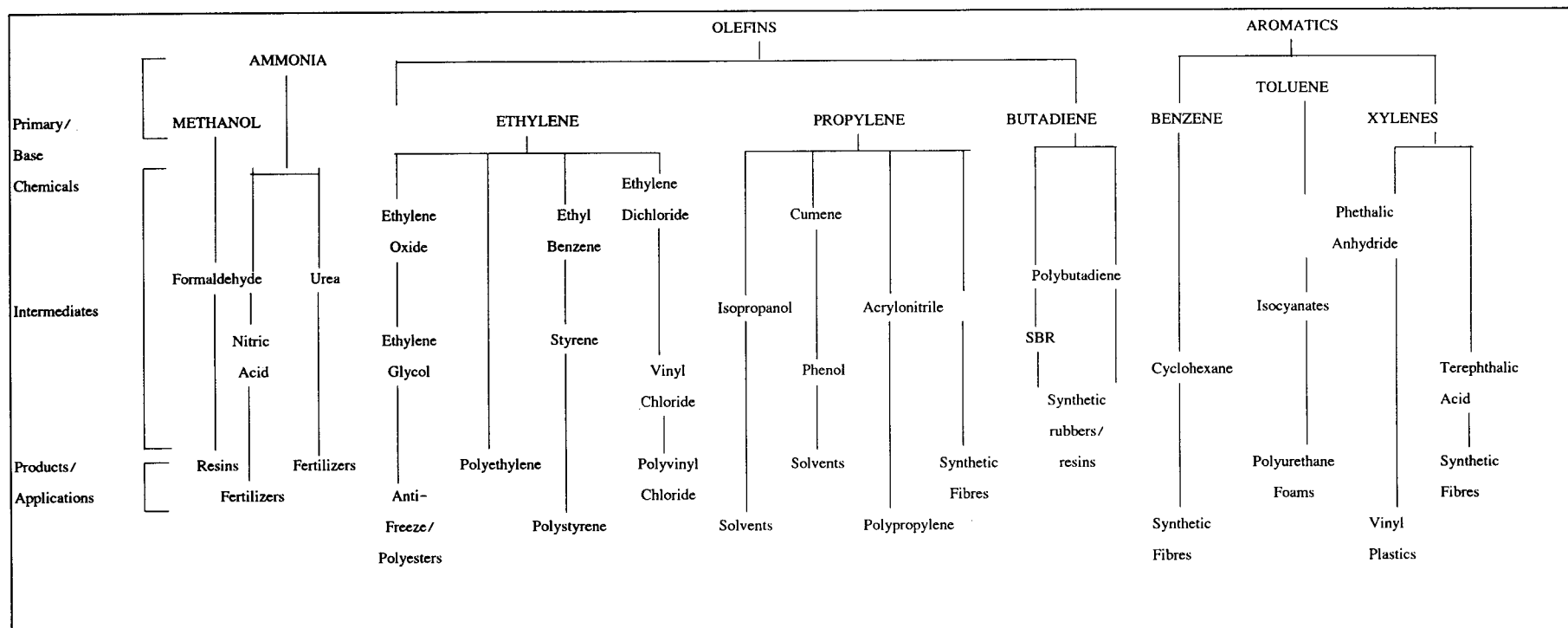
Figure 1: Forward and Backward Linkages of Resin and Plastic Product Production



Source: Banzon, Cesar P., 1994: Figure 1.

Figure 1

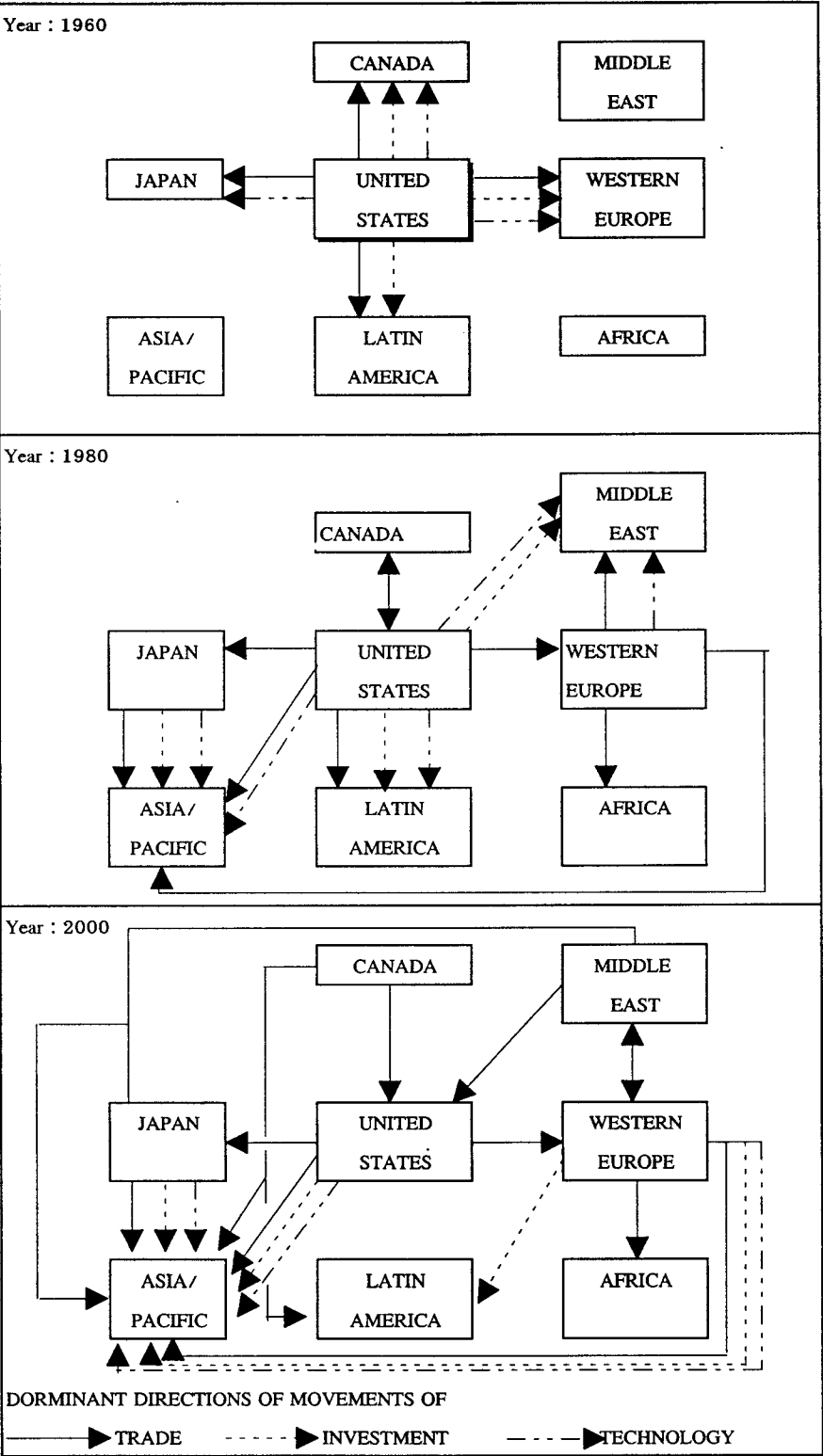
Figure 2: Flow of principle petrochemicals and applications of these chemicals



Source: Chapman, 1991: 24.

Figure 2

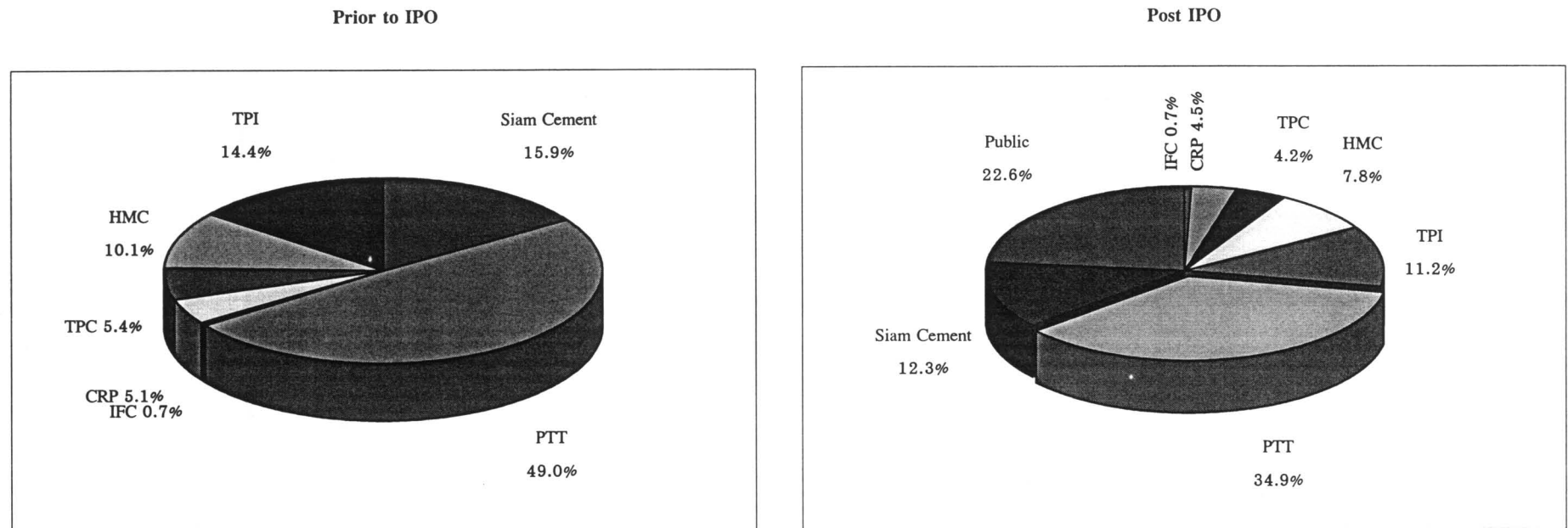
**Figure 3: Global Patterns of Trade, Investment and Technology
in the Petrochemical Industry, 1960, 1980 and 2000**



Source: Chapman,1991:292.

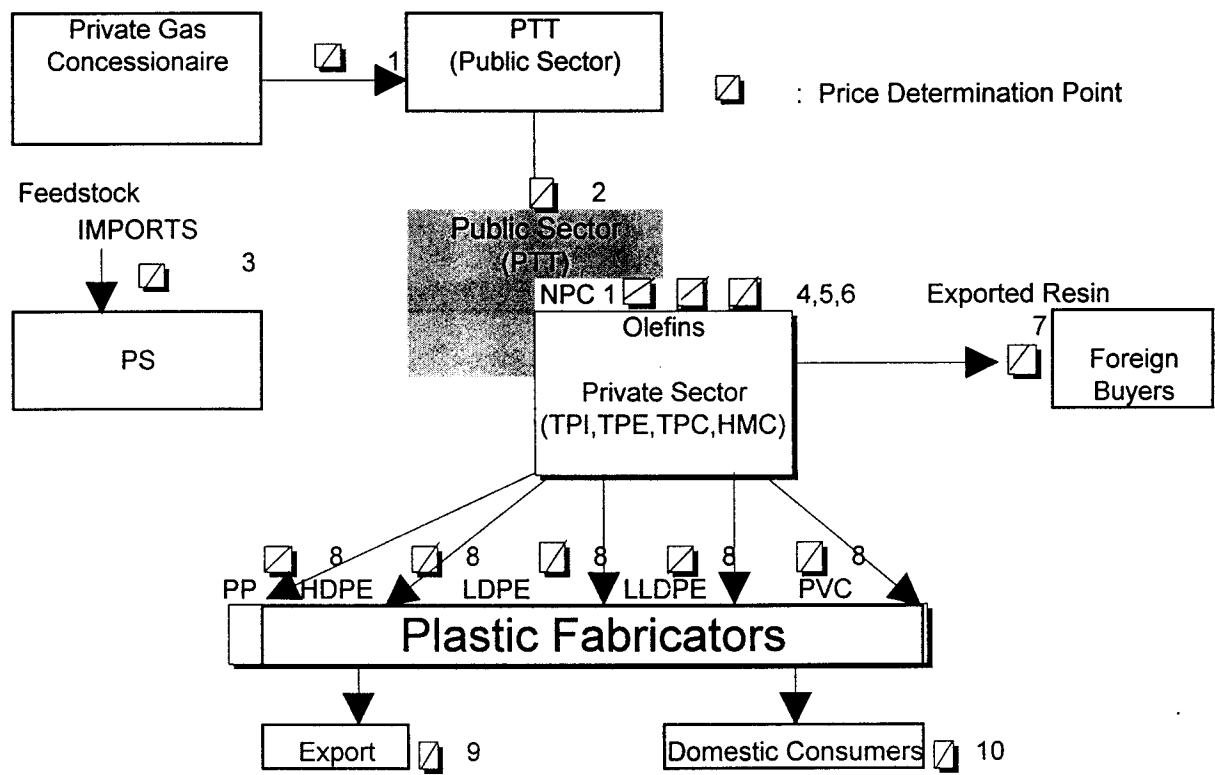
Figure 3

Figure 4 : NPC Share Holdings Structure before and after Initial Public Offering (IPO)



Source: NPC Investor Presentation, November 1993.

Figure 5 : Structure of Petrochemical Industry in Thailand with NPC 1 by Product and Price, Determination Points.

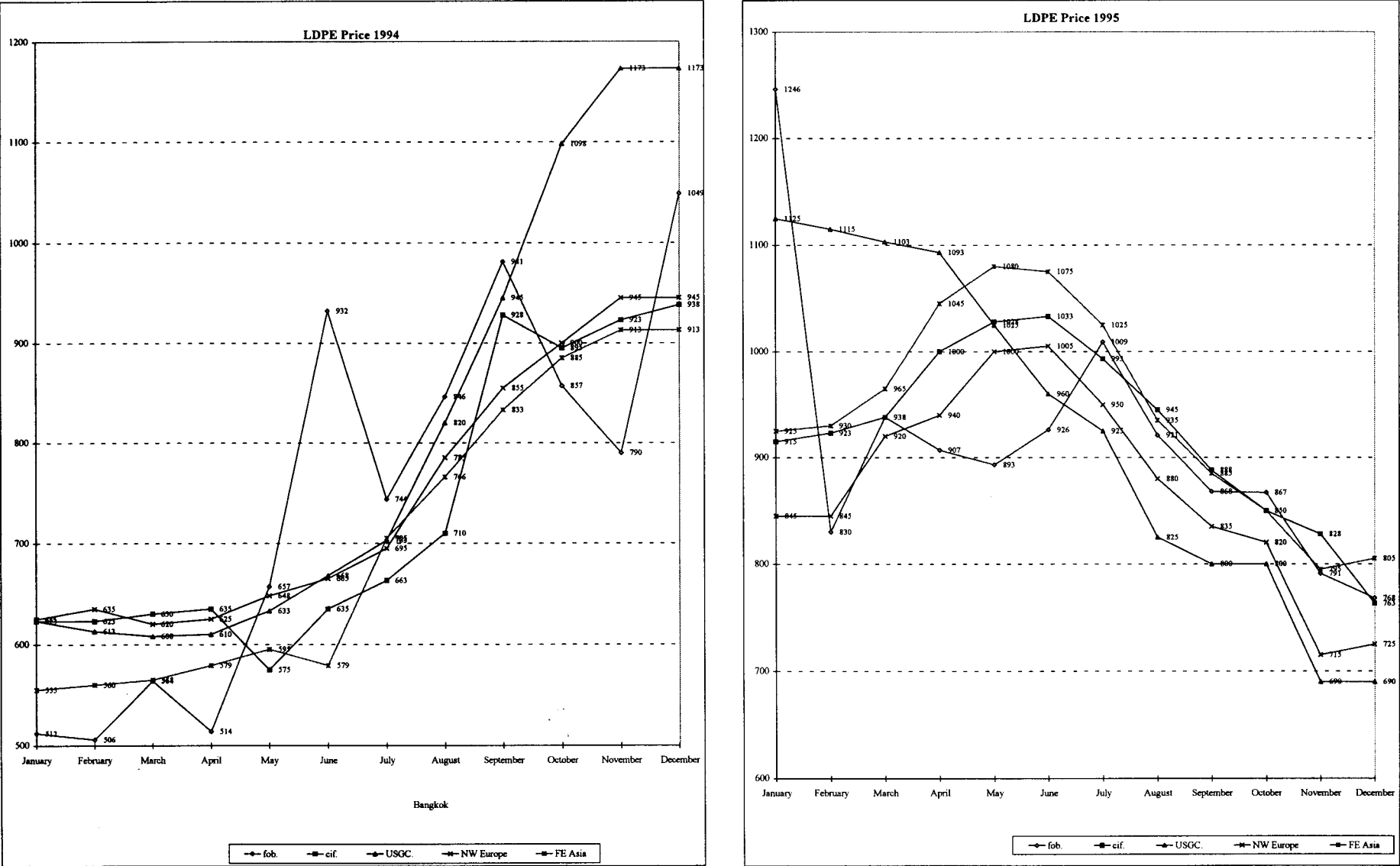


Product	Price Determinants
1 Natural gas	Fuel oil price determined at Singapore, with Thailand wholesale price index, and U.S. export price index.
2 Ethane Propane	World price and cost of production, currently world prices of ethane and propane + \$ US 80.
3 Imported Feedstock	World price + tariff
4 Ethylene Propylene	Contract market. Subject to minimum purchase contract; total cost plus profit, interest and depreciation.
5 Ethylene Propylene	Spot market. Sales above the minimum. Far East import price = C.I.F. + tariff
6 Ethylene Propylene	Expanded capacity output priced at U.S. Gulf coast + 10 % subject to contract.
7 Exported Resin	World price, spot or contract, depending on quality of product
8 Plastic Resins	C.I.F. (Import price) + tariff - reference price .Actual transaction price up to 15 % lower
9,10 Plastic Resins	C.I.F. (Import price) + tariff - reference price

Note : Tariff are for AFTA for 1996. Only NPC1 is included here. Products from NPC2 would be similarly priced.

Figure 5

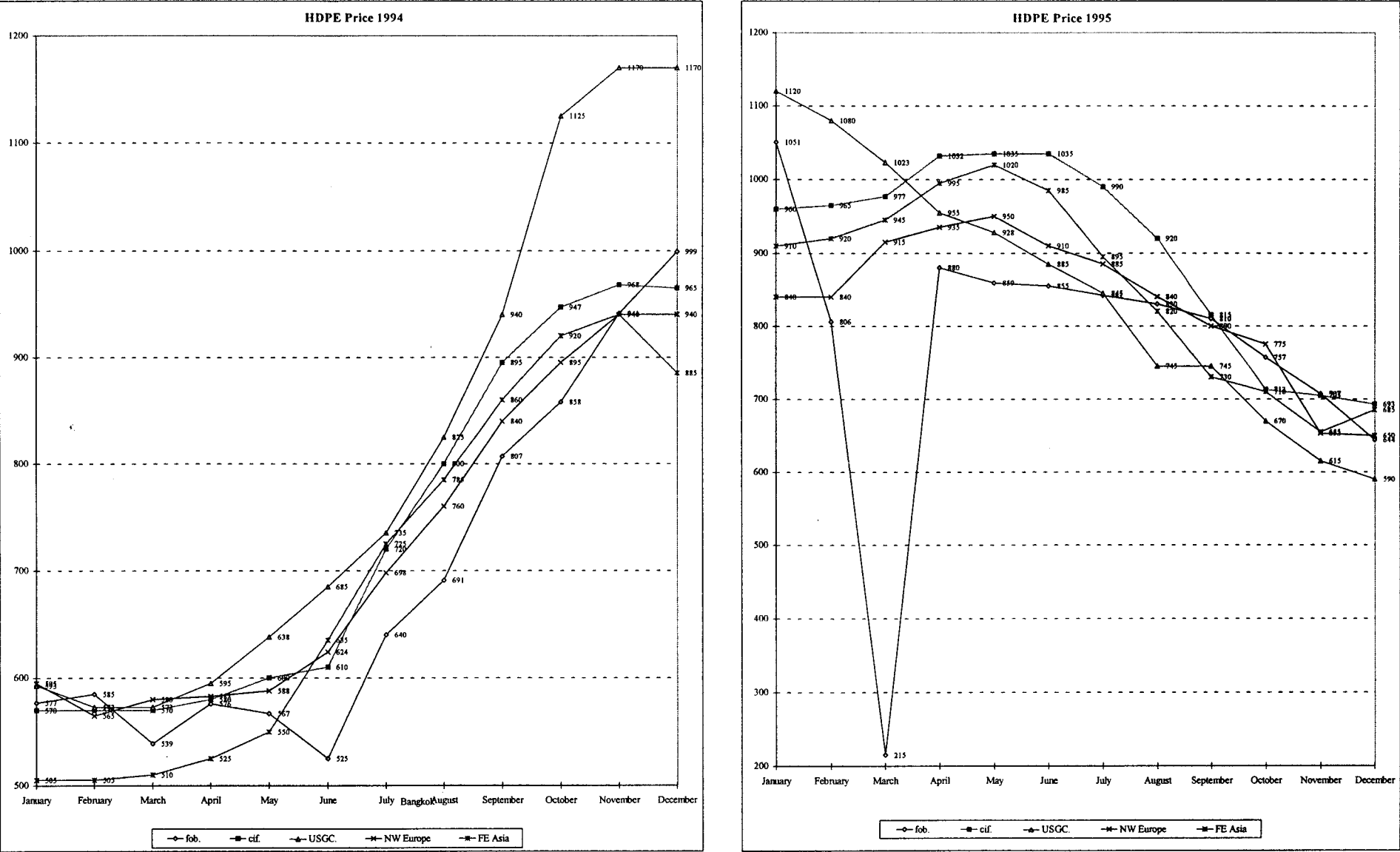
Figure 6 : LDPE Price Trends in 1994 and 1995 for C.I.F. Bangkok, FOB Bangkok, USGC, NW Europe and Far East Asia



Source: Derived from unpublished data of Plastic Industry Club ; Plastic Magazine 1994,1995; Customs Department Ministry of Finance, Bangkok. Actual data reproduced in Appendix 2.

Figure 6

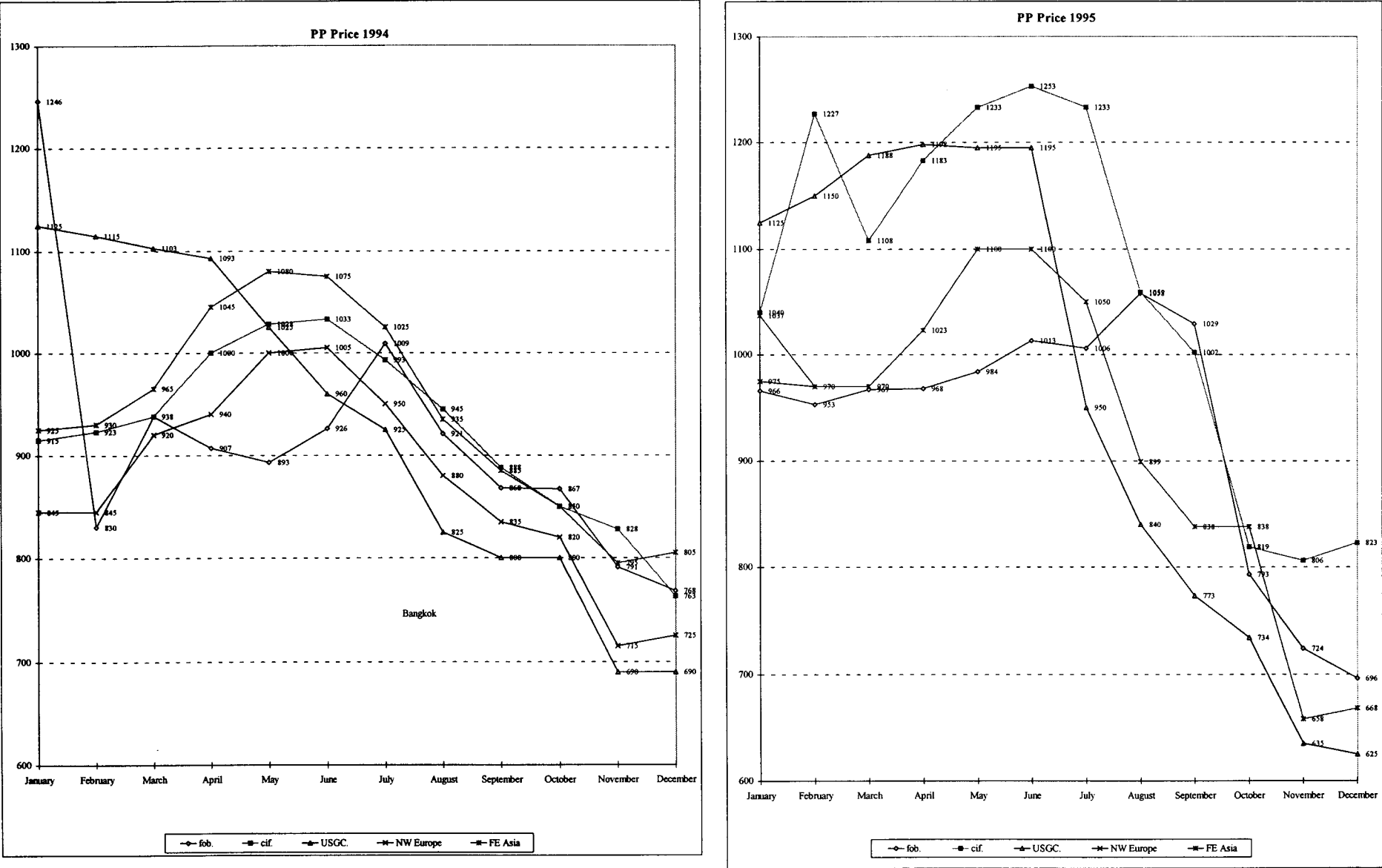
Figure 7: HDPE Price Trends in 1994 and 1995 for C.I.F. Bangkok, FOB Bangkok, USGC, NW Europe and Far East Asia



Source: Derived from unpublished data of Plastic Industry Club ; Plastic Magazine 1994,1995; Customs Department Ministry of Finance, Bangkok. Actual data reproduced in Appendix 2.

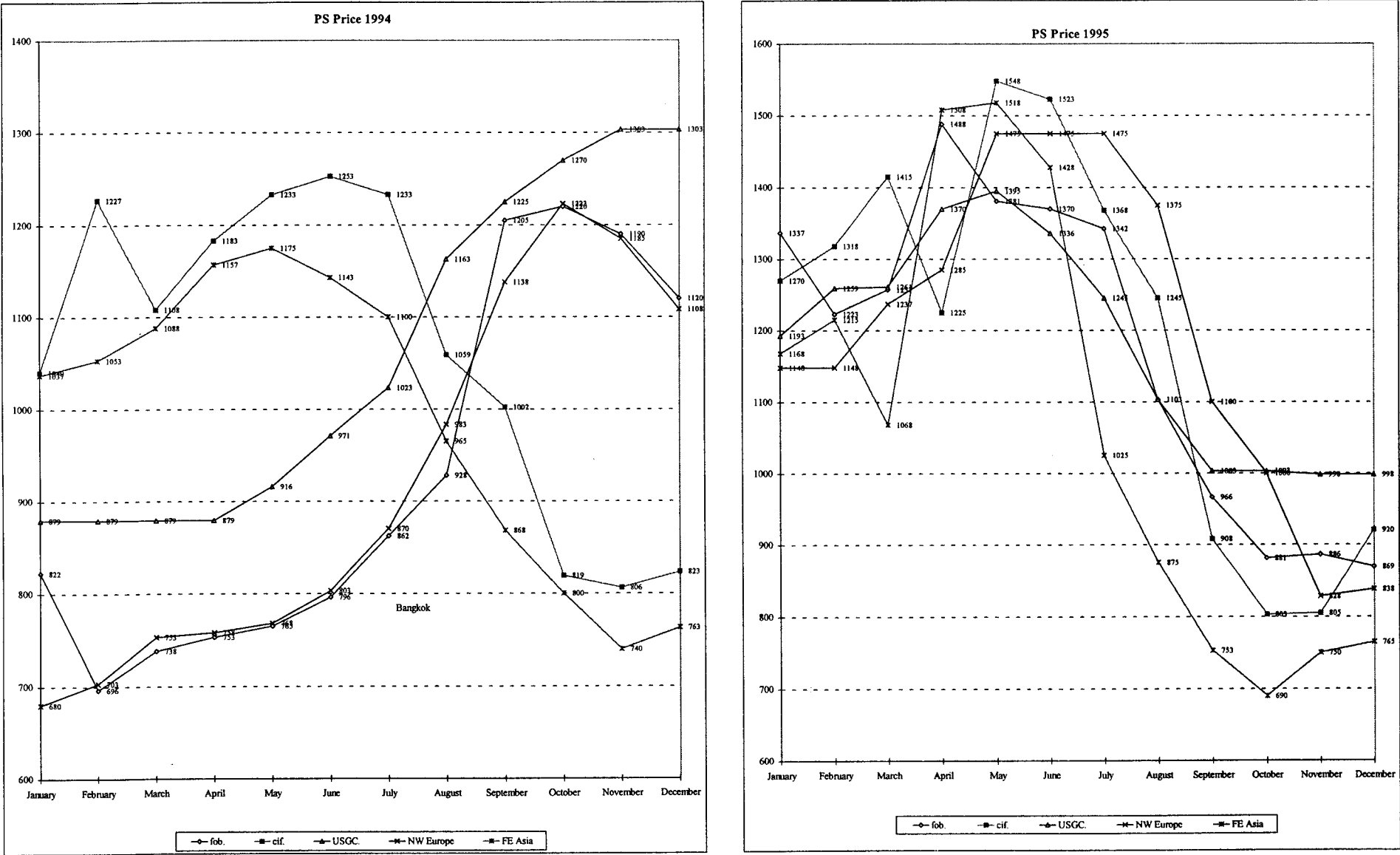
Figure 7

Figure 8: PP Price Trends in 1994 and 1995 for C.I.F. Bangkok, FOB Bangkok, USGC, NW Europe and Far East Asia



Source: Derived from unpublished data of Plastic Industry Club ; Plastic Magazine 1994,1995; Customs Department Ministry of Finance, Bangkok. Actual data reproduced in Appendix 2.

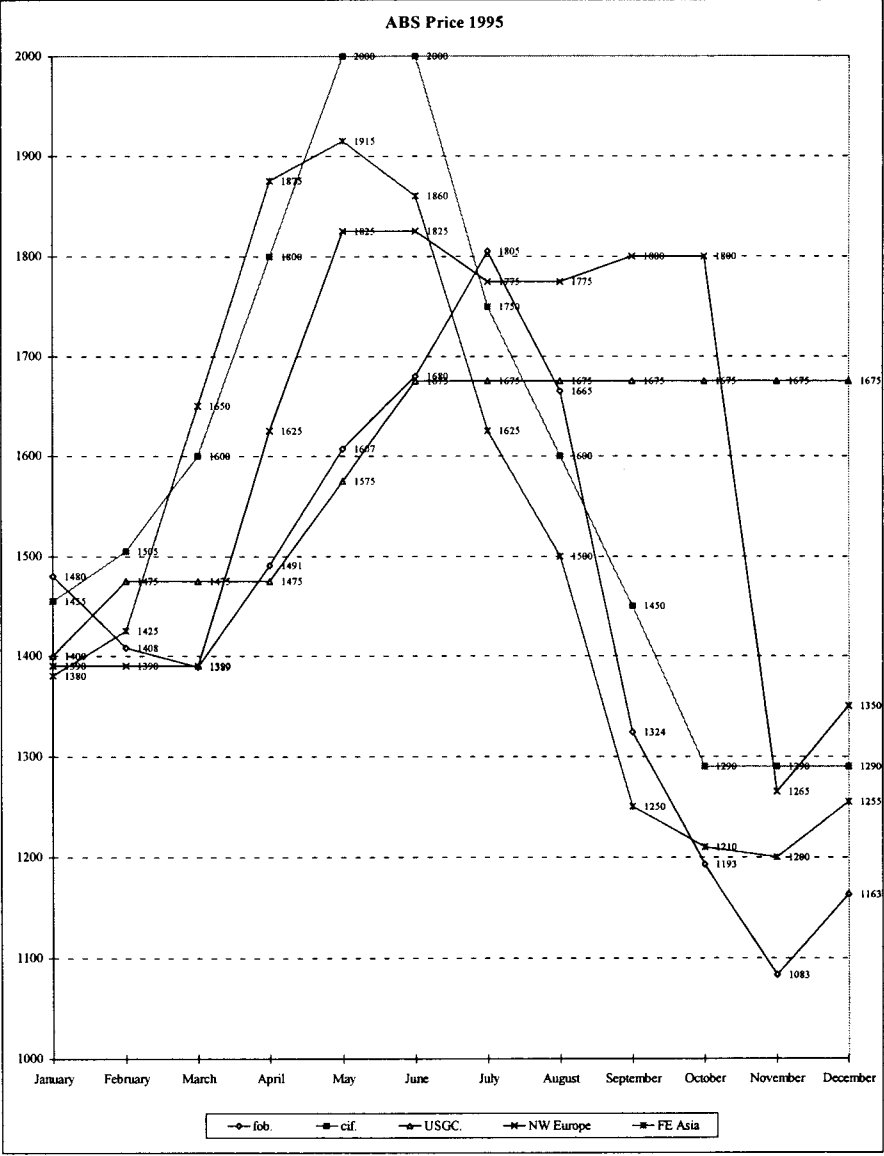
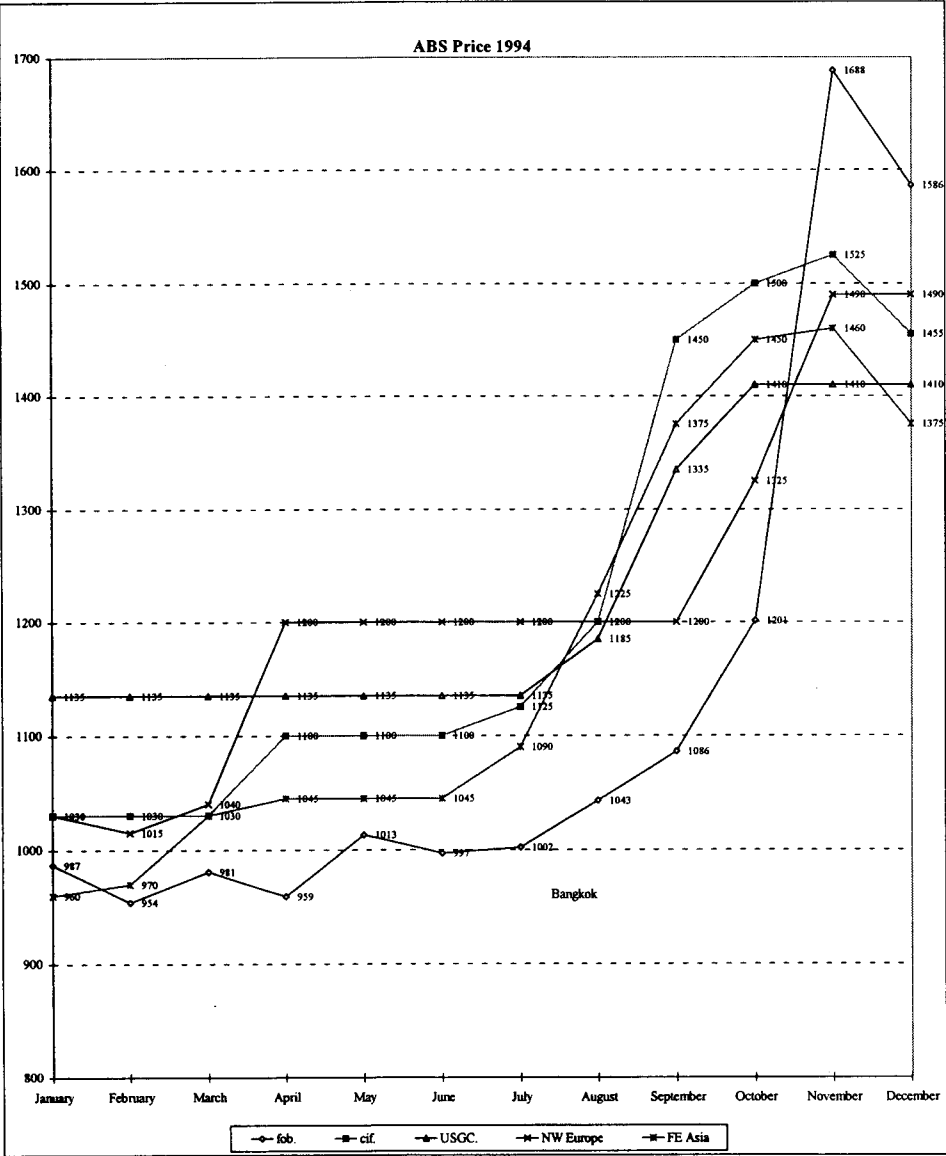
Figure 9: PS Price Trends in 1994 and 1995 for C.I.F. Bangkok, FOB Bangkok, USGC, NW Europe and Far East Asia



Source: Derived from unpublished data of Plastic Industry Club ; Plastic Magazine 1994,1995; Customs Department Ministry of Finance, Bangkok. Actual data reproduced in Appendix 2.

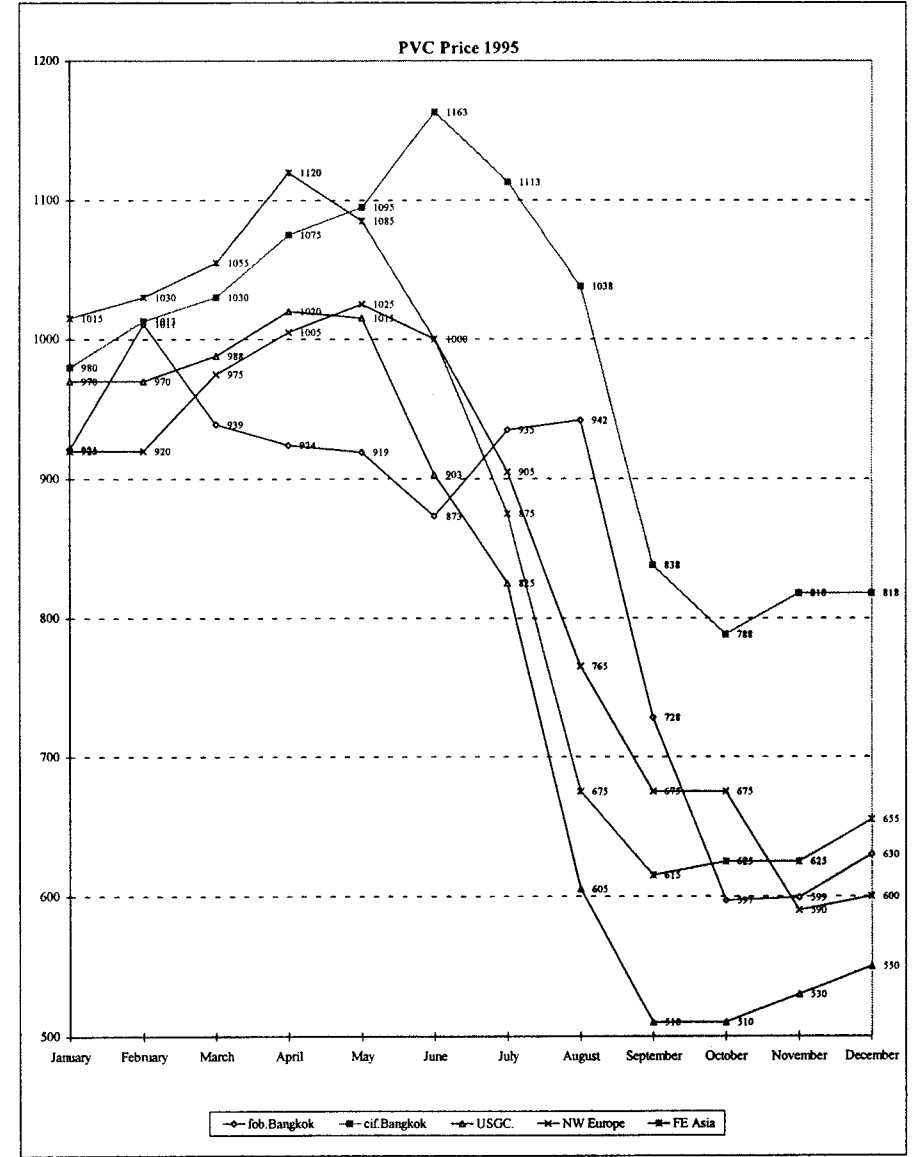
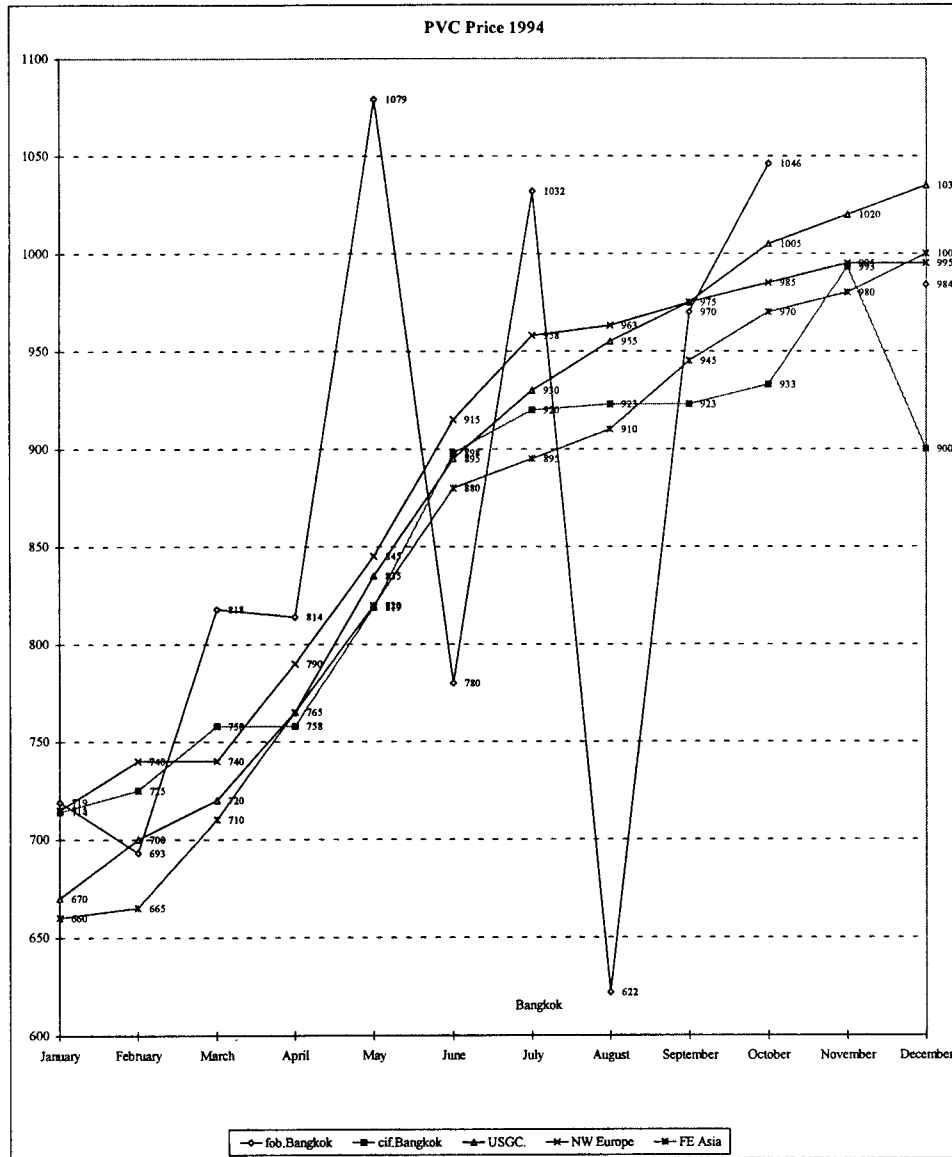
Figure 9

Figure 10: ABS Price Trends in 1994 and 1995 for C.I.F. Bangkok, USGC, NW Europe and Far East Asia



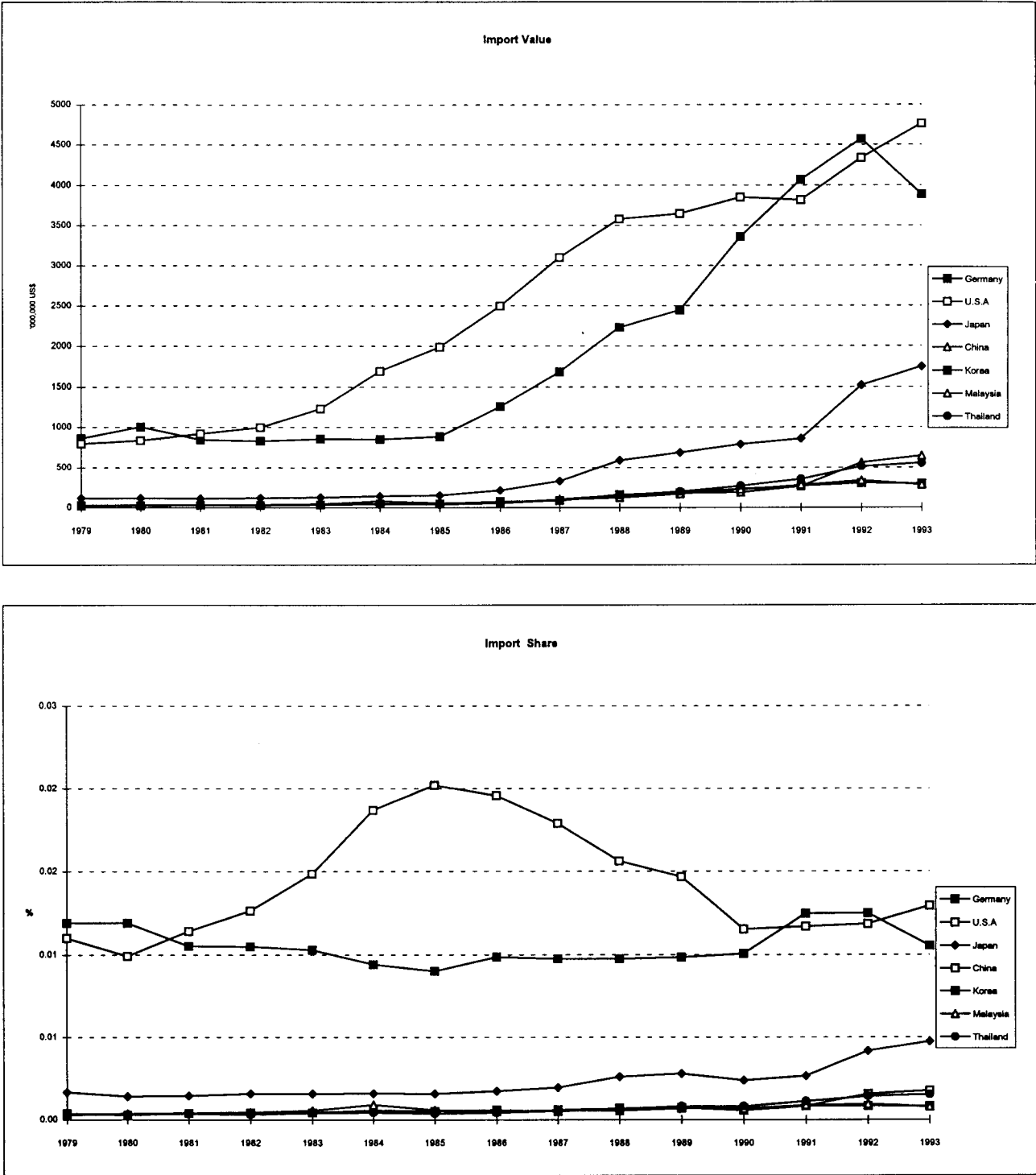
Source: Derived from unpublished data of Plastic Industry Club ; Plastic Magazine 1994 , 1995; Custom Department Ministry of Finance, Bangkok. Actual data reproduced in Appendix 2.

Figure 11: PVC Price Trends in 1994 and 1995 for C.I.F.Bangkok, USGC, NW Europe and Far East Asia



Source: Derived from unpublished data of Plastic Industry Club ; Plastic Magazine 1994,1995; Custom Department Ministry of Finance, Bangkok. Actual data reproduced in Appendix 2.

Figure 12: Imports of Plastics Products by Value (US\$) and Share of world imports, 1979-1993

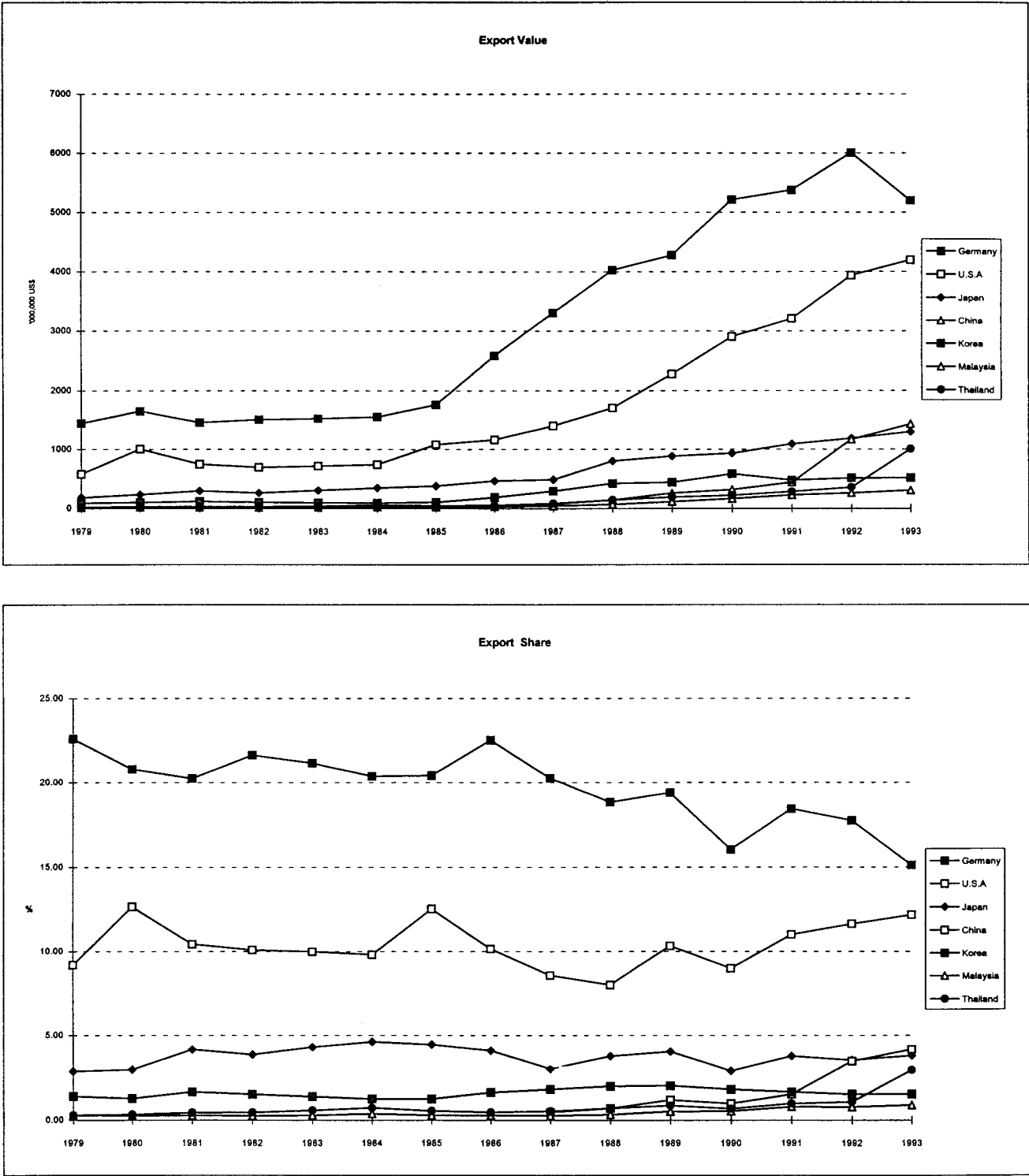


SITC 582 Product of Condensation Includes : phenolic resins, aminoplasts, alkyds, polyimides, polyurethanes, epoxide resins, and
SITC 583 Polymerization etc Products includes : polyethylene, polystyrene, polypropylene, polyvinyl chloride, Acrylonitrile butadiene
vinyl chloride and vinyl acetate, acrylic polymers, polyvinyl acetate, methacrylic polymers and acrylonitrile copolymers,
iron exchanger of the polymerization or copolymerization type, and others.

Source: Fukase 1995 Annex 10

Figure 12

Figure 13 : Exports of Plastics Products by Value (US\$) and Share of world exports, 1979-1993



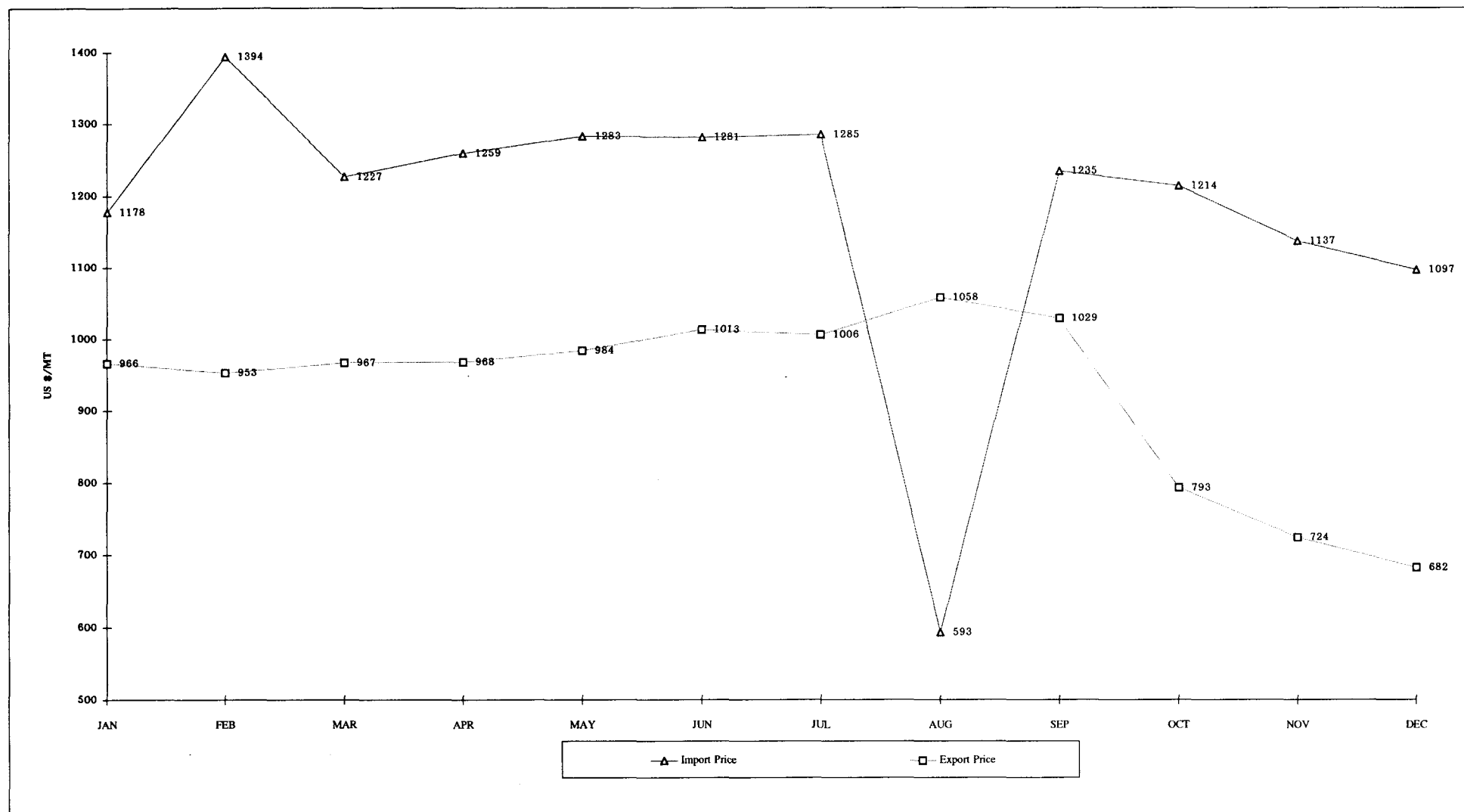
SITC 582 Product of Condensation Includes : phenolic resins, aminoplasts, alkyds, polyimides, polyurethanes, epoxide resins, and others.

SITC 583 Polymerization etc Products includes: polyethylene, polystyrene, polypropylene, polyvinyl chloride, Acrylonitrilebutadiene-styrene (ABS), vinyl chloride and vinyl acetate, acrylic polymers, polyvinyl acetate, methacrylic polymers and acrylonitrile copolymers, iron exchanger of the polymerization or copolymerization type, and others.

Source: Fukase 1995 Annex 11

Figure 13

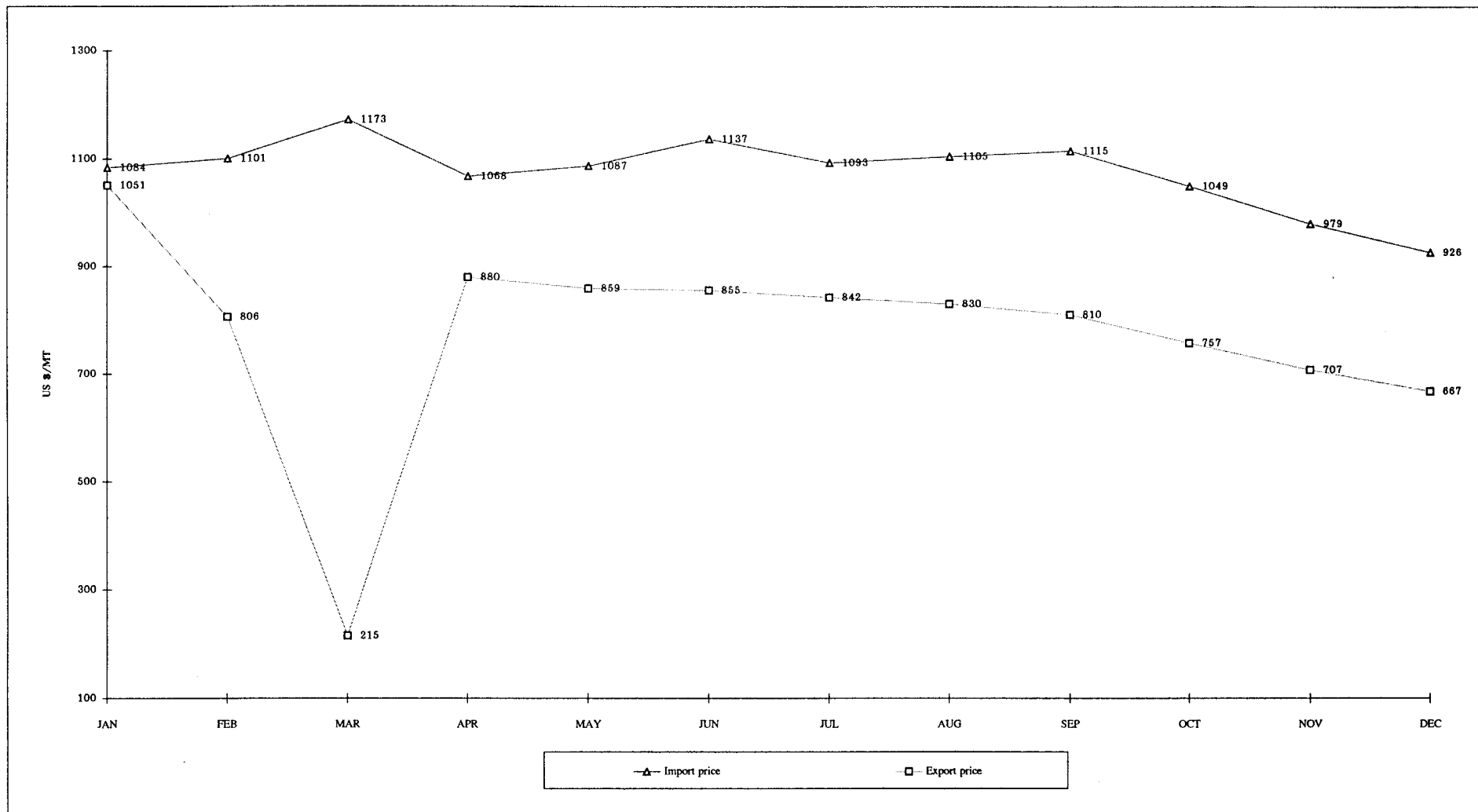
Figure 14: Export (C.I.F.) and Import (C.I.F.) Average Monthly Prices for PP in 1995 in Bangkok.



Source: Compiled from data obtained from Department of Customs, Bangkok.

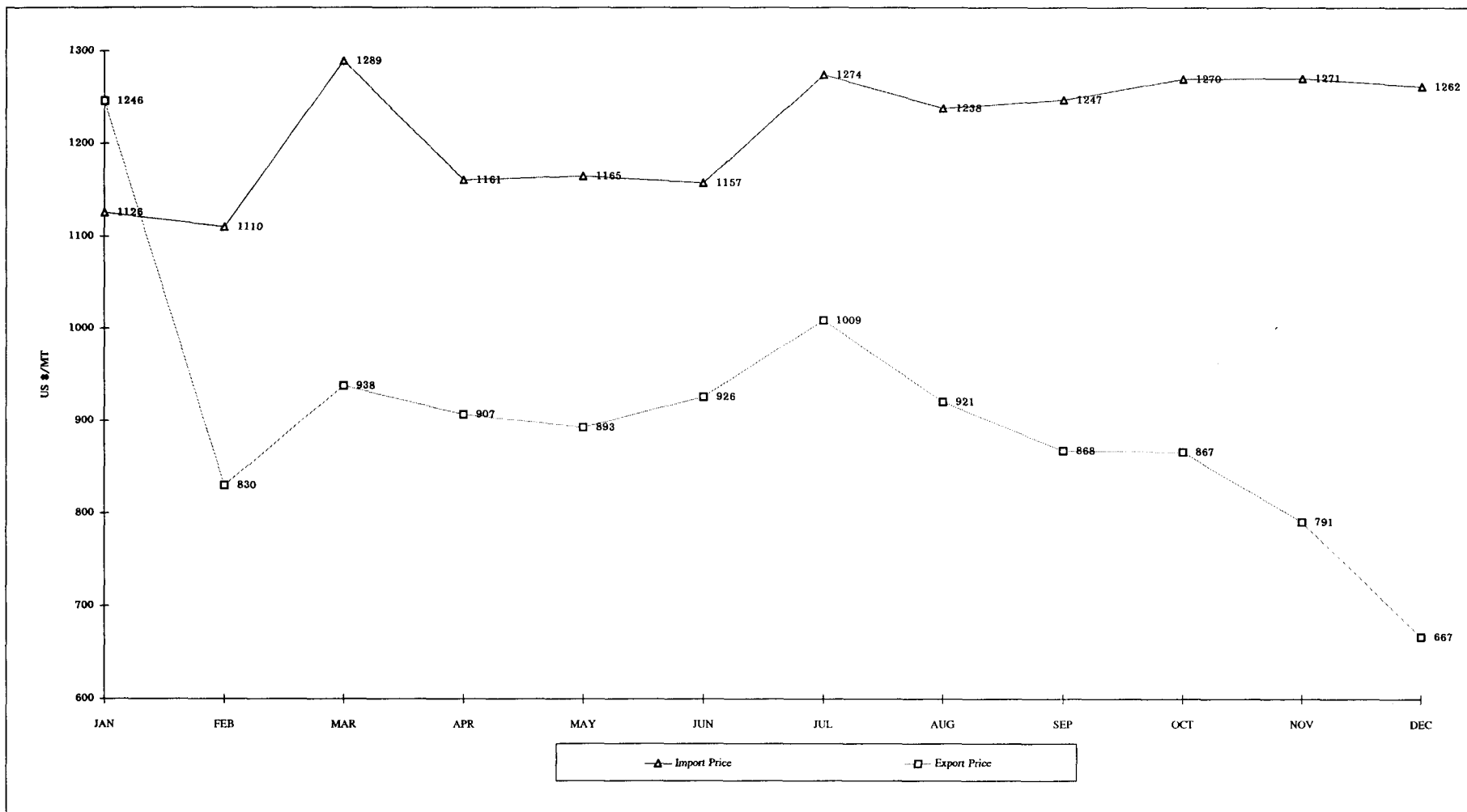
Figure 14

Figure 15: Export (C.I.F.) and Import (C.I.F.) Average Monthly Prices for HDPE in 1995 in Bangkok.



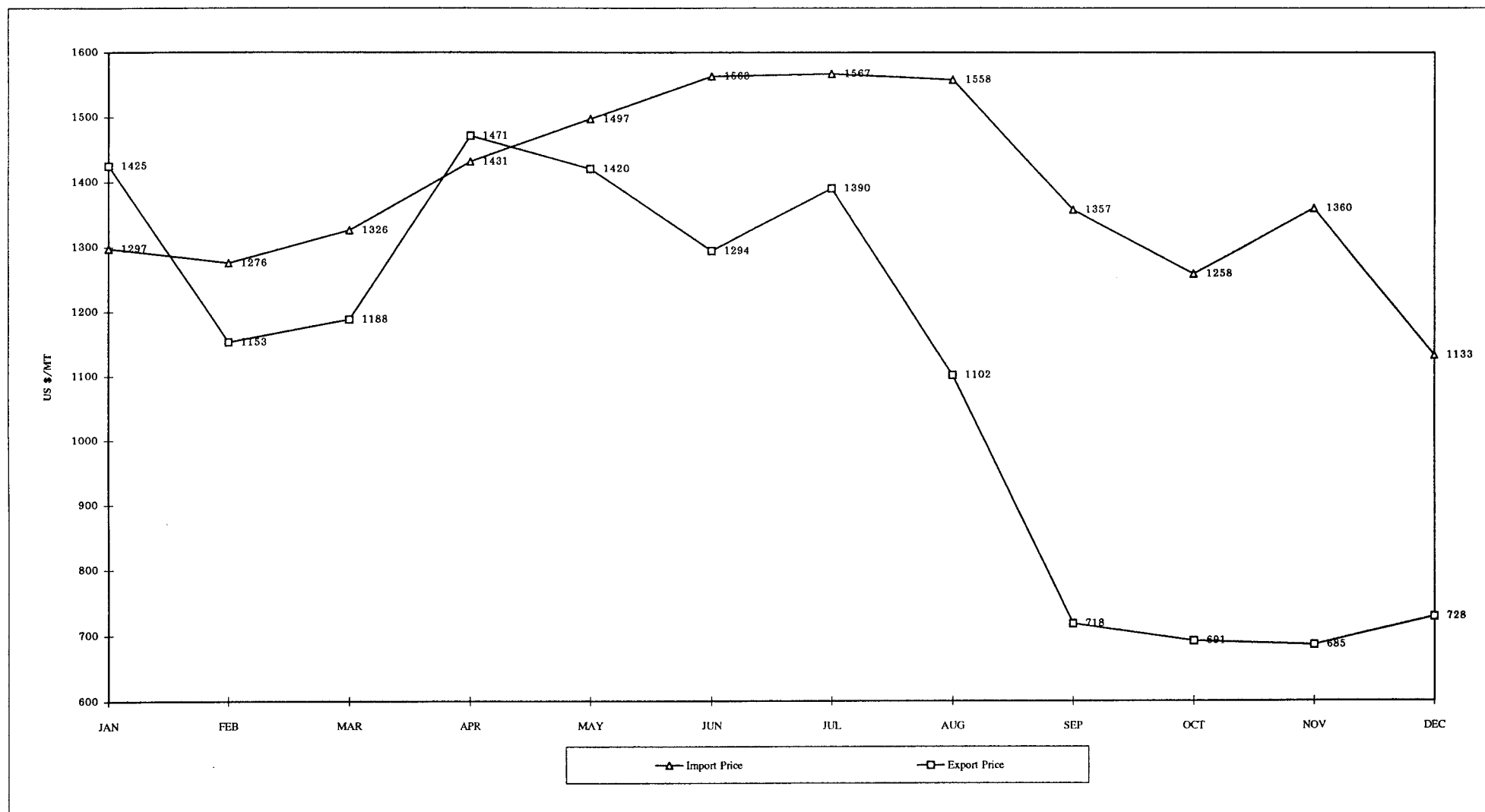
Source: Compiled from data obtained from Department of Customs, Bangkok

Figure 16: Export (C.I.F.) and Import (C.I.F.) Average Monthly Price for LDPE in 1995 in Bangkok



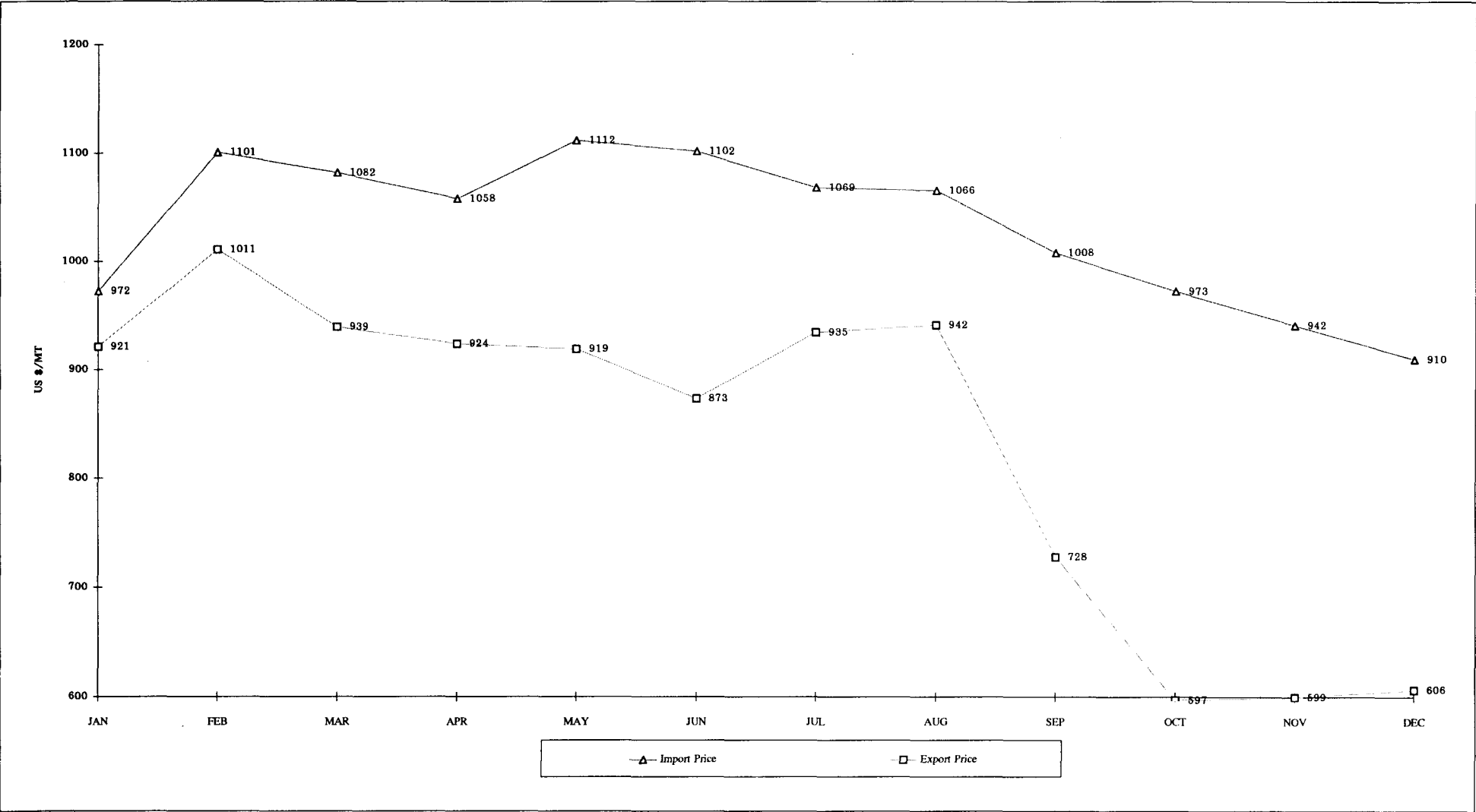
Source: Compiled from data obtained from Department of Customs, Bangkok.

Figure 17: Export (C.I.F.) and Import (C.I.F.) Average Monthly Price for PS in 1995 in Bangkok.



Source: Compiled from data obtained from Department of Customs, Bangkok.

Figure 18: Export (C.I.F.) and Import (C.I.F.) Average Monthly Price for PVC in 1995 in Bangkok.



Source: Compiled from data obtained from Department of Customs, Bangkok

Figure 18

**Appendix 1: Age Distribution of Thai Plastic Industry Club
Member Firms, 1993**

Year Established	Number of Firms
Before 1965	3
1965-1969	13
1970-1974	12
1975-1979	19
1980-1984	25
1985-1989	29
1990-1995	5

Note: Plastic Industry Club includes producers of feedstocks,
resins and plastic products.

Source: Compiled from The Federation of Thai Industries.
Plastic Industry Club. 1993.

Appendix 2: Price of Plastic Resins in 1994 and 1995

\$ U.S. per metric ton.

		F.O.B. Bangkok		C.I.F. Bangkok		USGC		NW Europe		Far East Asia	
		1994	1995	1994	1995	1994	1995	1994	1995	1994	1995
LDPE	January	512	1246	623	915	623	1125	625	845	555	925
	February	506	830	623	923	613	1115	635	845	560	930
	March	564	938	630	938	608	1103	620	920	565	965
	April	514	907	635	1000	610	1093	625	940	579	1045
	May	657	893	575	1028	633	1025	648	1000	595	1080
	June	932	926	635	1033	668	960	665	1005	640	1075
	July	744	1009	663	993	703	925	695	950	705	1025
	August	846	921	710	945	820	825	785	880	766	935
	September	981	868	928	888	945	800	855	835	833	885
	October	857	867	895	850	1098	800	900	820	885	850
	November	790	791	923	828	1173	690	945	715	913	795
	December	1049	768	938	763	1173	690	945	725	913	805
HDPE	January	577	1051	570	960	593	1120	595	840	505	910
	February	585	806	570	965	573	1080	565	840	505	920
	March	539	215	570	977	573	1023	580	915	510	945
	April	576	880	580	1032	595	955	583	935	525	995
	May	567	859	600	1035	638	928	588	950	550	1020
	June	525	855	610	1035	685	885	624	910	635	985
	July	640	842	720	990	735	845	698	885	725	895
	August	691	830	800	920	825	745	760	840	785	820
	September	807	810	895	815	940	745	840	800	860	730
	October	858	757	947	713	1125	670	895	775	920	710
	November	941	707	968	705	1170	615	940	653	940	655
	December	999	644	965	693	1170	590	940	650	885	685
PP	January	550	966	563	1040	668	1125	628	975	534	1037
	February	540	953	563	1227	660	1150	590	970	548	1053
	March	544	967	607	1108	660	1188	620	970	560	1088
	April	531	968	615	1183	665	1198	643	1023	590	1157
	May	556	984	645	1233	670	1195	653	1100	625	1175
	June	572	1013	645	1253	750	1195	718	1100	688	1143
	July	672	1006	808	1233	825	950	775	1050	803	1100
	August	684	1058	890	1059	910	840	860	899	840	965
	September	795	1029	1000	1002	1028	773	923	838	930	868
	October	854	793	1055	819	1120	734	1003	838	988	800
	November	1451	723	1080	806	1210	635	1075	658	1010	740
	December	958	696	1055	823	1185	625	1075	668	1008	763
PS	January	822	1337	685	1270	879	1193	763	1148	680	1168
	February	696	1223	685	1318	879	1259	763	1148	703	1215
	March	738	1257	740	1415	879	1261	763	1237	753	1068
	April	753	1488	760	1525	879	1370	818	1285	758	1508
	May	765	1381	760	1548	916	1395	818	1475	768	1518
	June	796	1370	768	1523	971	1336	828	1475	803	1428
	July	862	1342	788	1368	1023	1245	840	1475	870	1025
	August	928	1103	875	1245	1163	1103	945	1375	983	875
	September	1205	966	1188	908	1225	1003	1085	1100	1138	753
	October	1220	881	1325	803	1270	1003	1165	1000	1223	690
	November	1190	886	1330	805	1303	998	1248	828	1185	750
	December	1120	869	1290	820	1303	998	1248	838	1108	765
ABS	January	987	1480	1030	1455	1135	1400	1030	1390	960	1380
	February	954	1408	1030	1505	1135	1475	1015	1390	970	1425
	March	981	1389	1030	1600	1135	1475	1040	1390	1030	1650
	April	959	1491	1100	1800	1135	1475	1200	1625	1045	1875
	May	1013	1607	1100	2000	1135	1575	1200	1825	1045	1915

		F.O.B. Bangkok		C.I.F. Bangkok		USGC		NW Europe		Far East Asia	
		1994	1995	1994	1995	1994	1995	1994	1995	1994	1995
	June	997	1680	1100	2000	1135	1675	1200	1825	1045	1860
	July	1002	1805	1125	1750	1135	1675	1200	1775	1090	1625
	August	1043	1665	1200	1600	1185	1675	1200	1775	1225	1500
	September	1086	1324	1450	1450	1335	1675	1200	1800	1375	1250
	October	1201	1193	1500	1290	1410	1675	1325	1800	1450	1210
	November	1688	1083	1525	1290	1410	1675	1490	1265	1460	1200
	December	1586	1163	1455	1290	1410	1675	1490	1350	1375	1255
PVC	January	719	921	715	980	670	970	715	920	660	1015
	February	693	1011	725	1013	700	970	740	920	665	1030
	March	818	939	758	1030	720	988	740	975	710	1055
	April	814	924	758	1075	765	1020	790	1005	765	1120
	May	1079	919	819	1095	835	1015	845	1025	820	1085
	June	780	873	898	1163	895	903	915	1000	880	1000
	July	1032	935	920	1113	930	825	958	905	895	875
	August	622	942	923	1038	955	605	963	765	910	675
	September	970	728	933	838	975	510	975	675	945	615
	October	1046	597	993	788	1005	510	985	675	970	625
	November	**	599	980	818	1020	530	995	590	980	625
	December	984	630	980	818	1035	550	995	600	1000	655

** Data not available

ClF.Bangkok

LDPE = Average price of LLDPE (film) and LDPE (film)

HDPE = Average price of HDPE (film), (blwg) and HDPE (inj.)

PP = Average price of PP (yarn) ,(Inj.) and PP (cobol)

PS = Average price of PS (gpps) and PS (hips)

PVC=Average price of PVC (susp) and PVS (emuls)

Source: Derived from unpublished data of Plastic Industry Club. The Federation of Thailand Industry.

FOB Bangkok

Using hs-code for each product :

LDPE = 3901100005

HDPE = 3901200007

PP = 3902100000

PS = Average price of hs-code no. 3903110007 and 3903190004

ABS = 3903300004

PVC = 3904100001

Source: Customs Department, Ministry of Finance, Bangkok.

USGC, NW Europe and Far East Asia

LDPE = Average price of ldpe (gp)

HDPE = Average price of hdpe (inj.) and hdpe (bmldg)

PP = Average price of pp-homo and pp-cobol

PS = Average price of gp-ps and hi-ps

ABS = ABS

PVC = PVC (susp)

Source: Plastic Magazine 1994 and 1995 , Plastic Association.

Appendix 3: Petrochemical Product Imports to Thailand, 1989-1994, by quantity

		Quantity : '000 tor					
Commodity Code	Description	1989	1990	1991	1992	1993	1994
		Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
2901.210-001	Ethylene	118,832.0	55,196.9	91,876.7	83,967.1	92,731.0	142,488.0
2901.220-002	Propylene	9,232.5	123,391.3	143,091.1	176,103.9	181,185.8	224,212.4
3901.100-005	LDPE	25,787.0	44,400.2	37,894.7	55,360.2	60,668.9	94,706.0
3901.200-007	HDPE	66,956.5	55,115.1	40,496.2	48,226.1	39,724.7	64,865.0
3902.100-000	PP	100,541.2	118,379.5	31,513.3	47,600.9	36,420.0	32,035.0
3903.110-007	EPS	3,465.3	6,892.9	5,210.8	5,435.7	3,086.5	5,153.8
3903.300-004	ABS	14,669.6	23,308.0	23,155.4	29,303.1	29,505.9	41,728.7
3904.100-001	PVC	31,710.4	49,412.1	70,290.8	87,996.7	50,703.8	117,145.9

Source: Department of Customs, Bangkok.

Appendix 4: Petrochemical Product Exports from Thailand, 1989-1994, by quantity

		Quantity:'000 to					
Commodity Code	Description	1989 Quantity	1990 Quantity	1991 Quantity	1992 Quantity	1993 Quantity	1994 Quantity
2901.220-002	Propylene	0.0	0.0	0.0	0.0	0.0	0.0
3901.100-005	LDPE	273,932.3	374.3	2,148.7	1,330.0	4,533.0	2,259.2
3901.200-007	HDPE	2,564.4	10,923.5	28,692.4	593,579.2	380,290.3	23,469.8
3902.100-000	Polypropylene	5,307.5	4,054.3	48,852.3	6,286.7	6,161.1	39,183.3
3903.110-007	Expansible Polystyrene	20.5	131.1	843.4	571,500.0	956.8	2,530.9
3903.300-004	ABS-Copolymer	107.9	542.0	2,561.3	5,518.2	9,678.2	11,347.9
3904.100-001	PVC not Mixed with Other Substances	6,250.5	16,317.4	17,070.1	29,630.9	28,118.6	19,295.4

Source: Department of Customs, Bangkok.