CHEMICAL INDUSTRY GROWTH IN DEVELOPING COUNTRIES AND CHANGING U.S. TRADE PATTERNS

Report on Investigation No. 332-198 Under Section 332(b) of the Tariff Act of 1930

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David B. Rohr

Prepared principally by

Aimison Jonnard, Project Leader

David Michels

James Raftery

Robert Randall

Office of Industries

Erland H. Heginbotham, Director

Address all communications to
Kenneth R. Mason, Secretary to the Commission
United States International Trade Commission
Washington, DC 20436

Preface

On October 4, 1984, the United States International Trade Commission, pursuant to the provisions of section 332(b) of the Tariff Act of 1930 (19 U.S.C. 1332(b)), instituted investigation No. 332-198 on its own motion for the purpose of examining the expansion of the chemical industries in developing countries and changing U.S. chemical trade with these countries. Notice of the investigation was published in the October 17, 1984, issue of the Federal Register (49 F.R. 40676). Information for this report was obtained from Commission fieldwork, the U.S. Department of State and other Government agencies, publications, the Commission files, international organizations, the chemical industry, and other sources.

This report assembles and presents information and data on the changing competitive position of the United States and the developing nations in the world market for chemicals. The data on the 138 developing nations covered in this report are taken largely from United Nations statistical sources. In some instances, the latest data are for 1979; where possible, these data have been supplemented by information from other sources when available. However, for some developing nations no later data are available.

The study includes an analysis of factors that influence the competitive position of the chemical industry, such as demand, production, consumption, and trade. The report also makes a general assessment of future changes expected to occur in the chemical industries of developing countries and their possible effect on U.S. chemical trade.

The information and analysis in this report are for the purpose of this report only. Nothing in this report should be construed to indicate how the Commission would find in an investigation conducted under other statutory authority covering the same or similar matter.

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EXECUTIVE SUMMARY

The importance of the developing nations in the world's chemical and allied products industry is rapidly increasing, particularly in the petrochemicals area. Petrochemicals and their derivatives can be found in cars, clothes, food, pharmaceuticals, and other household items. In many of these applications they have largely replaced natural products. Because of the widespread diversity and use of petrochemicals, the development of a world-scale petrochemical industry has assumed a high degree of importance to some of the developing nations. The appeal of a world-scale petrochemical industry is greatest for those nations possessing large natural gas and crude petroleum reserves, because these materials are used by the petrochemical industry as sources of both energy and feedstocks. In addition, the expansion of petroleum refining capacity in many of these nations is providing a ready source for further energy and feedstock materials.

Within the last 2 or 3 years, an increasing number of conventional-energy-rich nations with low per capita petrochemical consumption have initiated programs to develop world-scale petrochemical industries on the basis of the export of as much as 90 percent of their domestic production. The announcements of these programs and the coming onstream of some of the initial facilities have been watched closely by many nations, including the United States, that historically have produced and traded in petrochemicals and their derivatives. The products of the new facilities are likely to be exported not only to nations to which traditional producer nations have historically exported but also to nations that have traditionally produced and exported petrochemicals and their derivatives. In fact, the expectation of increasing world capacity in petrochemicals has already brought about changes in the structure, product mix, and investment patterns of the chemical industries in many of the traditional producing nations.

The trend toward investment in the petrochemical industry in many of the energy-rich developing nations has been influenced by a number of factors. Revenues generated by crude petroleum exports and the crude petroleum price increases of 1973-74 and 1979-80 provided funds for such investment. In addition, many of these nations have sought to maximize revenues from their petroleum production and provide additional employment for their citizens. The recent crude petroleum price weakness resulting from the world surplus crude petroleum supply situation has also made diversification into derivatives more attractive to certain developing nations.

This study examines the expansion of the chemical and allied products industry in the developing countries and the outlook for U.S. chemical trade as a result of this development. The highlights of this study are as follows.

1. U.S. chemical trade trends and changes.

   - o U.S. chemical trade represented an increasing share of U.S. international trade during 1963-84 and has long been a strong positive component in the overall U.S. trade balance.

The U.S. chemical and allied products industry produces a complete range of intermediate chemicals as well as end-products such as fertilizer materials

and polymers, including plastics, synthetic fibers, and synthetic rubber. Petrochemicals, made from petroleum and natural gas, account for 75 percent of the value of chemicals production and 42 percent of the value of output of the entire chemical and allied products industry. The "allied products" portion of the industry accounts for more than 40 percent of the value of the whole and includes drugs and pharmaceuticals, agricultural chemical mixtures (fertilizers) and formulations (pesticides), cosmetics, detergents, paints and inks, adhesives, and many other products.

The petrochemical industry is composed of various sectors and can be thought of as situated between the feedstock industry and the petrochemical-dependent industries. It uses both natural gas and its components and petroleum products to produce primary and intermediate petrochemicals and petrochemical products, which in turn are used in the petrochemical-dependent industries to make such items as surface coatings, drugs, textiles, and fabricated rubber and plastics products.

Traditionally, chemical production capacity, and petrochemical production capacity in particular, was located primarily in the United States, Western Europe, and Japan. However, as petrochemical production capacity for these building-block petrochemicals comes onstream in certain developing nations, the shares of world trade and capacity held by the traditional producing areas are expected to decline. As this occurs, the U.S. chemical trade balance will become less favorable. The current strength of this trade is apparent in the following tabulation (in billions of dollars):

	U.S. exports	U.S. imports	Trade balance
1963----------	2.3	.5	1.8
1978----------	12.6	6.6	6.0
1980----------	22.5	8.6	13.9
1984----------	23.8	13.9	9.9

Chemicals have, over the period from 1963 to 1984, become more important as both a U.S. export item and a U.S. import item. The share of U.S. merchandise exports represented by chemicals grew from 8.4 percent in 1963 and 1972 to 8.9 percent in 1978 and 11.2 percent in 1984. U.S. imports of chemicals increased from 3.3 percent of the total value of all commodity imports in 1963 to 3.8 percent in 1978 and 4.3 percent in 1984.

The historical trend of petrochemical development in many developing nations was toward small production facilities to serve local markets. Despite large revenues generated by the increases in the price of crude petroleum during the past decade, local infrastructure and markets in most of the developing nations have not been able to support the development of large-scale petrochemical industries. Growth of infrastructure in these nations has been slow and extremely expensive, owing in part to the climatic conditions in many of these areas. This slow development has left many nations dependent upon imports of many petrochemicals and petrochemical products, even if some are manufactured internally, in order to satisfy their

increasingly diversified demand. For the first time, many of these nations are beginning to provide the bases upon which large, world-scale petrochemical industries may develop. It is the intent of many developing nations that these new petrochemical centers not only increase the flow of foreign exchange but also serve social goals, such as providing training and employment for their domestic labor force.

- o In 1984 the pattern of U.S. chemical exports to the developing nations differed from the pattern of U.S. production and reflected the particular requirements of the developing countries and the lack of local production.

The developing countries' purchases were concentrated in organic chemicals and intermediates, inorganic chemicals, polymeric materials, fertilizers, and pesticides. Purchases of drugs and pharmaceuticals; soaps, detergents, and cosmetics; and paints and other surface coatings tended to be lower relative to U.S. production levels. This purchase pattern indicates both the priorities and the needs of the developing countries and the lack of local production of certain of these products. It should be noted that production of chemicals and allied products in a typical developing country does not cover the gamut of products produced in more advanced countries. Many of the developing-country producers of chemicals, particularly those that are exploiting a particular natural resource, concentrate their efforts on only a few of the general categories tabulated below, usually those in which they have a raw material and/or an energy advantage.

The breakdown, by type of product manufactured in the United States in 1984, when shipments totaled $202 billion, compared with the pattern of U.S. exports to developing countries in 1984, when exports totaled $9 billion, is shown in the following tabulation (in percent):

	U.S. production	U.S. exports to developing countries
Organic chemicals and intermediates---	23.8	28.3
Inorganic chemicals----------	10.0	11.3
Plastics, other polymeric products----	17.0	20.0
Fertilizers----------	4.5	11.8
Drugs and pharmaceuticals----------	13.7	7.7
Soaps, detergents, cosmetics----------	13.5	4.6
Paints, surface coatings----------	5.5	-
Pesticides----------	2.5	5.6
Adhesives----------	1.8	.7
Explosives----------	.3	.7
Silvichemicals (rosin, etc.)----------	.3	.1
Miscellaneous----------	7.1	9.2
Total----------	100.0	100.0

- In 1984, U.S. chemical exports to developing nations constituted about 12 percent of all U.S. exports to these nations, but U.S. chemical imports from the developing nations constituted less than 1 percent of all U.S. imports from these nations.

For 1984, U.S. trade in chemicals with the major groups of trading partners, compared with all commodities, is shown in the following tabulation (in millions of dollars):

Trading partner group	Chemicals		All commodities	
	Exports	Imports	Exports	Imports
Developing countries	8,768	2,029	75,462	122,049
Developed countries	13,932	11,511	129,613	199,334
Nonmarket economies	1,051	402	6,982	4,343
Total	23,751	13,942	212,057	325,726

The above data for the developing countries include their exports of petroleum to the United States. Without these large U.S. petroleum imports included in the "all commodities" totals, U.S. chemical imports from the developing countries would be a far larger part of total U.S. imports from these nations.

In addition, although petrochemicals production is now the major category of U.S. chemicals output and trade, U.S. imports of petrochemicals from the Organization of Petroleum Exporting Countries (OPEC) developing-country producers of these products were only 2.6 percent of chemical imports in 1984 from all developing countries. In contrast, U.S. exports of chemicals to the OPEC countries were greater but still only a small percentage of the total--14.8 percent of total chemical exports to all developing countries. These small percentages merely indicate that production and exports of petrochemicals are still fairly widely spread among all the developing and developed countries. The petrochemical products from plants in the OPEC countries are still in the initial stages of their penetration of the world and U.S. chemical markets; their major impact is expected to occur in the late 1980s and early 1990s.

- In 1984, 92 percent of U.S. chemical exports to developing countries went to 31 countries, while 92 percent of U.S. chemical imports from developing countries were supplied by 14 countries.

In 1984, the value of U.S. chemical exports ranged from $56 million to Trinidad and Tobago to $1.29 billion to Mexico, and the value of chemical

imports ranged from $24 million from Yugoslavia to $523 million from Mexico. Only Mexico, Taiwan, Brazil, and the Republic of Korea (Korea) rank near the top of the lists as both export markets and import sources.

Examining regional trends, the eight East Asian developing nations are beginning to challenge the top eight Latin American countries as the leading foreign regional market for U.S. chemicals. This can be seen in a comparison of U.S. chemical exports in 1984 with 1980 and 1970 as shown in the following tabulation (in millions of dollars and in percent):

Region	1970	1980	1984	Percentage change in exports, 1984 over 1980
				Percent
Latin America--top 8 countries 1/	649	4,341	3,422	-21
East Asia--top 8 countries 2/	209	2,310	2,889	+25
East Asia as percent of Latin America	32	53	85	-

1/ In order, Mexico, Brazil, Venezuela, Colombia, Argentina, Chile, Peru, and Panama.

2/ In order, Taiwan, Korea, Hong Kong, Singapore, Indonesia, Philippines, Malaysia, and Thailand.

The 1984 U.S. chemical trade picture for all developing countries, by regions, is shown in the following tabulation (in millions of dollars):

	Exports	Imports	Trade balance
Mexico	1,286	523	+763
Caribbean and Central America	836	244	+592
South America	2,204	587	+1,617
Middle East	431	132	+299
South Asia	573	29	+544
East Asia	2,891	361	+2,530
Africa	269	15	+254
Europe	270	138	+132
Oceania	8	0.4	+7.6
Total	8,768	2,029	+6,739
(OPEC)	(1,297)	(52)	+1,245

During 1976-81, the average growth rate of chemical exports from developing countries was 21 percent per year. This was 1.4 times the growth rate of exports from the developed countries. Based on information on production, the developing countries' exports have probably maintained that edge.

2. Changes in the developing nations that have influenced world trade.

- o To direct and achieve goals in their industrialization plans, many of the developing countries have offered incentives for investment in favored industries; the chemical industry has usually been near the top of the list.

Incentives for investment vary from country to country, but the following are fairly typical:

--Low interest loans.
--Duty-free importation of equipment.
--Tax holidays.
--Accelerated depreciation for income tax purposes.
--Tax ceilings on taxable income.
--Incentive pricing of domestic raw materials to make them competitive with imported raw materials.
--State-financed research to aid local manufacturers with quality and operational problems.
--Reduced border taxes and import taxes and waiver of prior deposit on imports of raw materials and other non-equipment items.
--Rental of factories or land at concessional rates.
--Access to duty-free entry or entry at reduced duty levels for capital equipment and raw materials.
--Provision of credit to exporters on competitive terms.
--Export sales financing.
--Tax-free reserves allowed for foreign exchange and other export losses.
--Countertrade, including swaps of exports for nonrelated imports, has become increasingly employed, especially by countries with limited foreign exchange.

In the late 1970's and early 1980's, reduced investment by multinational companies seemed to make little difference because the non-petroleum-rich developing countries were able to meet their needs by borrowing from the recycled funds of petroleum-rich countries. Their aggregated borrowing from the private sector for all purposes increased from about $6 billion in 1973 to more than $60 billion in 1981, and their total debt increased from about $130 billion in 1973 to almost $700 billion at the beginning of 1984.

As the result of increasing concern about the ability of many of the non-petroleum-rich developing countries to manage the increased debt, additional private-sector loans to such countries have fallen rapidly and were less than $20 billion in 1983. The IMF has estimated that even if these developing nations can attract considerably more direct foreign investment in the next few years, such investment will still provide only about one-fifth of the foreign money needed by indebted developing countries. Recommendations of

the IMF to these countries, among other things, include that they reduce inflation and increase their efforts and policies to attract foreign investors. The same position has also apparently been reached, at least in general terms, by a number of the developing countries' leaders. However, a recent survey of large multinational companies suggests that incentives now in place can do little in the short term to boost the amount of direct investment these countries receive.

- o Many developing nations are again encouraging direct foreign investment, after previously encouraging and then discouraging such investment.

Industrialization of the developing countries 1/ has proceeded in several stages. First, until the early 1970's, multinational manufacturing companies, with chemical companies often leading the way, were investing in and building industrial plants in many of the developing countries principally to supply the local market. U.S. investment at that time was largely concentrated in Latin America. However, beginning in the early 1970's, some Latin American and other developing countries became increasingly restrictive with regard to direct foreign investment. These nations primarily were concerned about possible domination by owners of foreign industrial complexes and the prospects of having locally owned enterprises rendered economically noncompetitive or of having them acquired by the affiliates of the big multinational companies.

The next stage began when investment funds in the form of bank loans became more generally available in the 1970's largely as a result of the hundreds of billions of dollars of funds generated by the OPEC countries from sales of higher priced crude petroleum as well as from other sources. A large portion of such revenues was deposited in money center banks and lent to developing countries, including several OPEC countries. Many of these countries used these borrowed funds, with varying amounts of success, to invest in facilities for petrochemicals and related products and other manufacturing industries. By the mid-1980's, with the debt of developing countries exceeding $700 billion (about half of that in Latin America), and interest rates rising rapidly, many developing countries were having difficulties with debt repayment schedules. Additional loans as a source of investable funds have now been largely curtailed.

The fourth stage may be underway currently. Developing countries are again encouraging direct foreign investment but this time with fewer restrictions than in the past. This trend has been encouraged by the International Monetary Fund's recommendation that indebted developing countries increase their efforts to attract foreign investors. Some Middle East and East Asian countries have consistently welcomed and encouraged foreign investment with incentives.

1/ For purposes of this report there are 138 developing nations; see pp. 2-4 of the report for the actual listing.

Some Governments and government-owned natural resource companies in developing countries are able to attract private sector companies by offering import protection, subsidies, tax preferences, below-market loans, and raw materials or feedstocks at less than world prices.

- o Export promotion has replaced import substitution in many of the developing nations as the dominant trade policy.

Trade policies of many developing countries have likewise changed over the years. A few developing countries, particularly those in the Middle East and East Asia, have, from the beginning, industrialized with exports in mind. From the 1950's to the mid-1970's, import substitution was, however, the dominant theme among developing nations, and production facilities were scaled and protected to accomplish that end. In more recent years, as a result of debt-management problems and the imposition on certain developing countries of conditions making them eligible for aid from the International Monetary Fund, export promotion gained priority in their trade policy. The problem was that for many chemicals, especially petrochemicals, plants in all but the largest countries were built primarily for import substitution and were often of less than optimal size for economic operation. They produce products that are not cost-competitive with potential imports made in larger, newer foreign plants. They require import protection, incentives, or other government assistance to stay in business.

For certain developing nations that have published their chemical development plans, the following tabulation shows production capacity for key primary petrochemicals as a share of total world petrochemical-production capacity for these petrochemicals in 1980 and as a likely possibility in 1990 (in percent):

Country	Ethylene		Ammonia		Methanol	
	1980	1990	1980	1990	1980	1990
Saudi Arabia	1/	2	1/	1/	2	4
Indonesia	1	1	1	2	1	1
Kuwait	1/	1	1	1	1/	1
Mexico	1	2	2	4	1	4
Total	2	6	4	7	4	10

1/ Less than 0.5 percent.

3. Developed nation assistance to developing nations.

   o Trade and assistance programs offered to developing countries by the United States and other developed countries are intended to aid the developing countries to achieve industrial development and the ability to earn enough from exports to pay for needed imports and meet their debt obligations.

Included in these trade and assistance programs are the following:

--Trade preferences: The unilateral tariff reductions granted by the United States and other developed countries.
--World organizations: The World Bank lends most of its money for technological projects that enable an assisted country to increase its exports. It, like the United Nations Industrial Development Organization (UNIDO), also provides technical assistance. The complementary International Monetary Fund provides shorter-term balance-of-payment loans conditioned on agreement to increase exports.
--Regional development banks: The banks make loans on both conventional and concessional terms.

In chemicals and allied products, the developed countries, in the aggregate, have provided financial aid, loans, technology, and the preferential trading systems to enable the developing nations to increase exports to obtain funds to pay for imports. Also important have been the efforts of the chemicals producers themselves in developing countries. During 1960-79, the average annual 16.2 percent growth rate of chemicals production in developing countries was 1.45 times its annual growth rate in the developed countries. Since 1979, it is believed (in light of the known petrochemical plant shutdowns in developed countries and the accelerated construction and startups of such plants in developing countries) that the developing countries have maintained a faster growth in both exports and production of chemicals than have the developed nations. The areas in which petrochemical production has grown fastest are the Middle East and East Asia. The slowest growth has been in Africa and South Asia.

However, in spite of the fast growth of production and exports, the value of the chemical imports needed to satisfy consumption in the developing countries in 1979 was equal to almost half the value of their chemical production. The developed countries supplied most of the required imports.

4. The change in the position of the United States chemical industry in relation to the world's chemical industry.

   o Chemical trade between the United States and developing nations changed significantly between 1978 and 1984, as the share of total U.S. chemical exports going to developing countries tended to decrease while the import share from developing countries increased.

U.S. exports of chemicals to developing countries were about 40 percent of such exports to all countries during 1978-79. This percentage declined to about 37 percent during 1982-84, as many of the developing countries decreased their imports from the United States both in response to their economic problems and the high value of the U.S. dollar. This latter factor tended to make U.S. exports more expensive than those of other world suppliers. U.S. imports from developing countries were far less than exports but were a rapidly growing portion of total chemical imports--9.4 percent of total chemical imports in 1978 and 14.5 percent in 1984, as shown in the following tabulation:

Source	U.S. trade in chemicals with developing countries		
	1978	1980	1984
U.S. exports to developing nations			
billion dollars	4.99	9.58	8.77
Percent of total chemical exports	40	43	37
U.S. imports from developing nations			
billion dollars	0.61	0.88	2.03
Percent of total chemical imports	9	10	15

During 1978-84, U.S. exports to developing countries almost doubled in the first 2 years from $4.99 billion to $9.58 billion, then declined 8 percent to $8.77 billion in the next 4 years. U.S. imports from developing countries took 4 years to increase from $610 million to $1.04 billion, then almost doubled in the final 2 years to $2.03 billion in response to the recovery of the United States from its recession and the rise in value of the U.S. dollar.

- o The world is in the process of leaving an era of three decades during which the United States was the cost-competitive leader in petrochemicals. It is entering a new era in which Saudi Arabia and other energy-rich nations are in a position to exploit their own competitive positions in these feedstocks. For these reasons it is probable that past patterns of international petrochemical trade may change significantly in the next decade.

The U.S. balance of trade in chemicals and allied products, which peaked in 1980 at $13.9 billion (or $12.2 billion, depending on the chemical classification system that is employed) after many years of growth, has begun to decline and may continue to be eroded by the growing petrochemical industries of developing countries, which are bringing more plant capacity onstream. The impact of these industries in the developing countries may not

come so much from their penetration of the U.S. domestic market as they will from their displacement of U.S. exports of petrochemicals, which currently are nearly half of all U.S. exports of chemicals and allied products.

One of the Commission's recent studies on petrochemicals projects that the U.S. trade balance in (commodity and specialty) petrochemicals will decline from $10 billion in 1980 to only $1.6 billion in 1990 (in 1980 dollars) according to the base case scenario. Various projections for specific major petrochemicals made in both Commission and industry studies are summarized in the following paragraphs.

For ethylene, which is produced from both petrochemical and natural gas and is the largest volume petrochemical, production in developing countries in 1980 was 9 percent of that in the developed countries; by 1990 this figure is projected to grow to about 22 percent. For methanol, which is produced from natural gas, 1980 production in developing countries was 14 percent of that in developed countries. Plant capacity for methanol in developing countries has been projected to be 43 percent of that in the developed countries by 1990. Neither production nor consumption of methanol in 1990 can be reliably forecasted, however, because of the uncertainty about its use in gasoline. For polyethylene, which is produced from ethylene and accounts for more than half of the ethylene produced, the scheduled increase in production capacity in developing countries is 21 percent during 1983-89, or almost double what it is projected to be in the developed countries. The Middle Eastern countries, which had about 1 percent of the world's ethylene capacity in 1983, are expected, based on published construction plans, to have more than 4 percent by 1989, or 1.20 million metric tons in the latter year.

In fertilizers, developing countries have increased their consumption from 9 percent of the world total in 1965 to 20 percent at the present time and are projected to continue to increase consumption by 6 percent per year to the year 2,000 (to one-third of world consumption). The growth in fertilizer consumption in developed countries is estimated at 2.3 percent per year from the present to the year 2000. The developing countries, exploiting their natural resources, are increasingly penetrating the world market for fertilizers. Their advantages are based, at least in part, on the world's largest reserves of phosphate rock in the Middle East and North Africa, as well as large reserves of potash in the Dead Sea and low-cost natural gas from which to make ammonia for nitrogenous fertilizers. It is projected that by the year 2000 about 200 new world-scale fertilizer plants, costing $66 billion in 1984 dollars, will be required to meet demand. Assuming that funds are available, most of the new plants may be built in developing countries because of the growing internal markets and natural resources. In the United States, it is projected that the Florida phosphate rock industry will be rapidly depleting its existing mines by the early 1990's. Also, the United States has already depleted most of its competitive potash reserves and may be unable to compete economically with the nitrogenous fertilizer industries in developing countries, particularly if natural gas is completely decontrolled.

INTRODUCTION

At present, the production of chemicals is centered in the industrialized nations of the world. Leading international producers are the United States, the European Community (EC), and Japan. However, energy-rich developing nations are beginning to assume a role in the production of chemicals, particularly certain petrochemicals. These nations have a competitive advantage in the production of petrochemicals, which are highly energy intensive, because of relatively assured supplies of crude petroleum and natural gas at prices below world levels. In addition, the trend toward investment in the petrochemical industries in certain developing nations has been fostered by the availability in these nations of investment funds generated by their crude petroleum exports and the crude petroleum price increases of 1973-74 and 1979-80; their desire to market value-added products of crude petroleum and natural gas; and the recent crude petroleum price weakness, which has made diversification into derivatives even more attractive.

When crude petroleum is extracted from the ground, associated natural gas is often obtained. In the past, this natural gas was, and in some cases still is, flared, (burned in the atmosphere) without regard to economic value. Flaring takes place because it was not, and often still is not, economically efficient to capture and sell or utilize the natural gas--unlike the crude petroleum, which is primarily exported. The flaring of natural gas has been practiced extensively by many nations, particularly those in the Persian Gulf. These nations have had little or no internal use for the natural gas, and to transport it overseas to nations such as Japan and the United States entails considerable expenditure for a collection network, liquefaction plants, and special tanker vessels. However, natural gas and its components, such as methane and ethane, can be used as feedstocks to produce such petrochemicals as ammonia and ethylene. The natural gas and petroleum can also be used as sources of the energy required to convert the feedstocks to petrochemicals. Many of the petrochemicals, which are "valued-added higher order" forms of natural gas and its components, can be readily shipped around the world to many markets, including developing as well as developed nations.

Some U.S. companies have invested in petrochemical facilities in the Persian Gulf nations. Many of the developing nations diversifying into petrochemicals have recognized that they are deficient in one or more business areas, such as marketing, management, and technology, and have assumed joint-venture partners noted for their expertise in one or more of these areas. Saudi Arabia has followed this approach, and the Government-owned Saudi Basic Industries Corporation (SABIC) has entered into joint ventures with five U.S. companies. The U.S. companies have often obtained crude petroleum supply agreements and other incentives; some plan to close U.S. production facilities and import the lower cost joint-venture output for future upgrading in U.S. facilities.

It is probable that the U.S. petrochemical industry will change in response to increasing market competition from products made in the new petrochemical facilities coming on stream in many of the developing countries. The extent to which it will change will depend upon many factors.

In general, however, industry observers believe that the U.S. petrochemical industry should remain viable, although possibly in a changed form, and that demand for petrochemicals will not decline to any significant extent by 1990 due to reduced consumption or use of substitutes.

Chemical Products and Classification

The chemical industry has changed greatly during the past four decades. Petrochemicals production, which now is about three-fourths of the value of all chemicals production (i.e., not including the allied products portion of the industry), was very small at the beginning of World War II. Products now made from petroleum and natural gas were then made from coal and agricultural products. Synthetic rubber, synthetic fibers, pesticides, most medicinal chemicals, and the leading plastics and detergents of today either had not been developed or were at an early stage of development or commercialization. Three-quarters of today's commercial chemicals and products were not produced in 1950. 1/ Until the late 1950's and 1960's, the industry was generally secretive and unwilling to license its technology. This stimulated foreign direct investment by the leading chemical companies. Until the late 1970's, industry production doubled in magnitude in real terms every 7 to 10 years.

Today the industry is generally regarded as mature. Introductions of major new products are fewer than in the past. Growth has slowed to considerably less than double GNP growth. Plastics and synthetic fibers, for example, have already replaced so much wood, paper, metals, cotton, glass, and other "natural" materials that further penetration of these markets in the future is believed limited.

The chemical and allied products industry, usually referred to as the chemical industry, is best defined by consideration of the products actually produced by chemical companies and by allied products companies that use chemicals to make consumer products and end-user products including pharmaceuticals, cosmetics, paints and other surface coatings, detergents, fertilizers, printing ink, explosives, adhesives, pesticides, and others. Many of the latter products are also made by the chemical companies.

The industry is well defined by the coverage of group 28 in the U.S. Standard Industrial Classification system (SIC). The products in group 28, along with a few mineral products classified in other SIC groups, and their relative importance in the United States are shown in table 1. In general,

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1/ The Economist, Feb. 16, 1985, p. 25.

Table 1.--Chemicals and allied products: U.S. product shipments, 1983-84

(In billions of dollars)

Items	1983	1984 1/
Chemicals:		
Mineral chemicals (not SIC 28)	3.3	3.6
Inorganic chemicals including pigments, industrial gases, and radioactive materials	18.8	20.5
Organic chemicals, including dyes and organic pigments	40.5	47.3
Nitrogenous and phosphatic fertilizers	5.8	6.9
Plastics materials and synthetic resins	19.3	21.3
Synthetic rubber	3.4	3.7
Surface-active agents	1.9	1.9
Synthetic fibers	7.7	8.2
Cellulosic man-made fibers	1.2	1.4
Gum and wood chemicals	.7	.8
Carbon black	.7	.8
Fatty acids	.4	.4
Total	103.7	116.8
Petrochemicals included in above	(77.0)	(87.4)
Allied products:		
Mixed fertilizers	2.1	2.3
Pesticide formulations	4.4	5.0
Drugs and pharmaceuticals	25.0	27.9
Paint, varnish, lacquer, and related products	9.7	11.1
Adhesives and sealants	3.2	3.7
Soaps, cleaners, detergents, cosmetics, toiletries, and essential oils	25.9	27.1
Explosives	.6	.7
Printing ink	1.6	1.8
Miscellaneous chemical products	5.9	6.5
Total	78.4	80.1
Grand total	182.1	202.9

1/ Projected from data for the first 8 months of the year.

Source: U.S. Department of Commerce, Industrial Outlook, 1985, and estimates of the U.S. International Trade Commission staff.

this study follows the SIC classification system with the addition of certain minerals which are mainly the source of chemicals. 1/

Developing Countries Defined

There is no clear-cut distinction between developed and developing countries. In general, developed countries are the more wealthy ones with mature economies, including all or most of the countries of Western Europe, the United States, Canada, Japan, Australia, and New Zealand. A number of countries are borderline cases, classified differently by the United States and such organizations as the United Nations (UN), the World Bank, and the International Monetary Fund (IMF). Countries listed as developed by some of these organizations but developing by others include Portugal, Yugoslavia, Turkey, Greece, Israel, and South Africa. Other countries, such as the Republic of Korea (Korea) and Taiwan--the so-called newly industrialized countries (NICs)--are approaching the borderline. 2/

Compilation of a definitive list of developing countries is complicated by questions about the status of nonindependent countries and territories--e.g., Hong Kong--which are essentially indistinguishable from independent countries in the context of foreign trade. Also, several U.S. laws, such as legislation providing for the Generalized System of Preference (GSP) and the Caribbean Basin Economic Recovery Act, include nonindependent countries and territories in developing-country lists.

This study deals mainly with the 114 independent developing countries that are designated as beneficiary countries under the GSP and Caribbean Basin legislation, listed in table 2, plus 24 additional developing countries and territories, as follows:

1/ The trade statistics in this report are based on articles in SITC group 5 plus, unless otherwise noted, synthetic rubber, synthetic fibers, certain fertilizer materials (mainly phosphate rock), sulfur, and salt. The latter are taken from SITC group 2. In most years these SITC 2 products add somewhat less than 6 percent to the SITC 5 totals. Excluding the synthetic fibers, the SITC figures are within 4 percent of the TSUS and Schedule B totals for U.S. imports and U.S. exports (schedule 4). (For the convenience of analysts, the Department of Commerce publishes Schedule E statistics for exports and Schedule A statistics for imports; both of these categories are essentially the same as the SITC statistics. However, although Schedule E totals differed by only 0.2 percent from SITC totals in 1984, the difference was almost 8 percent for the 1980 numbers.)

2/ The World Bank list of NIC's in 1982 included Argentina, Brazil, Greece, Hong Kong, Israel, Korea, Portugal, Singapore, South Africa, and Yugoslavia. At that time the IMF classified Spain as a developed country. This information is from IMF's Occasional Paper No. 12, August 1982, p. 18.

See app. A for glossary/acronyms.

Table 2.--Independent country beneficiaries of the U.S. Generalized System of Preferences

Country 1/	Country 1/	Country 1/
Angola	Guinea	Portugal
Antigua and Barbuda	Guinea Bissau	Romania
Argentina	Guyana	Rwanda
Bahamas	Haiti	Saint Lucia
Bahrain	Honduras	Saint Vincent and the Grenadines
Bangladesh	India	
Barbados	Indonesia	Sao Tome and Principe
Belize	Israel	Senegal
Benin	Ivory Coast	Seychelles
Bhutan	Jamaica	Sierra Leone
Bolivia	Jordan	Singapore
Botswana	Kenya	Solomon Islands
Brazil	Kiribati	Somalia
Brunei Darussalam	Republic of Korea	Sri Lanka
Burkina Faso	Lebanon	Sudan
Burma	Lesotho	Suriname
Burundi	Liberia	Swaziland
Cameroon	Madagascar	Syria
Cape Verde	Malawi	Taiwan
Central African Republic	Malaysia	Tanzania
Chad	Maldives	Thailand
Chile	Mali	Togo
Colombia	Malta	Tonga
Comoros	Mauritania	Trinidad and Tobago
Congo	Mauritius	Tunisia
Costa Rica	Mexico	Turkey
Cyprus	Morocco	Tuvalu
Djibouti	Mozambique	Uganda
Dominica	Nauru	Uruguay
Dominican Republic	Nepal	Vanuatu
Ecuador	Nicaragua	Venezuela
Egypt	Niger	Western Samoa
El Salvador	Oman	Yemen Arab Republic (Sanaa)
Equatorial Guinea	Pakistan	
Fiji	Panama	Yugoslavia
Gambia	Papua New Guinea	Zaire
Ghana	Paraguay	Zambia
Grenada	Peru	Zimbabwe
Guatemala	Philippines	

1/ Pursuant to section 4(b)(1) of the Taiwan Relations Act (22 U.S.C. 3303(b)(1)), the reference to countries includes Taiwan.

Source: U.S. International Trade Commission, Tariff Schedules of the United States Annotated (1985), suppl. 2, p. 3.

Certain Organization of Petroleum Exporting Countries (OPEC)

Algeria	Nigeria
Gabon	Kuwait
Iran	Qatar
Iraq	Saudi Arabia
Libya	United Arab Emirates

Certain Caribbean Basin Initiative (CBI) beneficiaries

British Virgin Islands
Montserrat
Netherlands Antilles
Saint Christopher-Nevis

Other developing countries and territories

Bermuda	Hong Kong
Ethiopia	Macao
Falkland Islands	New Caledonia
French Guiana	Reunion
French West Indies (Guadalupe and Martinique)	Yemen (Aden)

For purposes of comparison and analysis, the developing countries and territories of the world are subdivided regionally and compared with the United States, other developed countries, and nonmarket economies (NME) as indicated in the following tabulation:

	Number
Developed countries	22
Developing countries and territories	138
Mexico and South America	15
Caribbean and Central America	24
Middle East	14
South Asia	8
East Asia	9
Africa (excluding South Africa)	51
Europe	6
Oceania	11
Nonmarket economy and other countries	15
Total	175

CHEMICAL INDUSTRIES OF DEVELOPING COUNTRIES

Industrial History

With the exception of countries located in Central and South America, most of the developing countries covered in this study were either European colonies or existed in different form prior to World War II. Most of the former European colonies gained their independence in the 1950's and 1960's (see app. C for dates). Since then their economic progress for the most part has been rapid, but some have been more successful than others. As a group, their combined gross domestic product of about $2.3 trillion in 1982 was more than three-fourths of that of the United States. 1/

After World War II, most of the developing countries, aided by developed countries, began or intensified efforts to industrialize their economies. One method involved investment in industrial plants by U.S. and other multinational companies. Because of historic ties and proximity to Central and South America, most of the initial U.S. foreign direct investment in developing countries was concentrated in those countries 2/ as shown in the following tabulation (in billions of dollars):

Source	1950 book value	1970 book value
Developed countries	5.7	53.2
Latin America	4.4	14.7
Middle East	-	2.0
Other developing countries	-	4.6
Unallocated	1.7	3.6
Total	11.8	78.1

In contrast, European and Japanese companies invested mostly in their former colonies and nearby countries in Asia and Africa. Such investment brought them technology, capital funds, and management skills. U.S. chemical companies made larger foreign investments in the 1960's than other U.S. manufacturing industries. 3/ By the early 1970's, however, the annual level of new investment by multinational companies had peaked and, in fact, some foreign countries, especially those of Latin America, began to restrict additional investment. The presence of the multinational firms was often seen as a threat to local competition and the local political and social framework. 2/ Also by that time, technology had become a commodity that, together

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1/ Based on statistics of the World Book, International Monetary Fund, the United Nations, and estimates of the staff of the U.S. International Trade Commission.

2/ United States Senate, "Implications of Multinational Firms for World Trade and Investment and for U.S. Trade and Labor," February 1973. This study was performed by the U.S. International Trade Commission (then the U.S. Tariff Commission).

3/ Ibid., p. 106

4/ "The World Chemical Economy," Chemical and Engineering News, Apr. 16, 1973, pp. 32-35.

with the ability to learn or hire industrial skills, was readily available on the world market. Most important, large new sources of capital funds became available from the energy-rich countries and other sources.

The nationalization of petroleum resources by the OPEC 1/ countries and increases in crude petroleum prices generated surplus funds by those countries, which accumulated to $251 billion in 1979 and peaked at $413 billion in 1982. 2/ Much of this money, so-called petrodollars, was invested in money-center banks and portfolio investments in the developed countries. Recycling of these funds posed a major problem for the banks. The banks loaned a significant amount of the funds to the developing countries to pay for industrial investment and pay for petroleum imports. 3/ By 1983-84, however, OPEC's current-account balance had become negative, and many of the developing countries were having difficulty meeting their debt obligations. As a consequence, a number of the developing nations have reportedly been rethinking their opposition to or limitations on investment by multinational companies. 4/

During these years, many of the developing countries also received direct financial aid from the United States and other developed countries, and indirect aid through the World Bank, IMF, and regional development banks. 5/

Latin America

During the 1960's and 1970's, Latin America economies grew at a rate that substantially exceeded the 2.5 percent annual increase in per-capita income established as a goal in the Alliance for Progress. 6/ During those 2 decades, Latin America's gross domestic product, expressed in 1982 dollars of constant value, more than tripled, going from less than $200 billion in 1960 to $618 billion in 1981. The following years, however, from 1981 to 1984, "ushered in the most acute, prolonged, and widespread economic crisis that the region had experienced since the 1930s." 7/ With debt interest payments of $40 billion in 1983--5 times what they were in 1977--most of the countries of the region made efforts to realign their economies, moving toward an expansion of exports and a curbing of imports. 8/ Prior to this time, the Latin American

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1/ Abbreviations are explained in the glossary at the end of the report.

2/ Economic Observer, Chase Manhattan Bank, September/October 1984.

3/ The Wall Street Journal, Nov. 20, 1984, p. 31; The Economist, July 6, 1985, p. 17.

4/ Business Week, Aug. 27, 1984, pp. 48-56.

5/ During 1980-83, net flows of capital to all developing countries averaged about $100 billion per year from the following sources: 35 percent from official development assistance, 21 percent from official nonconcessional lending, 12 percent from direct foreign investment, 30 percent from commercial bank lending, and 2 percent from other sources. See "Lending Debtors A Helping Hand," The Economist, July 6, 1985, p. 70.

6/ A special report prepared by the Inter-American Development Bank and published as a supplement to the Washington Post, Mar. 17, 1985, p. IDB5.

7/ Ibid.

8/ The Wall Street Journal, Mar. 26, 1984, p. 1, Chemical Week, June 20, 1984, p. 53.

countries' manufacturing plants were mostly intended for import substitution, with only minor emphasis on export promotion. As noted above, some countries decided to give more encouragement to direct foreign investment.

Africa

Economic growth in many of the 51 developing African countries has been handicapped by rapid population growth, declining real prices for many important commodity exports, droughts, civil unrest, lack of investment capital, and other problems. Many of the countries are geographically small and landlocked. Of the world's 36 poorest countries, 29 are to be found south of the Sahara Desert. 1/ During the decade of the 1970's, a time of boom for many, average annual per-capita income of the 46 sub-Saharan countries was $441, and for the low-income countries it was much less. Food production per capita declined 10 percent. During 1980-84, the growth of GDP was about zero. African economic problems have been viewed as a "production crisis....which has arisen from the widespread adoption of structures of prices and incomes which have provided inappropriate production incentives." In addition, there are inherent difficulties in that "Africa is diverse and vast....a region of Balkanized economies almost all with very limited internal markets, with unbalanced resource bases which can often only be linked by very high-cost transport." 2/ The barriers to foreign investment can be formidable. 3/ The U.S. Government has stressed that "the U.S. private sector can be a powerful tool in Africa's development by providing capital and productive know-how for self-sustaining growth....(and the Government) is working to facilitate that process through a network of bilateral investment treaties with selected countries." 4/

Middle East

This region consists of six OPEC member countries and eight others. As described in recent United States International Trade Commission studies on petrochemicals, 5/ and borne out by subsequent events, most of these

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1/ The Washington Post, Dec. 23, 1984, p. A18; The Washington Post, Dec. 31, 1984, p. A12; Department of State Bulletin, March 1985, p. 23-26; and "Changing Course; Africa's New Leaders Are Trying to Right Past Wrongs," The Wall Street Journal, July 18, 1985, pp. 1 and 15.

2/ Department of State Bulletin, May 1984, p. 43.

3/ The Washington Post, Dec. 23, 1984, p. A18, and The Washington Post, Dec. 31, 1984, p. A12.

4/ Business America, Aug. 20, 1984, p. 34.

5/ U.S. International Trade Commission, The Probable Impact on the U.S. Petrochemical Industry of the Expanding Petrochemical Industries in the Conventional-Energy-Rich Nations, USITC Pub. 1370, April 1983, and The Shift from U.S. Production of Commodity Petrochemical to Value-Added Specialty Chemical Products and the Possible Impact on U.S. Trade, USITC Pub. 1677, April 1985, and Potential Effects of Foreign Governments' Policies of Pricing Natural Resources, USITC Pub. 1696, May 1985.

countries, directly and indirectly, have benefited from the petroleum riches of their region. Although they have been running a negative current account balance since 1983, they continue to make substantial investments in their infrastructure and petroleum-refining, petrochemical, and other energy-intensive industries.

South Asia

The region that stretches from India and Pakistan to Burma has had moderate industrial growth and a generally low GNP per capita that, in 1981, ranged from $140 in Bangladesh to $350 in Pakistan. 1/ India has about three-fourths of this region's population and GDP. In 1960, India's GDP was considerably larger than the combined GDP's of the next two developing countries in size--Brazil and Argentina--and it was larger than the GSP of all of developing Africa, the GDP of the Middle East, or the GDP of the nine countries of East Asia. However, by 1982, the GDP of India ranked third after those of Brazil and Mexico, was less than half the GDP of the Middle East, and was less than half the GDP of the nine countries of East Asia. To improve its economic condition, India, as described in later sections of this report, has announced a program aimed at reducing Government obstructions to industrial investment, "unshackling the private sector," and stimulating economic growth.

East Asia

Since the end of the Vietnam War, the economies of the six members of the Association of South East Asian Nations (ASEAN, formed in 1967, includes Brunei, Indonesia, Malaysia, the Philippines, Singapore, and Thailand) plus Korea, Taiwan, and Hong Kong have been growing faster in real terms than those of any other developing region or developed countries, such as Japan or the United States. 2/ Their average growth rate was 6.8 percent in 1981, 3.6 percent in 1982, and 5.3 percent in 1983. In 1982, their GNP per capita ranged from $580 in Indonesia to $5,740 in Singapore. Their total population equals that of all of North America. The economic success of this group of countries has been attributed to their free-enterprise philosophies, skilled work forces, and pragmatic economic policies, including major emphasis on export promotion. 3/ Some of them benefit from raw materials such as petroleum, natural rubber, and tin and other metals. Although the Philippines has been experiencing problems, the region generally has remained politically stable, even with changes in leadership. Most of these nine countries have been very receptive to foreign investment, which has come in large amounts from Japan as well as from the United States and Western Europe. The managing director of the IMF has cited their success in using foreign investment as an alternative to aid or borrowing. 4/

1/ World Bank.

2/ Yearbook of U.S.-Japan Economic Relations in 1983, October 1984, pp. 15-16.

3/ U.S. Department of Commerce, Business America, Nov. 28, 1983, p. 3; The Economist, Aug. 4, 1984, p. 12; and The Economist, Jan. 19, 1985, p. 67.

4/ Wall Street Journal, Jan. 21, 1985.

Industry Growth

Table 3 shows the growth in production of chemicals from 1960 to 1979. Industry sources attribute the rapid growth in chemicals by the developing countries to technology transfer, finance, trade preferences, and other assistance supplied by the developed countries, as well as to the resources and efforts of the developing countries themselves. Chemical production in the developing countries grew 50 percent faster than chemical production in the developed countries during the 20 years 1960-79. During 1960-65, the growth rate of developing countries in chemicals averaged 12.8 percent per year while that for developed countries was 8.2 percent per year. During 1965-79, these same growth rates were 17.6 percent and 12.2 percent, respectively. The apparent faster growth in the latter years is not real but rather the result of inflation brought on by higher prices of fuel and petrochemical feedstock after the OPEC countries implemented large price increases on crude petroleum exports in 1974 and 1979. Additional evidence of growth of the developing countries' chemical industries is that their value of production increased from 7 percent of that of the developed countries' in 1960 to more than 16 percent as large in 1979.

Quantitative data are incomplete, but the record of much slower growth since 1979 in the developed countries, including the closing of some chemical plants in Western Europe, Japan, and the United States in more recent years, is in contrast to continued growth in production and construction of new chemical plants in the developing countries. As pointed out in a recent U.S. International Trade Commission report on petrochemicals, 1/ Japan reduced its petrochemical capacity by about 25 percent between 1982 and 1985 (capacity peaked in 1982); Western Europe reduced its ethylene capacity by 21 percent (more than 3 million tons per year) during 1979-83, and reduced its capacity for other large-scale petrochemicals by 12-19 percent during those years; and the United States reduced its ethylene capacity by about 10 percent (more than 1 million tons per year) during 1982-84. In contrast, during 1982-86, the developing countries added or are in the process of adding 8 million metric tons of ammonia capacity (compared with 3.2 million tons by the developed countries), and 1.2 million metric tons of methanol capacity (compared with 1.0 million tons, in one developed country). 2/ In ethylene, the developing countries are in the process of adding more than 9 million metric tons per year of new capacity compared with 3 million tons per year in the developed countries (Canada, Australia). 3/ It is probably only a matter of time before the United States and other developed nations, the world's largest exporters

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1/ U.S. International Trade Commission, The Shift from U.S. Production of Commodity Petrochemicals to Value-Added Specialty Products and the Possible Impact on U.S. Trade, USITC Pub. 1677, April 1985, pp. 25, 27, 31, 49, 50, and 56; and "The Petrochemical Industry: An Unfinished Adjustment Process," OECD Observer, March 1985, pp. 6-10.

2/ Ibid.

3/ R. Dodge, DeWitt and Co., "Ethylene and Co-products, Supply and Trade Shifts," Chemical Marketing Research Association presentation, March 1985. Also "Ethylene Plants: Their Fortunes Are Improving, Slowly," Chemical Week, June 19, 1985, pp. 36-39.

Table 3.--Chemicals: Growth in world production, by regions, 1960, 1965, and 1979

Region	Production			Percent-per-year change in growth rate	
	1960	1965	1979	1960-65	1965-79
	-----Million dollars------				
Total developed countries--	59,053	87,452	435,000	8.2	12.2
Developing countries:					
Latin America and the Caribbean	2,110	3,360	26,917	9.8	16.1
Middle East	113	207	5,370	13.0	26.5
Africa	330	580	2,833	12.1	12.0
South Asia	609	1,159	5,897	14.0	12.3
East Asia	271	546	12,880	15.2	25.7
Oceania	-	-	30	-	-
Europe 1/	610	1,478	17,269	19.4	19.4
Total developing countries	4,043	7,330	71,196	12.8	17.6
Total market economies plus Romania and Yugoslavia	63,096	94,782	506,196	8.5	13.7
Total nonmarket economies 2/	9,185	17,310	3/	15.6	3/
Total world 2/	72,281	112,092	3/	9.0	-

1/ Romania, Yugoslavia, Turkey, Portugal, Malta, and Cyprus.
2/ Excluding China but including Vietnam.
3/ Not available.

Source: United Nations Industrial Development Organization, International Symposium on Industrial Development, (chemical industry study (ID/CONF. 1/25)), Athens, November-December 1967, pp. 1-2, (Annex); and table 5 of this report.

of the major petrochemicals, find their exports greatly diminished or even become net importers of those chemicals and products. 1/ A recent comprehensive listing of major worldwide petrochemical construction projects that have been recently completed, are under construction, or are still in the planning and design phase, describes 135 projects for developing countries compared with 54 in developed countries and 39 in nonmarket-economy countries. Table 4 gives some country-by-country details of these petrochemical projects.

Foreign Trade by Developing Countries

Foreign trade has always been important to the developing countries. The latest trend, however, is to stress exports more than has been done in the past. Imports have continually been of importance as a source of materials and items not produced in the developing nations.

Table 5 (and app. B) shows world production, trade, and apparent consumption of chemicals in 1979. 2/ (More recent data are unavailable for many countries.) While exports exceeded imports by $27 billion in the developed countries in 1979, imports were $24 billion more than exports in the developing countries. The latter group's imports were about 40 percent of their value of production, and nearly four times their value of exports. Whereas imports of the developing countries were 37 percent of those of the developed countries, the former's exports were only 7 percent of those of the developed countries.

All products

Exports of the developing countries grew from $44 billion in 1965 to $498 billion in 1980. In the 15-year period, the proportions of manufactures and fuels have grown to exceed those for agricultural products and minerals, as shown in the following tabulation (in percent of total):

1/ U.S. International Trade Commission, The Shift from U.S. Production of Commodity Petrochemicals to Value-Added Specialty Products and the Possible Impact on U.S. Trade, USITC Pub. 1677, April 1985, pp. 25, 27, 31, 49, 50, and 56.

2/ See app. B for country details.

Table 4.--Petrochemicals: Major worldwide construction projects, by countries, as of October 1984

Country	Projects
India	24
China	19
United States	18
Brazil, Mexico, and Saudi Arabia 1/	14
Argentina	12
U.S.S.R	9
Canada	8
Korea, Japan, and Spain 1/	6
Taiwan, Netherlands, and Hungary 1/	5
Libya, Nigeria, Turkey, Yugoslavia, Egypt, and Kuwait 1/	4
Bolivia, Burma, Indonesia, Israel, Thailand, Czechoslavakia, France, Italy, and South Africa 1/	2
Bahrain, Chile, Colombia, Ecuador, Iran, Malaysia, Portugal, Qatar, Ras Al-Khaimah, Romania, Syria, Trinidad, Tunisia, Bulgaria, East Germany, North Korea, Poland, Austria, Belgium, Finland, Greece, and United Kingdom 1/	1
Total 53 countries	228

1/ Each.

Source: "Worldwide Construction," Oil & Gas Journal, Oct. 29, 1984, pp. 98-102.

Table 5.--Chemicals: Production, imports, exports, and apparent consumption in market economy countries, by regions, 1979

Region	Production	Imports 1/	Exports 1/	Apparent consumption	Imports to consumption	Exports to production
	Millions of dollars				Percent	
Developed countries	435,000	88,459	115,221	408,238	22	26
Developing countries	71,196	32,663	8,637	95,222	34	12
Caribbean and Central America	1,612	1,676	575	2,713	62	36
Mexico and South America	25,305	6,772	1,860	30,217	22	7
Middle East	5,370	4,107	954	8,523	48	18
Africa	2,833	4,675	580	6,928	68	21
South Asia	5,897	1,820	222	7,495	24	4
East Asia	12,880	9,399	3,244	19,035	49	25
Oceania	30	119	2	147	81	7
Europe 2/	17,269	4,095	1,200	20,164	20	7
Market economies of world	506,196	121,122	123,858	503,460	24	24

1/ Trade statistics for most countries are for SITC group 5 and therefore exclude synthetic fibers, synthetic rubber, sulfur, and some fertilizer materials (mainly phosphate rock).

2/ Romania, Yugoslavia, Turkey, Portugal, Malta, and Cyprus.

Source: United Nations Yearbook of International Trade Statistics, 1981; private communication from World Bank; Republic of China Statistical Yearbook, 1984; and estimates of the staff of the U.S. International Trade Commission.

Commodity group	Exports of developing countries 1/	
	1965	1980
Manufactures	16	26
Fuels	16	32
Agricultural products	42	20
Metals and minerals	10	6
Nonfactor services	16	16
Total	100	100

1/ World Bank, World Tables, The Third Edition, 1983.

Imports of all commodities of the developing countries partly shifted (in value) to fuels while manufactures and agricultural products decreased proportionately, as shown in the following tabulation (in percent of total):

Commodity group	Merchandise imports of developing countries 1/	
	1965	1980
Manufactures	67	61
Agricultural products	22	16
Fuels	8	20
Metals and minerals	3	3
Total	100	100

1/ World Bank, World Tables, The Third Edition, 1983.

In 1981, the latest year for which data are available, merchandise exports of the developing countries--$548 billion--were 28 percent of world exports, and imports of the developing countries--$509 billion--were 26 percent of world imports. Two-thirds of the developing country exports went to the developed countries, Western Europe receiving 29 percent and the United States 21 percent. Almost half of Africa's exports were shipped to Western Europe, and about one-third of Latin America's exports went to the United States. 1/

Exports to countries in Africa and the Middle East in 1981 came mostly from Western Europe. About a third of Latin America's imports were from the United States, and about 20 percent came from both Western Europe and other Latin American countries.

1/ United Nations, 1982 Yearbook of International Trade Statistics.

Chemicals

Table 6 names the principal chemical exports of most of the developing countries in recent years, generally in order of value. Because most of the product descriptions are limited to the SITC 5 general classifications used by the UN, they show types of products exported rather than individual chemicals.

Chemical exports of developing countries in 1980 are estimated to have been about 6 percent of exports of manufactures, and chemical imports about 15 percent of imports of manufactures.

Imports of chemicals by developing countries in 1981 amounted to $38.1 billion, or nearly four times their chemical exports of $10.4 billion. As shown in table 7, Africa, the Middle East, and the group as a whole imported a much greater value of chemicals from Western Europe than from the United States. Latin America, on the other hand, imported 46 percent of its requirements from the United States, and 32 percent from Western Europe. Asia's imports were 29 percent from the United States, 24 percent from Western Europe, and 21 percent from Japan.

In exports of chemicals as shown in table 8, the developing countries' trade in 1981 in the aggregate was 23 percent to non-Japanese Asia, 17 percent to Japan, 16 percent to Western Europe, 14 percent to Latin America, and 12 percent to the United States. Latin America was the only region that exported a significant share to the United States--27 percent.

FACTORS INFLUENCING THE DEVELOPMENT AND COMPETITIVENESS OF THE CHEMICAL INDUSTRIES OF DEVELOPING COUNTRIES

Competitive factors in the chemical industry are similar to those in other industries except for the greater influence of petroleum and natural gas resources and the relatively smaller importance of labor costs. In general, they include the following, which are discussed later in this report:

- Minimum economic plant size
- Investment funds
- International financial institutions
- Exchange rates
- Inflation rates
- Petroleum and natural gas resources
- Mineral and agricultural resources
- Labor
- Technology
- Transportation

The Strength of the Host Country Economy

A typical generalization within the chemical industry is that chemical consumption is about 5 percent of gross domestic product (GDP) in most

Table 6.--Chemicals: Exports of developing countries, by sources, 1982 and earlier years

Source	Year 1/	Value	Principal types of products
		Million dollars	
Mexico and South America:			
Argentina	1982	390	Hydrocarbons and other organic chemicals and vegetable tanning agents.
Bolivia	1979	2/	Inorganic chemicals.
Brazil	1982	909	Organic chemicals, plastics materials, and perfumes.
Chile	1980	184	Inorganic chemicals and plastics materials.
Colombia	1982	94	Pesticides, organic chemicals, and medicinals.
Ecuador	1979	3	Unspecified.
Guyana	1979	5	Aluminum oxide and hydroxide.
Mexico	1982	714	Ammonia, inorganic and organic chemicals, sulfur, medicinals, and salt.
Paraguay	1981	12	Vegetable tanning agents.
Peru	1982	44	Explosives, perfumery and cosmetics, inorganic chemicals, and albuminoid substances.
Suriname	1976	131	Aluminum oxide and hydroxide.
Uruguay	1981	40	Plastics materials, soaps and washing preparations, casein, organic chemicals, and varnish.
Venezuela	1981	119	Chemical elements and compounds, unspecified.
Caribbean and Central America:			
Bahamas	1977	80	Organic chemicals and hormones.
Barbados	1980	15	Medicinals, pesticides, and varnishes and paint.
Belize	1980	2/	Glands and medicinals and perfume products.
Bermuda	1981	12	Medicinals.
Costa Rica	1981	81	Medicinals, fertilizers, and pesticides.
Dominica	1978	3	Soaps and essential oils.
Dominican Republic	1982	35	Heterocyclic organic chemicals and nitrogenous fertilizers.
El Salvador	1981	29	Medicinals, soap and perfume, and pesticides.

See footnotes at end of table.

Table 6.--Chemicals: Exports of developing countries, by sources, 1982 and earlier years--Continued

Source	Year 1/	Value	Principal types of products
		Million dollars	
Caribbean and Central America--Continued:			
Guadeloupe	1982	2	Organic chemicals--amide-function.
Guatemala	1981	124	Medicinals, perfumery, and soaps.
Haiti	1979	7	Essential oils.
Honduras	1981	29	Soaps and rosin chemicals and organic chemicals.
Jamaica	1981	16	Perfumes and cosmetics, paint, and medicinals.
Martinique	1982	6	Fertilizers and organic chemicals.
Netherlands Antilles	1979	38	Organic chemicals and ammonia.
Nicaragua	1982	20	Plastics materials and organic and inorganic chemicals.
Panama	1982	4	Medicinals and perfumes and cosmetics.
Saint Lucia	1980	2/	Acyclic alcohols and derivatives and soaps.
Trinidad and Tobago	1982	162	Ammonia and organic chemicals.
Middle East:			
Bahrain	1981	4	Perfumery and paint and related products.
Iraq	1978	38	Oil refinery chemical byproducts.
Israel	1982	765	Fertilizers, miscellaneous, inorganic chemicals, plastics materials, and pesticides.
Jordan	1982	69	Pharmaceuticals, cosmetics and perfume, soap, and paint and varnish.
Kuwait	1981	788	Oil refinery byproducts, and nitrogenous fertilizers.
Lebanon	1977	38	Superphosphate fertilizer and medicinals.
Oman	1982	2	Perfumery and cleaning materials.
Qatar	1981	211	Nitrogenous fertilizers and plastics materials.
South Asia:			
Bangladesh	1980	10	Organic chemicals, and fertilizers.
Burma	1976	1	Fertilizers.

See footnotes at end of table.

Table 6.--Chemicals: Exports of developing countries, by sources, 1982 and earlier years--Continued

Source	Year 1/	Value	Principal types of products
		Million dollars	
South Asia--Continued:			
India	1980	315	Medicinals, dyes, soaps, chemical elements and compounds, and perfumery.
Macao	1981	6	Medicinals.
Nepal	1980	2/	Natural dyes.
Pakistan	1982	14	Organic chemicals.
Sri Lanka	1982	12	Fertilizers and perfume and cleaning materials.
East Asia:			
Hong Kong	1982	772	Dyes, perfumery, medicinals, plastics materials, and organic chemicals--much reexports to China.
Indonesia	1982	61	Nitrogenous fertilizers.
Korea	1981	644	Fertilizers, organic chemicals, and plastics.
Malaysia	1981	133	Fatty acids (SITC 43131) and unspecified chemicals.
Philippines	1981	106	Organic chemicals (especially fatty alcohols) and plastics materials.
Singapore	1982	805	Medicinals, organic chemicals, fertilizers, and plastics materials.
Thailand	1982	58	Unspecified.
Africa:			
Egypt	1982	38	Essential oils and perfume products.
Libya	1981	58	Organic chemicals.
Morocco	1982	760	Phosphate rock, phosphoric acid, and superphosphates.
Tunisia	1981	366	Phosphatic fertilizers, acid, and ore; fluorides and other inorganics; and barium sulfate.
Cameroon	1982	13	Soap and cleansers and perfume products.
Chad	1975	3	Sera, vaccines, etc., (SITC 54163).
Comoros	1976	3	Essential oils.
Congo	1980	2/	Potassic fertilizers.
Ethiopia	1982	2	Essential oils.

See footnotes at end of table.

Table 6.--Chemicals: Exports of developing countries, by sources, 1982 and earlier years--Continued

Source	Year 1/	Value	Principal types of products
		Million dollars	
Africa--Continued:			
Gabon	1980	33	Radioactive elements and isotopes (SITC 5241).
Ivory Coast	1982	31	Perfumery and cleaning products and pesticides.
Kenya	1980	49	Perfumery materials, soaps and cleansing agents, pesticides, dyes and tanning agents, and medicinals.
Liberia	1981	2/	Unspecified.
Madagascar	1981	4	Essential oils.
Malawi	1980	1	Unspecified.
Mali	1979	2/	Explosives and pyrotechnics.
Mauritania	1975	6	Explosives and medicinals.
Mozambique	1975	2/	Fertilizers.
Reunion	1982	5	Essential oils.
Senegal	1981	100	Phosphate rock and fertilizers.
Somalia	1980	2/	Vegetable alkaloids (opium).
Tanzania	1980	4	Vegetable tanning extracts.
Zaire	1978	2	Unspecified.
Zambia	1979	2	Inorganic chemicals.
Zimbabwe	1982	16	Medicinals, soaps and cleansers, and vegetable tanning agents.
Europe:			
Cyprus	1982	19	Perfumes, medicinals, and pesticides.
Malta	1981	5	Medicinals and pigments and paints.
Portugal	1982	343	Organic chemicals, medicinals, rosin derivatives, and inorganic chemicals.
Romania	1973	276	Fertilizers, inorganic and organic chemicals, and dyes and tanning agents.
Turkey	1982	206	Synthetic fibers, phosphatic fertilizers, boric and other inorganic chemicals, and organic chemicals.
Yugoslavia	1982	1,126	Chemical elements and compounds (mostly alumina and inorganic), explosives and pyrotechnics, medicinals, and plastics materials.

See footnotes at end of table.

Table 6.--Chemicals: Exports of developing countries, by sources, 1982 and earlier years--Continued

Source	Year 1/	Value	Principal types of products
		Million dollars	
Oceania:			
Fiji	1982	6	Perfumery products, inorganic chemicals, and plastics materials.
French Polynesia	1982	2/	Perfumes.
Kiribati	1979	20	Natural phosphates (SITC 2713).
Samoa	1981	2/	Soaps.

1/ The most recent year for which (United Nations) data were available.
2/ Less than $1 million.

Source: United Nations Yearbook of International Trade Statistics, 1979 and 1981.

Table 7.--Chemicals: Imports of developing countries, by suppliers and by markets, 1981, 1/ 2/

Suppliers of imports	All developing countries	Latin America and Caribbean	Africa	Middle East 1/	Asia and Oceania 1/	OPEC
	Value (billion dollars)					
Total	38.12	10.95	6.30	6.43	14.45	9.73
	Percent of total					
Developed countries	81.6	82.9	88.4	82.5	77.6	85.0
Nonmarket economy countries	5.7	3.7	5.4	7.9	6.2	4.5
Developing countries	12.7	13.4	6.2	9.6	16.2	10.5
OPEC 3/	1.4	.8	.6	2.3	1.7	1.2
Developed countries:						
United States	26.5	45.5	4.6	10.0	29.2	14.3
Western Europe	42.5	31.9	77.5	67.8	24.2	62.7
Japan	9.6	2.2	1.6	4.2	21.1	7.1
Other	3.0	3.3	4.7	.5	3.1	.9
Developing countries:						
Latin America and Caribbean	4.5	12.8	.8	1.9	.9	2.7
Africa	1.3	.1	2.7	1.0	1.7	1.4
Middle East	1.4	.2	.6	4.3	1.5	2.4
Asia (and Oceania)	5.5	.3	2.1	2.4	12.1	4.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

1/ In U.N. statistics, Turkey and Cyprus are included in the Middle East, and Kampuchea and Laos are included with the other Asian developing countries. Portugal, Yugoslavia, and Malta are categorized as developed countries.

2/ SITC 5 data only. Synthetic fibers, synthetic rubber, sulfur, and some fertilizer materials are therefore not included.

3/ Figures for OPEC are a portion of the developing countries total figures.

Source: United Nations Yearbook of International Trade Statistics, 1982.

Table 8.--Chemicals: Exports of developing countries, 1981 1/ 2/

Recipients of exports	All developing countries	Latin America and Caribbean	Africa	Middle East	Asia and Oceania
	Value (billion dollars)				
Total	10.37	3.76	1.02	1.29	4.29
	Percent of total				
Developed countries	49.5	51.8	42.5	52	46
Nonmarket economy countries	4.1	2.7	8.7	3	5
Developing countries	46.4	45.5	48.8	45	50
OPEC	9.9	7.1	13.8	19	9
Developed countries:					
United States	12.3	26.5	.5	1	6
Western Europe	15.5	19.3	41.2	25	4
Japan	16.6	4.2	.3	23	31
Other	5.0	1.9	.5	2	5
Developing countries:					
Latin America	14.2	37.4	1.1	1	1
Africa	3.8	1.4	17.0	3	3
Middle East	6.0	3.2	6.6	23	4
Asia and Oceania	22.5	3.5	24.1	18	42
Total	100.0	100.0	100.0	100	100

1/ In U.N. statistics, Turkey and Cyprus are included in the Middle East, and Kampuchea and Laos are included with the other Asian developing countries. Portugal, Yugoslavia, and Malta are categorized as developed countries.

2/ SITC 5 data only. Synthetic fibers, synthetic rubber, sulfur, and some fertilizer materials are therefore not included.

3/ Figures for OPEC are a portion of the developing countries total figures.

Source: United Nations Yearbook of International Trade Statistics, 1982.

countries. 1/ However, since inhabitants of the countries with the lowest incomes necessarily spend almost all their financial resources on necessities such as food and shelter, their market for chemicals is limited. Developing countries generally tend to lack both capital for investment and sufficient domestic market demand for economic-size chemical plants. Therefore most developing countries have negative trade balances on chemicals. Developed countries have therefore been the net exporters. This situation is changing in chemicals for two reasons--(1) the petroleum-rich countries, most of which are developing countries but have large capital resources, have been investing heavily in chemical plants with the intention of exporting much of their production; and (2) the IMF and banks that have supplied funds have encouraged developing countries to become net exporters.

There is a point where a country starts to produce its own chemicals for import substitution and/or export promotion. In the view of one industry analyst, "chemical industry growth typically starts after a country reaches the $2,000 GDP-per-capita threshold." 2/

Of the 138 developing countries examined, about 34 were close to or above the $2,000 GNP-per-capita level (in 1981) as shown in the following tabulation of World Bank statistics: 3/

1/ Gross domestic product (GDP) is the value of goods and services produced within a country minus deductions for depreciation and other capital consumption allowances. It is the total value added by all industries. By comparison, Gross national product (GNP) is GDP plus income received from abroad such as remitted interest and profit on investment, remitted earnings of migrant workers, and similar items.

For the United States in 1981, GNP exceeded GDP by 1.9 percent; for Egypt by 3.6 percent; for Saudi Arabia by 1 percent; for Kuwait, because of its huge foreign investments, by 34 percent; and for Japan by zero percent. For some countries deeply in debt -- e.g., Brazil, Israel, Argentina -- GDP exceeded GNP by about 3 percent.

In this report GDP and GNP are used interchangeably because data are often available only for one of the two, and because for most countries the difference is small.

See app. C for population and GDP data for developing countries.

2/ Chemical and Engineering News, Oct. 17, 1983, p. 11.

3/ This tabulation omits some countries with relatively large GNP's, listed below, because their populations are too large for their GNP to average $2,000 per capita.

South Asia	:	India (GNP in 1982 was 77 percent of that of all South Asia)
Middle East	:	Iran (Possibly Iraq, whose GNP was unavailable)
East Asia	:	Indonesia
Africa	:	Nigeria, Egypt
Caribbean	:	Trinidad, Dominican Republic

See app. C for additional GDP data for developing nations.

Data are from World Bank, World Tables, 3d ed., 1983. (For Brunei, 1984 data, The Washington Post, July 7, 1985.)

Western Hemisphere

Trinidad	$5,600	Argentina	2,600
Venezuela	4,200	Mexico	2,200
Barbados	3,500	Brazil	2,200
Uruguay	2,800	Panama	1,900
Chile	2,600	Bermuda	NA

Middle East

United Arab Emirates	$25,000	South Asia--none	
Kuwait	21,000		
Saudi Arabia	12,000	East Asia	
Bahrain	9,000		
Oman	6,000	Brunei	22,000
Israel	5,000	Singapore	5,200
		Hong Kong	5,100
Africa		Malta	3,600
		Taiwan	2,600
Libya	8,500	Korea	1,700
Gabon	3,800		
Algeria	2,100	Europe	
		Cyprus	3,800
		Yugoslavia	2,800
		Portugal	2,500
		Malaysia	1,800

Another industry study, in the 1960's, found that the value of chemical production in developing countries could be expressed by the following formula: 1/

$$C = 0.0129(P)^{0.997}(G)^{1.2}$$

where C = Value of chemical production, in million of dollars
P = Population, in millions
G = GNP per capita, in dollars

This formula indicates that GNP per capita is far more important than population alone. Using 1978-79 data, this mathematical formula was tested and found to correlate fairly well with factual data for most of the world after changing the constant of 0.0129 to 0.0149, as shown in the following tabulation:

1/ Derived from Long Range Energy Study, Standard Oil Company of New Jersey, 1964.

Countries	Population	Gross domestic product (GDP)	GDP per capita	Chemicals production	Chemicals production calculated by formula
	Million dollars 1981	Billion dollars 1978		Million dollars 1979	Million dollars 1979
Mexico and South America	311	439	$1,400	25,305	26,800
Caribbean and Central America	49	36	740	1,612	2,000
Middle East	93	264	2,850	5,370	
South Asia	930	159	170	5,897	6,400
East Asia	326	206	630	12,880	10,800
Africa	467	228	490	2,833	
Oceania	4	5	1,200	30	
Europe (5 countries excluding Romania)	79	130	1,650	9,269	8,400
Total	2,259	1,467	650	63,196	

GDP statistics: United Nations yearbook of national accounts statistics (1960-78) and International Monetary Fund's international financial statistics (1980-82). Chemical statistics from this report, table 5.

In the Middle East, Africa, and Oceania, the formula calls for chemical production above (by a factor of 3 or more) what was actually produced, but this may be explained. In the Middle East, almost instant growth in GNP occurred when the OPEC countries' nationalized their petroleum industries and raised the price of petroleum. They immediately set their sights on petrochemicals, but it has taken 12 years to build the infrastructure and the chemical plants. Within the next year or two, actual production should exceed what would be calculated from the formula. In Africa, it is possible that there are just too many small low-income countries whose governments have not been able to get industrialization programs going in an organized way. In any case, empirical formulas such as this are useful as one of the forecasting tools of chemical company planners and analysts because GNP and population forecasts are more widely available than any others. Comparative growth rates for GDP and chemicals for 1960-79 are given in the following tabulation (in percent per year):

	GDP 1/	Chemicals
Developing countries:		
Latin America and Caribbean	12.3	16.7
Middle East	20.0	22.8
South Asia	7.8	12.7
East Asia	13.2	22.8
Africa	12.7	12.2

	GDP 1/	Chemicals
Developing countries--Continued:		
Europe	15.7	19.3
Total	12.4	16.2
Developed countries	11.0	11.2

1/ GDP for 1979 taken as the average of 1978 and 1980.

The above tabulation shows that only in Africa did chemicals fail to exceed GDP in growth during 1960-79. In the developed countries as a whole and in the Middle East, the growth rates for GDP were the same as for chemicals. However, the growth of chemicals (and GDP) in the Middle East, 22.8 percent per year, was equalled only in East Asia, also 22.8 per cent per year for chemicals. But growth of chemicals in East Asia was much faster than growth of GDP. In Latin America, South Asia, and Europe, chemicals outpaced GDP significantly. For the developing countries as a whole, chemicals grew 16.2 percent per year while GDP grew 12.4 percent per year; however, price increases affected the growth percentages. Therefore, it maybe somewhat more meaningful to express the data in terms of chemicals as a percent of GDP in 1960 and 1979 as shown in the following tabulation:

	Chemicals production		
	As percent of GDP		As percent of
	1960	1979	manufactures, 1979
Developing countries:			
Latin America and Caribbean	3.1	4.5	11.6
Middle East	.9	1.9	
South Asia	1.4	3.2	6.0
East Asia	1.2	5.3	
Africa	1.2	1.1	
Europe	7.6	12.4	
Oceania	-	.6	
Total	2.2	4.2	9.6
Developed countries	6.3	6.5	10.3

The data indicate that chemicals remained flat at about 6.5 percent of GDP at the beginning and end of the 20-year period for the developed countries. In contrast, the developing countries as a group almost doubled the percentage share of GDP that was held by chemicals -- from 2.2 to 4.2 percent -- but their chemicals ended up with a considerably smaller share of GDP than that of the developed countries.

Since 1979, the developed countries, as discussed in other sections of this report, have decreased their production and the production capacity of petrochemicals, whereas capacity to produce chemicals in the petroleum-rich and East Asian developing countries has been rapidly expanded.

Factors of Scale

One important consideration in the development of chemical production facilities, especially with petrochemicals, is the scale factor. Many countries' lack sufficient domestic demand to support petrochemical plants of minimum economic size. Such countries must develop export markets if they are to build economic-scale chemical plants and operate them competitively with those elsewhere in the world. Saudi Arabia has formed a number of joint-ventures with large multinational firms to build world-scale petrochemical plants to serve export markets. These Western firms not only furnish technology and knowhow but they also market much of the output. Saudi Arabia has contributed financing and low-cost raw materials to these joint-venture projects.

Production of most basic and intermediate petrochemicals is best carried out in large-scale plants. A typical product cost structure for such a U.S. plant is given in the following tabulation:

$0.12	Payroll for all employees (50 percent is pay to production workers).
.58	Materials and fuel
.04	Depreciation
.08	Pretax profit
.18	Other--other operating costs, interest, advertising and other services, and the non-salary cost of R & D, distribution and selling, and administration and general.
$1.00	Final sale

Markets of sufficient magnitude can be created by a group of countries provided that they accept an allocation of responsibility for the production of different petrochemical products. This division of production has proved to be difficult to negotiate and fully implement in the case of developing countries. 1/ The Andean Common Market is an example of the group approach. The member countries--Venezuela, Colombia, Ecuador, Peru, and Bolivia--agreed on a regional program of "integration industries." The Andean Pact assigned what amounted to a regional monopoly to individual plants that were to supply specified products to the entire five-nation group. 2/ The plan called for $2.8 billion in petrochemical investments during 1978-84, with 70 percent of that for intermediate products and the rest for intermediate chemicals. Investment by foreign companies was precluded by Decision 24 of the pact. The investment was to be distributed as follows: Bolivia, $459 million; Colombia, $416 million; Ecuador, $502 million; Peru, $737 million; and Venezuela, $641

1/ "Long-term arrangments for the development of petrochemical industry in developing countries including arrangements for marketing petrochemicals produced in developing countries," the UNIDO Secretariat ID/WG. 336/2, Mar. 31, 1981. p. 8.

2/ Business Week, Aug. 27, 1984, p. 48, and Chemical Week, May 23, 1979, p. 29.

million. 1/ However, these countries' inadequate financial resources and other problems resulted in little progress, and few of the projects were completed. Colombia proposed that investment by foreign companies be permitted and encouraged in the member countries. As an ex-president of Colombia said recently, "We agreed on Decision 24, and all the foreign capital went to Asia." 2/ As noted later, Ecuador, in late 1984, also rethought the implications of Decision 24 and signed an agreement with the United States to attract U.S. investment. Colombia took similar action in early 1985. 3/ Venezuela, which for years had an ambivalent attitude toward foreign investment, issued long-awaited rules in June 1985 that relaxed controls on foreign investments. 4/

More successful has been the Association of South East Asian Nations (ASEAN), consisting of Singapore, Thailand, Malaysia, Indonesia, the Philippines, and Brunei. These countries, especially Singapore, have welcomed foreign investment and have expanded very rapidly in chemicals as well as in other industries.

The Gulf Cooperation Council (GCC) was set up in 1981 by Saudi Arabia, Kuwait, Bahrain, Qatar, the United Arab Emirates, and Oman to coordinate industrial projects, mostly in chemicals and metals. The GCC acts to prevent overlapping of projects so that member countries can achieve sufficient market autonomy within particular industrial sectors to operate plants at maximum efficiency. Implementation of their agreement began in 1983 with the elimination of most customs duties, easing of capital flows and restrictions on labor mobility and promotion of regional development. 5/

As noted previously, the chemical industry is capital intensive, and large plants are a necessity for primary petrochemicals and second- or third-stage petrochemical intermediates. Partly for that reason, petrochemical products are produced in government-owned or government-controlled (i.e., majority ownership in joint venture) companies in most developing countries that have such investments. In many developing countries, private investment for these petrochemicals is discouraged or not allowed. 6/ The same situation exists in countries whose chemical industries are based on (and largely limited to) other mineral resources.

Economic and Financial Factors

Except for some of the energy-rich countries, nearly all developing countries need money from abroad to invest in industrial enterprises. As of early 1985, this presented problems to most of them because of debts contracted

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1/ Ibid.
2/ Ibid.
3/ U.S. Department of Commerce, Business America, May 13, 1985, p. 31.
4/ "Venezuela Wooing Foreign Investors," The Washington Post, July 23, 1985, p. D3.
5/ "Arabian Peninsula Survey," The Economist, Feb. 10, 1983, p. 25.
6/ U.S. International Trade Commission, Petrochemical reports, op. cit.

in earlier years. As a group, the gross external debt of the non-petroleum-rich developing countries reached 158 percent of their annual exports of goods and services in 1983 before decreasing to 151 percent in 1984. Debt service (including interest and amortization) was about 23 percent of exports of goods and services in those years. 1/

Studies show that direct foreign investment in the developing countries grew about 3 percent per year in real terms during the 1970's and reached about $140 billion in 1983. Brazil, Malaysia, Mexico, Singapore, and South Africa (the latter considered "developing" in these studies) accounted for more than half of that total. These studies project faster growth in direct direct foreign investment during 1985-90, but even if this occurs it will still provide only about one-fifth of the foreign money needed by indebted developing countries. And it may be of little help to the poorest nations. 2/ The developing countries' recovery depends on their international trade. World trade increased by 8.8 percent in volume terms in 1984. The petroleum-exporting developing countries only managed to increase exports by 2.5 percent, but the others increased theirs by 12 percent, more than the developed countries' increase of 9.9 percent. If, as projected, the non-petroleum-rich developing countries can continue to increase their exports by more than 7 percent in 1985 and in 1986, the balance-of-payments adjustments should be simplified, and the developing countries should in the future be able to consume a larger share of their output themselves. Other observers are less sanguine since the current forecast assumes significant progress in the battle against inflation and it is far from certain where necessary investment funds will come from. 3/

Among the consequences of inflation is flight of capital from countries with high debt, high inflation, and overvalued currency. In the case of Argentina, Brazil, Mexico, and Venezuela, whose gross foreign debt had grown to about $272 billion near the end of 1984, residents of those countries reportedly had borrowed in the neighborhood of $146 billion of those dollars from their central banks after they had been converted to pesos, cruzeiros, and bolivars; converted the money back into dollars; and (quite legally) invested those dollars abroad in banks and other assets in the United States and Europe. The residents' home-country debt obligations were substantially washed away by continuing inflation and currency devaluations. In Venezuela, the value of the bolivar was decreased 67 percent on February 18, 1983. Instantly, a Venezuelan who had converted 430,000 bolivars to 100,000 dollars and invested them in a Miami bank now found that investment to be worth 1,250,000 bolivars. The interest of 10 percent now earned 125,000 remitted bolivars per year, and such transfers, if desired, are legal. Reportedly, when the governments of those countries asked for foreign aid and loans to keep their economies going, it was partly because they could not persuade their own citizens to invest domestically or repatriate foreign deposits. Perceived political and economic instability in many of these countries has caused many of their wealthier citizens to transfer much of their wealth out

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1/ "Drying Out the Debt Addicts," The Economist, Apr. 20, 1985, p. 86.
2/ The Economist, Apr. 27, 1985, p. 92.
3/ "Incautious Optimism From the IMF," The Economist, Apr. 20, 1985, p. 71.

of the country to "safe haven" countries like the United States and Switzerland. 1/

While developed countries have been living with floating exchange rates since 1973, developing countries, many with high inflation, have been more reluctant to expose their currencies to market forces. Though the trend is downward, more than 40 percent of the developing countries still peg their currencies to one of the leading currencies (27 percent to the U.S. dollar) and another 30 percent peg to a composite currency (Feb. 1985 data). Since their inflation rates in many cases are not as low as those in the United States, Japan, or Europe, official exchange rates in some countries are frequently in need of adjustment. Overvaluation of a currency adversely affects the profitability of export industries and encourages imports. In such cases the countries lose their international competitiveness. One response is import controls. Another is frequent currency devaluations. Many countries tend to postpone devaluations as long as possible for domestic political reasons. The best remedy, according to the IMF, is to reduce inflation. Until that is achieved, the IMF recommends frequent devaluations to preserve export competitiveness as the next best thing. Countries cannot postpone needed devaluations indefinitely, because most of them will continue to need foreign financing. 3/ Mexico recently let its peso appreciate to the point where it was nearly as overvalued in real terms as it was at its peak in January 1982. The peso was devalued by 33 percent in mid-1985 only after capital flight had reportedly carried away much of the central bank's rebuilt foreign reserves. 4/

The average inflation rate of the developing countries was 38 percent in 1984, led by the South American and Central American average of 120 percent. Examples include Bolivia at 1,700 percent, Argentina 688 percent, Brazil 224 percent, and Peru 111 percent. Because of the influence of such extreme examples, some analysts concentrate on the median rate, which was 10 percent during 1983-84 (and trending downward). The median rate for the developed countries was 4 percent, and the developing countries in East Asia have also succeeded in holding down their inflation. 5/

In order to attract direct foreign investment, countries have increased incentives and attempted to streamline the bureaucratic process. In one country, where 39 separate approvals for a project were required before 1979, the number was cut to 14 in 1985. However, in some countries, impediments to investing remain high. Officials must be courted, paperwork processing is slow, and there may be performance requirements and other restrictions. 6/

1/ "Where the Latin American Loans Went--Wealthy Individuals Recycled About One-Third of the Money Into Investments in the U.S. and Europe," Fortune, Nov. 26, 1984, p. 195. Also Forbes, June 3, 1985, p. 50, The Washington Post, Sept. 1, 1985, p. M1, and The Wall Street Journal, Oct. 11, 1985, pp. 1, 24.

3/ "Hung Up on a Peg--Developing Countries Letting Their Exchange Rates Become Overvalued--Results are Always Bad, Sometimes Disastrous," The Economist, May 18, 1985; also May 25, 1985, p. 69.

4/ "Under the Volcano," The Economist, July 13, 1985, pp. 15-16.

5/ "Incautious Optimism from the IMF," The Economist, Apr. 20, 1985, p. 71.

6/ The Economist, June 22, 1985, p. 69, and "Position of the Chemical Manufacturers Association on International Investment Restrictions," June 8, 1983, 21 pp.

The problems that Latin American countries have incurred because of their import substitution policies are noted in the government involvement section. A similar problem in the Philippines has been described as follows: "The current economic difficulties in the Philippines have their roots in decisions taken soon after independence in 1946 to pursue an import substitution rather than an export diversification model of development. Import restrictions, generally over-valued exchange rates, and preferential allocation of subsidized credit were the principal tools used in the pursuit of this. The result was an industrialized structure that was overly capital intensive and that could not compete in world markets." 1/

Although shortage of capital is making developing countries take more interest in attracting foreign investment, the large U.S. multinational chemical companies decreased the proportion of foreign investment going to developing countries from a peak of 23 percent in 1981 to only about 12 percent in 1984. They had been directing 20-25 percent of their capital spending, which totaled about $15 billion in 1984 ($13 billion in 1973), to foreign projects. 2/ Behind this lessening of interest was the concern of the multinational companies with competition from chemicals produced in Saudi Arabia and other petroleum-rich countries, with political risk in some countries, with the perceived slowing of growth in the overall chemical industry, and with their own interest in diversifying into other types of products such as chemical specialties.

Much of the financing of major chemicals projects in developing countries comes from international organizations such as the World Bank, the United Nations International Development Organization (UNIDO), and the regional development banks. These organizations also have provided technical assistance in the appraisal and implementation of the projects, including training programs for the workers and technical assistance during the critical periods of start-up. For example, the World Bank during the 1970's helped with loans totaling more than $1.3 billion to finance and establish 25 major fertilizer projects in 11 developing countries. The World Bank's assistance has included advice on the appropriate nature and level of technology in relation to plant location and infrastructure, and assistance with market studies and with negotiations between interested parties in different countries. 3/ By 1985, the nature of the assistance had changed. According to the chief of the World Bank's division of fertilizer, refining, and other chemical industries, "Over the next few years, the bank isn't expected to be supporting many new chemical plants. It will instead focus on the improvement of existing plants, involving corporate restructuring, technological modernizing, and energy conservation....70 to 75 percent of our activities will go toward making better use of existing chemical technologies." 4/

1/ U.S. Department of Commerce, Business America, Apr. 1, 1985, p. 30.

2/U.S. Department of Commerce; Chemical Week, Jan. 2-9, 1985, p. 28, and Mar. 20, 1984, p. 10; and Chemical and Engineering News, Feb. 11, 1985, p. 51.

3/ "The Fertilizer Industry in Developing Countries," Chemical Engineering Progress, October 1979, pp. 21-27.

4/ Chemical and Engineering News, Apr. 8, 1985, p. 10.

Petroleum and Natural Gas Resources

The key figure in the tabulation of production costs previously given is the 58-cents-per-dollar-of-sales for materials and fuel. It is this comparative price advantage in energy-rich developing nations with petroleum and gas resources that has given these developing countries the potential to succeed in the petrochemical industry.

The corollary to the 58-cents-per-sales-dollar figure for cost of raw materials and fuel, discussed above, is the implication that most developing countries, which lack mineral, agricultural, and other natural resources, and have only limited funds for R & D activities, with only a few well-known exceptions, are unlikely to achieve anything more in the chemical field than producing relatively simple products for local consumption with protection from imports when needed.

Petroleum

As of January 1985, 17 countries possessed 97 percent of the world's petroleum reserves, as given in the following tabulation (in billions of barrels). 1/

Source	Developing countries	Developed countries	Nonmarket economies
Saudi Arabia	171		
Kuwait	93		
U.S.S.R			63
Mexico	49		
Iran	49		
Iraq	44		
United Arab Emirates	33		
United States		27	
Venezuela	26		
Libya	21		
China			19
Nigeria	17		
United Kingdom		14	
Algeria	9		
Indonesia	9		
Norway		8	
Canada		7	
Total	521	56	82
Percent of world reserves	75	8	14

1/ Oil and Gas Journal, Dec. 31, 1984, p. 87. See app. D for additional details.

Of the 17 countries, all but one of which (Mexico) are OPEC members, 11 are developing countries and possess 75 percent of the world's petroleum reserves. Overall, at least 50 developing countries are known to have some petroleum reserves, and 81 developing countries operate petroleum refineries. Refineries produce as liquid byproducts or coproducts the naphtha or gas oil that are feedstocks for most of the world's petrochemical production. However, in those 81 countries most of the refineries have too small a capacity to sustain production of petrochemicals on a competitive world scale. 1/

Production of crude petroleum can be a profitable business. Although the price of crude petroleum has declined from the peak of $35 per barrel (42 gallons) in 1981 to $26.95 in October 1984, 2/ and about $25 per barrel in March 1985, 3/ the average cost of bringing this petroleum out of the ground (not including exploration costs) has been only about $2.00 per barrel in Saudi Arabia, $4.00 to $6.00 per barrel in the United States, $3.00 to $6.50 per barrel in Mexico, 4/ and $5.00-8.00 per barrel in the North Sea (of which 25-35 percent is maintainance costs of the platforms). 5/ For petrochemicals produced from this petroleum in an integrated operation (i.e., controlled by a single owner), it should matter little, in terms of economics, from the viewpoint of a petroleum-rich developing country whether the feedstock cost to the chemical plant is closer to the cost of crude petroleum or natural gas (in which case the petrochemicals would be the profitable outputs) or whether it is closer to world prices, in which case the chemicals might show no profit but the petroleum refinery or petroleum production unit would show the large return. Feedstock pricing policies for production of chemicals might well be determined by what it takes to sell the chemicals in various areas and cognizance of provisions of fair trade laws in market countries.

Natural gas

Natural gas (mostly methane) and its ethane content are sources of ammonia, methanol, ethylene, and the thousands of downstream chemicals made therefrom. Much of the supply of natural gas is "associated" with crude petroleum; that is, it comes out of the ground at the same time from the same well. Until recent years, natural gas was an unwanted coproduct in then-remote crude petroleum producing regions such as the Arabian peninsula. For years the petroleum-rich Middle East countries consumed as much as they could in power stations and desalination plants, but most of the natural gas was "flared," or burned off into the atmosphere. Under these conditions the cost of the gas at the wellhead could be viewed as essentially zero. The cost more recently, as the gas has become the feedstock for petrochemical plants, is

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1/ In the petroleum industry, a world-scale refinery's capacity is in the neighborhood of 100,000 barrels per day or more, but the economics of producing petrochemicals from refinery byproducts varies from one chemical to another.

2/ These are average f.o.b. prices of U.S. imports, reported in U.S. Department of Energy, Monthly Energy Review, Oct. 1984. The average landed price at U.S. ports was about $1.03 per barrel higher.

3/ Hydrocarbon Processing, March 1985, p. 15.

4/ Industry sources and, for Mexico, Department of State, January 1985.

5/ The Economist, May 18, 1985, p. 76.

mainly associated with the cost of piping and pumps to get it from numerous well locations to the petrochemical producing sites. In Saudi Arabia, the Government makes it available at about 50 cents per 1,000 cubic feet compared with a price of almost $3.00 in the United States. ($3.00 natural gas is equivalent to about $18-per-barrel crude petroleum.) The price of natural gas in Mexico is about midway between these prices. In Venezuela, natural gas for an iron ore reduction plant is reportedly priced at only 23 cents per 1,000 cubic feet. 1/

Although natural gas can be and is readily transported overland in international trade by pipeline, ocean transportation entails major expenditure, beyond the collection network, for liquefaction plants and specialized tanker vessels. Therefore, most countries prefer to collect most of their natural gas and pipe it to a centralized location to be separated into its components--methane, ethane, and heavier fractions--which can be turned into primary petrochemicals such as ethylene, methanol, ammonia, and their derivative chemicals, such as intermediates and plastics, which are more easily shipped to markets in both developing and developed nations. Because crude petroleum wells (with their associated natural gas) are widely spread over their producing regions, flaring of some unused natural gas will continue into the future with little change according to industry sources. The following tabulation gives production of natural gas in billions of cubic feet and the percent that is or will be recovered for useful purposes: 2/

Source	1979	1984	1990
Middle East:			
Iran, Saudi Arabia, Kuwait and others billions of cubic feet--	1,985	1,780	2,020
Percent recovered	38	62	65
Latin America:			
Mexico, Argentina and others billions of cubic feet--	2,000	2,790	3,290
Percent recovered	60	72	76
Africa:			
Algeria, Libya, and others billions of cubic feet--	830	1,500	1,950
Percent recovered	21	25	30
Far East:			
Indonesia, Malaya and Brunei, Pakistan and others billions of cubic feet--	-	2,245	2,910
Percent recovered	65	70	-

1/ R. Whipp, Fiorde Venezuela, presentation to American Institute of Chemical Engineers, Washington, DC, April 1985.

2/ T. Manning, of Purvin and Gertz, "Worldwide Resources for Petrochemical Development," presentation to Chemical Marketing Research Association, Mar. 11-14, 1985. See app. D for additional details.

In the Middle East, some countries with large gas reserves have built petrochemical plants to utilize all or most of the associated gas expected from forecasted crude petroleum production. When petroleum production had to be restricted in OPEC countries at the beginning of the current petroleum surplus period in the early 1980s, Saudi Arabia and Kuwait ran short of natural gas. Kuwait's fertilizer plants could produce at only 60 percent of capacity in 1982-83. In 1984, Saudi Arabia was producing and storing petroleum that it could not sell just to get the associated gas. Because nonassociated gas in the region is plentiful in some states, such as Qatar and the United Arab Emirates, the Gulf Cooperation Council reportedly plans a gas pipeline network linking the six states. 1/

The world's reserves of natural gas, in terms of energy content, are about 80 percent as large as those of crude petroleum. However, the distribution of the gas reserves is far different; more than 40 percent are in the U.S.S.R. and the United States is second in rank. Twelve countries, including seven developing countries, hold 70 percent of the world's proved reserves of natural gas, measured in trillions of cubic feet as shown in the following tabulation: 2/

U.S.S.R----------	1,450	Netherlands----------	68
United States----	198	Venezuela----------	55
Saudi Arabia-----	123	Malaysia----------	50
Algeria----------	109	Indonesia----------	40
Canada----------	92	Nigeria----------	36
Norway----------	89	Total----------	2,387
Mexico----------	77	Total----------	3,402

The importance of the cost of natural gas used as a chemical feedstock, and of the location of the source of the natural gas, is illustrated in a recent industry study. The study compares production economics of methanol plants in developed countries with those in developing areas where large amounts of natural gas are available. 3/ These estimates are for 600,000 metric tons per year plants, as follows:

1/ The Washington Post, Jan. 15, 1984, p. G-5; "Oil and the Gulf," The Economist, July 28, 1984, p. 39 of the special survey.

2/ Oil and Gas Journal, Dec. 31, 1984, p. 87.

3/ R.E. Simmons, Tenneco Oil Company, presentation to Chemical Marketing Research Association, Mar. 11-14, 1985.

Source	U.S. Gulf plants	Plants in Western Europe	Plants in developing countries
Investment----------million dollars--	200	200	300
Feedstock--Natural gas cost:			
Natural gas----------per million Btu--	$3.00	$4.00	-
Flare gas----------do----	-	-	$0.50
Production cost:			
Gas cost----------per metric ton--	$100.00	$133.00	$17.00
Conversion cost----------do----	27.00	27.00	32.00
Sales and administrative cost----------do----	10.00	10.00	14.00
Terminalling cost----------do----	8.00	8.00	13.00
Depreciation and finance changes-------do----	22.00	22.00	33.00
Total, f.o.b. plant----------	167	200	109

The developing country producers with low-cost gas obviously have the initial cost advantage, even with a higher price for all other production cost factors except raw materials. This should serve them well in much of the world's export market. But, as described in a later section, the world methanol market has much excess capacity, and its great but as yet unrealized potential lies in the market for blends with, or as a substitute for, gasoline. The gasoline market is mostly in the United States and Western Europe, and in those countries the cost picture changes somewhat for methanol from the plants in developing countries, as shown in the following tabulation (in dollars per metric ton): 1/

Cost item	U.S. Gulf, for fuel	U.S. Gulf, for chemical use	Western Europe
Freight----------	36	36	30
Tariff----------	0	18	17
Plant f.o.b. cost----------	109	109	109
Total delivered (c.i.f.) cost---------	145	163	156

Finally, if the selling price is set to yield a 20 percent before-tax return on invested capital, the "required" selling prices for the three regions' producers would include this return on investment--$67 per metric ton for the U.S. and Western European plant and $100 for a remote area plant. Overall, for delivery to the United States and Western Europe, the plants in developing

1/ Ibid. with U.S. duty adjusted to 18.4 percent ad valorem.

countries are seen to lose all or most of their production cost advantage, as shown in the following tabulation (in dollars per metric ton):

Cost, profit, and price	Methanol delivered to United States and Western Europe			
	U.S. plants	Plants in Western Europe	Remote plant	
			To U.S. Gulf	To Europe
Plant cost	$167	$200	$109	$109
Freight and duty (fuel or chemical)			36 or 54	47
Return on investment	67	67	100	100
"Required" selling price	234	267	245 or 263	256

One final adjustment would be for delivery to the U.S. east coast, for example, in which freight would be added to the U.S. output and some portion might be subtracted from the offshore producers' freight. In any case, the United States and Western European producers, after all economic factors are considered, are at less of a competitive disadvantage in their own market areas than might initially be supposed.

A comprehensive study of comparative economics of production of primary petrochemicals is included in a recent report of the U.S. International Trade Commission. 1/

Reserves, production, and refining capacity, by region

Table 9 summarizes regional data for reserves of both natural gas and crude petroleum, refining capacity for crude petroleum in 1984, and production of petroleum and natural gas in 1984.

Table 9 shows that Mexico and South America had about 12 percent of the world's reserves of crude petroleum and 5 percent of natural gas reserves in 1984, 5 percent of natural gas production, 11 percent of crude petroleum production, and 7 percent of crude petroleum refining capacity. As shown in the following tabulation, while Mexico and Venezuela have most of the Latin American reserves and production, nine other countries have appreciable reserves and production and more than half of the petroleum refining capacity of the region. 2/ Only four small countries and territories in South America have no significant activity in either oil or gas.

1/ U.S. International Trade Commission, Potential Effects of Foreign Governments' Policies of Pricing Natural Resources, USITC Pub. 1696, May 1985.

2/ See App. D for additional details.

Table 9.--Natural gas and crude petroleum: Proved reserves and refining capacity as of January 1985, natural gas and crude petroleum production in 1984, by sources

Source	Natural gas		Crude petroleum		
	Reserves	Production	Reserves	Production	Refining capacity
	Billions of cubic feet		Million dollars	Million barrels per day	
Developing countries:					
Mexico and South America	174,351	3,239	82,275	6.05	5.20
Caribbean and Central America	10,580	123	1,041	.18	1.68
Middle East	869,355	1,533	398,381	11.42	4.05
South Asia	37,930	474	3,610	.59	.94
East Asia	103,752	1,302	13,228	1.99	3.70
Africa	186,826	1,629	55,426	4.67	2.04
Europe and Oceania 1/	11,100	1,280	344	.04	.77
Total developing	1,393,894	9,580	554,305	24.94	18.38
United States	198,000	18,068	27,300	8.75	15.40
Other developed countries	322,731	10,060	32,962	5.48	23.24
Nonmarket economies	1,487,400	21,654	84,100	14.97	17.50
World 2/	3,402,025	59,932	689,667	54.09	74.91
Developing market economy countries as percent of world	41	16	80	46	25

1/ Romania and Yugoslavia not included in crude petroleum statistics; they are in the nonmarket economy group.

2/ Because of rounding, figures may not add to totals shown.

Source: Oil and Gas Journal, Dec. 31, 1984, p. 87, and International Petroleum Encyclopedia, 1985, p. 286.

Source	Natural gas		Crude petroleum		
	Reserves	Production	Reserves	Production	Refining capacity
	Billions of cubic feet		Million barrels	Million barrels per day	
Mexico	77,000	1,373	48,600	2.74	1.27
Venezuela	55,370	610	25,840	1.72	1.22
9 other countries 1/	41,980	1,256	7,835	1.59	2.71
4 other countries or territories 2/	-	-	-	-	-
Total	174,350	3,239	82,275	6.05	5.20

1/ Argentina, Brazil, Ecuador, Colombia, Peru, Chile, Bolivia, Uruguay, and Paraguay.
2/ Suriname, Guyana, Falkland Islands, and French Guiana.

Caribbean and Central American countries are a small percentage of the total. Trinidad and Tobago had almost all the reserves and production, but only 18 percent of the region's refining capacity. Other leading countries with petroleum refineries are the Netherlands Antilles, the Bahamas, and 11 other countries. Eight countries reported no activity. Guatemala has begun to produce a small quantity of natural gas. It has been announced that a large refinery in the Netherlands Antilles will be closed.

The Middle East countries account for 57 percent of the world's reserves of crude petroleum and more than one-fourth of the reserves of natural gas, but only 2.5 percent of gas production (in 1984) and about one-fifth of the crude petroleum production. Of the 14 countries, only Lebanon, Jordan, and North and South Yemen had no reserves as of January 1985. All the countries but North Yemen did some refining in 1984. Saudi Arabia, Kuwait, Iran, Iraq, and the United Arab Emirates had most of the petroleum reserves, production, and refining capacity. In natural gas, Iran, Saudi Arabia, Kuwait, and the United Arab Emirates have most of the reserves, and in 1984, Iran, the United Arab Emirates, and Saudi Arabia led in gas production.

In the South Asian countries, gas reserves, split equally between India and Pakistan, are only 2.7 percent of the total for all developing countries. Petroleum reserves of the region, almost all of which are in India, are less than 1 percent of the developing countries' total. The South Asian countries produced 5 percent of the natural gas that was produced by developing countries in 1982, and 2 percent of the developing countries' crude petroleum. Of the eight countries six have oil refineries, whose capacity--mostly India's--was 5 percent of the total in 1984.

In the East Asian countries, gas reserves are 7 percent and petroleum reserves 2 percent of the total for developing countries. The East Asian

countries produced 14 percent of the gas and 8 percent of the petroleum in 1982 and 1984, respectively. Their oil refining capacity was 20 percent of the total for developing countries and was located principally in Singapore, Korea, Indonesia, and Taiwan. All of the nine countries except Hong Kong had some refining capacity.

In Africa, most of the crude petroleum reserves--10 percent of the total for developing countries--are in the five North African countries located along the Mediterranean, followed by Nigeria. Fifteen African countries have some petroleum reserves, and 24 have refining capacity. These countries produced 19 percent of the developing countries' crude petroleum in 1984. In natural gas, Africa has 13 percent of the reserves and 17 percent of the production (1984) in developing countries, more than half of which is located in Algeria alone.

In Europe, Romania was a major source of crude petroleum and natural gas in the early days of the industry and still produces significant quantities. Turkey has small reserves and production of crude petroleum and natural gas, and all of the European countries have refining capacity.

Mineral and Agricultural Resources

Chemicals derived from agricultural sources and minerals other than petroleum and natural gas have accounted for about 25 percent of the total value of chemical production (not including allied products) in the United States in recent years, and this percentage probably is approached in the rest of the world.

Minerals

The leading minerals, their uses, and some of the developing countries that produce them are listed later in this section. Most of these minerals, unlike petroleum, tend to be competitively priced close to their cost of production. During the recent recession, many of the mines and processing plants for potash, phosphate rock, alumina, sulfur, titanium ore, and soda ash were closed. With the economic recovery of most of the world, many of these mines have reopened, and some minerals, such as titanium ore and sulfur, have come close to being in short supply, but some minerals have yet to recover economically. Developing countries with major or significant shares of world production include the following:

Alumina and bauxite-----	Jamaica, Suriname, Yugoslavia
Antimony oxide----------	Bolivia, China
Arsenic-----------------	Mexico
Boron-------------------	Turkey
Bromine-----------------	Israel
Chromite ore------------	Zimbabwe, Turkey, India
Cobalt ore--------------	Zaire
Fluorspar---------------	Mexico, China, Thailand
Iodine------------------	Chile

Mercury	China, Algeria, Mexico
Phosphate rock	Morocco
Potash	Israel
Soda ash	Romania
Strontium concentrate	Mexico, Turkey
Sulfur	China, Mexico
Titanium concentrate	Malaysia

Despite continuing softness in the market for phosphate rock, Morocco is constructing the largest phosphate fertilizer plant in the world. Due on stream in 1986-87, it will have the capacity to produce nearly 2 million tons per year of ammonium phosphates and triple superphosphate. 1/

Coal is an important source of chemicals through utilization of the coal tar that is produced as a byproduct of coke. The United States, U.S.S.R., China, Poland, and four other developed countries hold 92 percent of recoverable coal reserves and accounted for 80 percent of production (1980-83 data). However, at least 20 developing countries are mining coal in significant quantities, including India, Korea, Taiwan, Yugoslavia, Brazil, Mexico, Pakistan, and Colombia. Colombia, in a $3 billion joint venture with a U.S. firm, is rapidly developing large resources and associated port facilities and plans to be exporting 15 million metric tons per year of steam coal by 1989. 2/ In future decades, when petroleum and natural gas reserves will reportedly dwindle, coal, coal tar, and coke may again become the prime raw materials for ammonia, methanol, and cyclic intermediates, as they were for 20 years prior to World War II.

Nearly all developing countries produce at least some of their chemical-based consumption requirements such as soap, paint, fabricated plastics and rubber products, mixed fertilizers, simple pharmaceuticals, and cosmetics. Facilities to produce these products in the developing nations generally are simply constructed and operated and non-capital-intensive, and employ simple technology. Their chemical raw materials can be imported or produced locally.

Beyond the simplest chemical operations, the presence of certain natural resources has enabled many developing countries to succeed in establishing profitable chemical businesses, both for internal consumption and export. The chemically important ores and mineral resources include petroleum, natural gas, and coal as sources of organic chemicals and products, and, for inorganic chemicals, the minerals that are most important as sources of chemicals are based on the following chemical elements: aluminum, antimony, arsenic, boron, bromine, chlorine, chromium, cobalt, fluorine, iodine, mercury, phosphorus, potassium, sodium, strontium, titanium, and "rare earth" minerals such as monazite, which contains thorium, cerium, and other such elements. Limestone, for calcium and magnesium, is present in almost every country. Iron, copper, zinc, and other metal ores are also important for chemicals.

1/ Hydrocarbon Processing, September 1984, p. 40.

2/ U.S. International Trade Commission, "The Position and Competitiveness of the United States in World Coal Trade, USITC Pub. 1772, October 1985; and Forbes, Oct. 7, 1985, p. 8.

Table 10 shows the developing countries that lead in producing most of the above-named ores and minerals, along with the United States.

Agricultural sources

Animal and vegetable fats and oils, carbohydrates such as starch and sugar, wood products such as cellulose and naval stores, casein from milk, and tropical and other vegetation are major sources of chemicals in developing countries. Crops from temperate regions, such as corn and soybeans, are also major sources of chemicals, but these are dominated by the developed countries.

Pharmaceuticals.--Prior to World War II, the pharmaceutical industry was based mostly on biological products, but since then the most notable developments in medicinal chemicals have been synthetic organic chemicals--antibiotics, other antiinfective agents, central nervous system depressants and stimulants, and gastrointestinal agents (mainly choline chloride). Yet the principal active ingredient of fully 25 percent of all prescription drugs sold is extracted directly from plants, a percentage that translated into an $8 billion market share in 1980. The figure for nonprescription drugs is much higher. Some 7,000 medical compounds in the modern Western pharmacopoeia are derived from plants; they include oldtimers like quinine, derivatives of curare and other alkaloids, ipecac, digitalis, cortisone, and reserpine. 1/

Other products.--Pyrethrum has been a leading insecticide for decades. Being non-toxic to warm-blooded life, it can be used in dairy barns and on vegetables up to the time they are picked. Kenya is the source of two-thirds of the world supply, but, because of competition from synthetic insecticides, production is half of what it was some years ago.

Natural rubber production, which is about half that of synthetic rubber, has been boosted by the necessity for its use in radial tires. Malaysia, Indonesia, and Thailand account for nearly 80 percent of world supplies, which were 4 million metric tons in 1983. Prices of natural rubber were declining throughout 1984, and, in Malaysia, palm oil, with higher yields and profitability, supplanted rubber as the major crop. 2/

Production of vegetable oils, along with animal fats, amounted to 62 million metric tons in 1982 compared with 31 million metric tons in 1962. It can be expected to continue to grow in coming years especially in developing countries because, although annual per-capita consumption in developed countries has stabilized at about 35 kilograms, it is less than 10 kilograms per capita in most developing countries. Developing countries are the main source of many of these oils, 85 percent of which are consumed in food products. The remaining 15 percent go into chemical industry products, such

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1/ "Modern drugs from folk remedies," Chemical Week, Feb. 27, 1985, p. 52; and "Rain Forests," The New Yorker, Jan. 14, 1985, p. 61.

2/ Colin A. Houston and Associates, Chemical Marketing Research Association presentation, May 1984; "Rubber--No Bounce," The Economist, Nov. 24, 1984; Barron's, Jan. 21, 1985.

Table 10.—Selected minerals and ores: Production, by the United States and principal developing countries, 1983

(In thousands of short tons)

Country	Alumina from bauxite	Antimony oxide	Arsenic trioxide	Boron minerals	Bromine	Chromite ores	Cobalt ore	Fluorspar (calcium fluoride)
United States	4,440	1	1/	1,303	185	2/	2/	61
Algeria	2/	2/	2/	2/	2/	2/	2/	2/
Argentina	2/	2/	2/	153	2/	2/	2/	27
Bolivia	2/	12	2/	2/	2/	2/	2/	2/
Botswana	2/	2/	2/	2/	2/	2/	2/	2/
Brazil	660	2/	2/	2/	2/	310	2/	66
Chile	2/	2/	2/	2/	2/	2/	2/	2/
China	880	11	2/	30	2/	2/	2/	528
Christmas Island	2/	2/	2/	2/	2/	2/	2/	2/
Colombia	2/	2/	2/	2/	2/	2/	2/	2/
Cyprus	2/	2/	2/	2/	2/	11	2/	2/
Egypt	2/	2/	2/	2/	2/	2/	2/	2/
Guatemala	2/	2/	2/	2/	2/	2/	2/	2/
Guinea	660	2/	2/	2/	2/	2/	2/	2/
India	495	2/	2/	2/	2/	400	2/	20
Israel	2/	2/	2/	2/	77	2/	2/	2/
Jamaica	2,090	2/	2/	2/	2/	2/	2/	2/
Jordan	2/	2/	2/	2/	2/	2/	2/	2/
Kenya	2/	2/	2/	2/	2/	2/	2/	88
Korea	2/	2/	2/	2/	2/	2/	2/	2/
Madagascar	2/	2/	2/	2/	2/	100	2/	2/
Malaysia	2/	2/	2/	2/	2/	2/	2/	2/
Mexico	2/	2	5	2/	2/	2/	2/	667
Morocco	2/	1	2/	2/	2/	2/	1	70
Namibia	2/	2/	1	2/	2/	2/	2/	2/
Nauru	2/	2/	2/	2/	2/	2/	2/	2/
New Caledonia	2/	2/	2/	2/	2/	100	2/	2/
Pakistan	2/	2/	2/	2/	2/	2/	2/	2/
Peru	2/	1	2	14	2/	2/	2/	2/
Philippines	2/	2/	2/	2/	2/	365	1	2/
Portugal	2/	2/	2/	2/	2/	2/	2/	2/
Romania	550	2/	2/	2/	2/	2/	2/	2/
Saudi Arabia	2/	2/	2/	2/	2/	2/	2/	2/
Senegal	2/	2/	2/	2/	2/	2/	2/	2/
Sierra Leone	2/	2/	2/	2/	2/	2/	2/	2/
Sri Lanka	2/	2/	2/	2/	2/	2/	2/	2/
Sudan	2/	2/	2/	2/	2/	30	2/	2/
Suriname	1,320	2/	2/	2/	2/	2/	2/	2/
Syria	2/	2/	2/	2/	2/	2/	2/	2/
Thailand	2/	1	2/	2/	2/	2/	2/	283
Togo	2/	2/	2/	2/	2/	2/	2/	2/
Tunisia	2/	2/	2/	2/	2/	2/	2/	38
Turkey	63	1	2/	730	2/	440	2/	2/
Venezuela	616	2/	2/	2/	2/	2/	2/	2/
Yugoslavia	1,210	2	2/	2/	2/	2/	2/	2/
Zaire	2/	2/	2/	2/	2/	2/	16	2/
Zambia	2/	2/	2/	2/	2/	2/	4	2/
Zimbabwe	2/	2/	2/	2/	2/	475	2/	2/
Total world	32,450	53	25	2,450	398	8,921	27	4,741

See footnotes at end of table.

Table 10.—Selected minerals and ores: Production, by the United States and principal developing countries, 1983—Continued

(In thousands of short tons)

Country	Iodine	Mercury	Phosphate rock	Potash	Soda ash (sodium carbonate)	Strontium concentrate	Sulfur	Titanium concentrate
United States	1/	1	14,400	1,574	8,467	2/	10,200	1/
Algeria	2/	2/	300	2/	2/	3	2/	2/
Argentina	2/	2/	2/	2/	2/	1	2/	2/
Bolivia	2/	2/	2/	2/	2/	2/	2/	2/
Botswana	2/	2/	2/	2/	2/	2/	2/	2/
Brazil	2/	2/	1,430	24	210	2/	347	17
Chile	3	2/	2/	2/	2/	2/	152	2/
China	2/	1	2/	28	2/	2/	2,200	2/
Christmas Island	2/	2/	422	2/	2/	2/	2/	2/
Colombia	2/	2/	8	2/	138	2/	2/	2/
Cyprus	2/	2/	2/	2/	2/	2/	2/	2/
Egypt	2/	2/	226	2/	2/	2/	2/	2/
Guatemala	2/	2/	2/	2/	2/	2/	2/	2/
Guinea	2/	2/	2/	2/	2/	2/	2/	2/
India	2/	2/	204	2/	760	2/	165	173
Israel	2/	2/	2/	1,100	2/	2/	2/	2/
Jamaica	2/	2/	2/	2/	2/	2/	2/	2/
Jordan	2/	2/	1,580	188	2/	2/	2/	2/
Kenya	2/	2/	2/	2/	165	2/	2/	2/
Korea	2/	2/	2/	2/	250	2/	2/	2/
Madagascar	2/	2/	2/	2/	2/	2/	2/	2/
Malaysia	2/	2/	2/	2/	2/	2/	2/	209
Mexico	2/	2/	231	2/	440	33	1,796	2/
Morocco	2/	2/	7,100	2/	2/	2/	2/	2/
Namibia	2/	2/	2/	2/	2/	2/	2/	2/
Nauru	2/	2/	715	2/	2/	2/	2/	2/
New Caledonia	2/	2/	2/	2/	2/	2/	2/	2/
Pakistan	2/	2/	2/	2/	120	2/	2/	2/
Peru	2/	2/	2/	2/	2/	2/	2/	2/
Philippines	2/	2/	2/	2/	2/	2/	2/	2/
Portugal	2/	2/	2/	2/	180	2/	126	2/
Romania	2/	2/	2/	2/	1,060	2/	385	2/
Saudi Arabia	2/	2/	2/	2/	2/	2/	880	2/
Senegal	2/	2/	480	2/	2/	2/	2/	2/
Sierra Leone	2/	2/	2/	2/	2/	2/	2/	79
Sri Lanka	2/	2/	7	2/	2/	2/	2/	99
Sudan	2/	2/	2/	2/	2/	2/	2/	2/
Suriname	2/	2/	2/	2/	2/	2/	2/	2/
Syria	2/	2/	413	2/	2/	2/	2/	2/
Thailand	2/	2/	2/	2/	2/	2/	2/	2/
Togo	2/	2/	834	2/	2/	2/	2/	2/
Tunisia	2/	2/	1,870	2/	2/	2/	2/	2/
Turkey	2/	2/	2/	2/	2/	17	2/	2/
Venezuela	2/	2/	2/	2/	2/	2/	2/	2/
Yugoslavia	2/	2/	2/	2/	210	2/	498	2/
Zaire	2/	2/	2/	2/	2/	2/	2/	2/
Zambia	2/	2/	2/	2/	2/	2/	105	2/
Zimbabwe	2/	2/	46	2/	2/	2/	2/	2/
Total world	14	7	42,000	29,530	31,262	121	55,520	3,235

1/ Not available.
2/ Minor source or nonproducer.

Source: U.S. Department of the Interior, Minerals Yearbook, 1983.

as fatty acids and alcohols, fatty amines and esters, and glycerine, the ultimate end uses of which are soaps and detergents, drugs and cosmetics, paints and lubricants, mining, textiles, and plastics. Some vegetable oils--castor, linseed, and tung--are unsuitable for food and are consumed entirely for industrial purposes. 1/

Coconut oil production is concentrated in the islands of the Western Pacific as a smallholder crop and is important in the production of soap and detergents. Castor oil production is concentrated in Brazil and India. Palm oil, production of which is concentrated in Malaysia, is among the highest yielding oil crops known--2.2 to 2.7 tons of oil annually per acre. Palm oil has grown from about 5 percent of the vegetable oils market in 1962 to more than 12 percent in 1984. 2/

Production of oils and fats in 1982, in millions of metric tons, is shown in the following tabulation: 3/

Palm and palm kernel oils----------	6.4
Coconut oil----------	2.9
Soybean oil----------	13.4
Industrial oils (castor, tung, linseed)----------	1.1
Other oils (sunflower, rapeseed, etc.)----------	21.3
Animal fats----------	16.6
Total----------	61.7

Vegetable oil is a renewable resource and will continue to grow in volume while crude petroleum (i.e., mineral oil) will become more scarce. The price of the latter will increase, and vegetable oils may replace petroleum in some end uses such as lubricants, certain petrochemical feedstocks, diesel fuel (in the form of methyl esters and hydrocarbons), and plasticizers, to the benefit of many of the developing countries.

A notable chemical development in Brazil is its huge production from sugar cane of ethyl alcohol, which is substituted for gasoline. When petroleum and natural gas prices increase in future years, Brazil will have the option of substituting ethyl alcohol for ethane and naphtha as a source of ethylene, as was done in the United States in World War II to make ethylene for synthetic rubber production.

Flavor extracts, spice oleoresins, essential oils (e.g., clove, cinnamon, camphor, citronella), perfumery materials, and related products are produced in all regions of the world, both developed and developing. Leading developing-country exporters of these products, generally in the order of their exports to the United States, include Indonesia, Haiti, Brazil, Mexico, Argentina, Peru, Jamaica, India, Malagasy Republic, Paraguay, Egypt, Romania,

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1/ Colin A. Houston, op. cit.
2/ Ibid.
3/ Ibid.

and Guatemala. Production of some of these products is labor-intensive and benefits from low wage rates. (U.S. imports of these materials in 1984 exceeded $200 million, mostly from developed countries.)

Labor

The fact that production labor in the previous production cost tabulation was 6 cents per dollar of sales indicates that an abundance of low-wage labor gives little or no competitive advantage to a developing country in most of the chemical industry's products.

The decline of the labor force with increasing productivity has been another significant factor. In the United States, employment of production workers in the chemical industry declined about 8 percent from 633,300 in 1979 to 584,800 in the first quarter of 1985. Total employment dropped 3 percent from 1,109,300 in 1979 to 1,060,400 during 1979-85 (first quarter). Eighty percent of the employment was in industrial chemicals (organic and inorganic); pharmaceuticals; and cosmetics, detergents, and cleaners. 1/ Productivity improvement also exists in the rest of the world but to an unknown degree.

Capital Investment

The cost-of-construction index for chemical plants in developing countries is often 20-30 percent higher than in developed countries. However, this is only a minor handicap since, for chemicals in non-petroleum-rich countries, the cost of capital, as depreciation, is typically only about 10 percent of sales. In addition, in petroleum-rich countries, the higher capital cost to produce petrochemicals is usually more than offset by cheaper raw materials.

For the Arabian peninsula's countries--the members of the Gulf Cooperation Council--the capital-intensity of petrochemicals has not been burdensome because of their income from exports of petroleum. The individual petrochemical firms benefit from the reportedly low (2-3 percent) interest rates local governments are charging on the loans provided to build the plants. 2/ Some petroleum-rich developing countries have been experiencing capital funding difficulties because their spending commitments have been based on over-optimistic expectations of income from petroleum exports.

Technology

Competitive technology, including patent rights, can be purchased for most commodity chemicals and products, but not for many of the downstream (third and fourth derivative) chemicals and specialty products. In technology, the developing countries are at a disadvantage because of their relative lack of research and development (R & D) activity. The developed

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1/ Chemical and Engineering News, July 15, 1985, p. 13.
2/ The Economist, July 28, 1984, pp. 30 and 40.

countries spend more than 2 percent of GNP on R & D, and their chemical industries surpass that average. In the United States, chemical companies' R & D expenditures in 1984 were 3.5 percent of sales, compared with 3.0 percent for all manufacturing. 1/ The chemical industry is technology-intensive and, as noted by a laboratory director of a prominent U.S. research institute. 2/

> "For many of the sectors in the chemical process industies (CPI), the majority of R & D expenditures (two-thirds to three-quarters) are for improving existing products or for developing new processes to produce existing products.... For most CPI companies, the R & D that supports existing business may in fact be 'nondiscretionary.' If it is not done, the company may not be able to compete in the business on a long-term basis."

This being the case with many products, a developing country can engage a contractor to build a large state-of-the art chemical plant and train its workers but then find with the passage of years that it is no longer process-cost-competitive. One alternative is to encourage investment by, and joint ventures with, the large multinational chemical companies, which should find it worth their while to incorporate process improvements developed by their home-country R & D.

Alternatively, the developing countries for some years have had the objective of being "cut in on the spoils of technological development." Their tactics have included negotiations with developed countries; choosing not to guarantee patent rights or payment of royalties; and/or forcing revocation of a patent, or compulsory license to a third party, when a country decides a patent is not being used or is not yielding benefits. 3/ In general in developing countries, patent life is very short and patent protection is often inadequate. In most, only the process can be patented, not the product. This is a serious handicap in the chemical industry because process patents in chemicals and pharmaceuticals are relatively easy to circumvent. 4/ These practices, in fact, may be counterproductive for chemical products in that they may give little incentive for either domestic or foreign-owned firms to develop new processes, or for foreign-owned firms to bring them into such a country. 5/

1/ "Another Strong Year for R & D Spending," Chemical Week, May 22, 1985, p. 21.

2/ SRI International, Chemical Industries Division Newsletter, September/October 1984, p. 1.

3/ "LDCs Win Some Worrisome Points at Patent Talks," Chemical Week, Nov. 18, 1981, p. 18.

4/ U.S. Department of Commerce, Business America, Mar. 18, 1985, p. 6; Chemtech, May 1985, p. 284.

5/ U.S. International Trade Commission petrochemical report, April 1985, op. cit.

In Korea, for example, only process (not product) patents for chemical compounds are reportedly permitted. Trademark laws are alleged to be weak and enforcement is spotty. 1/ In Mexico, foreign patents and trademarks are not recognized unless registered in Mexico. The life of a patent is 5 years, renewable for additional 5-year periods, but the Government can reassign the right to exploit a patent that is not exploited within 3 years after registration. Moreover, the Law on Inventions and Trademarks prohibits patent protection on chemicals, pharmaceuticals, and pesticides. Processes for manufacturing these chemical products are also unpatentable. In the section on counterfeiting, 10 developing countries are named that have been cited by the United States as offering inadequate protection to intellectual property, including patent rights.

Transportation

Chemicals, their products, and their raw materials are shipped across national borders in bulk mostly as liquids and liquefied gases, but some as solids. Some developing countries benefit from location on a seacoast and along major shipping lanes. The East Asian countries, situated on shipping routes between Japan and the Middle East and Europe, are examples of this. Morocco and other North African countries benefit from proximity to Europe. Brazil has the seacoast location but has paid considerably more than the United States to ship its products to Europe because of fewer and smaller ship sailings and shipments. 2/

Table 11 shows a sampling of shipping rates for various quantities and routes in early 1985, which was a depressed period for the shipping industry. For comparative purposes, the unit values of most of the chemicals in the upper part of the table were probably around $550 per metric ton, and those for ammonia, ethylene, vinyl chloride, and propane and butane (LPG), probably ranged from around $200 (ammonia) to $400 (vinyl chloride) per metric ton. Shipping rates for petroleum and products are also included for comparison.

A recent U.S. International Trade Commission study gives much information on cost of transportation of petrochemical feedstocks and primary products. 3/

DEVELOPING GOVERNMENT INVOLVEMENT IN THE CHEMICAL INDUSTRIES OF DEVELOPING COUNTRIES

Government Ownership

As discussed previously, most of the developing countries did not achieve independence until the 1950s and 1960s, at which time they lacked sufficient capital and technology in their private sectors to enter complex and capital-intensive industries like chemicals, where for many products the economy of scale is important and exports can, therefore, be a necessity. Government ownership in basic industries has been viewed as necessary and

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1/ U.S. International Trade Commission, Targeting, op. cit., pp. 138 and 216.
2/ European Chemical News, Jan. 3, 1983.
3/ U.S. International Trade Commission, Petrochemicals, May 1985, op. cit.

Table 11.--Petrochemicals: Shipping rates and quantities, by routes, early 1985

Route	Quantity	Shipping rate
	Metric tons	Per metric ton
Liquids--easy to ship:		
U.S. Gulf to Taiwan	4,500	$38
U.S. Gulf to Taiwan (acrylonitrile)	2,500	43
U.S. Gulf to Japan	5,000	37
U.S. Gulf to Japan	2,500	40, 47
U.S. Gulf to western Mediterranean	2,000	28
U.S. Gulf to Italy	2,000	33
U.S. Gulf to Rotterdam	2,500	24, 28
U.S. Gulf to Rotterdam	5,000	18
Rotterdam to U.S. Gulf	2,500	16
Le Havre to U.S. Gulf	5,500	18
Rotterdam to U.S. east coast	1,000	20
Rotterdam to U.S. east coast	5,000	14
Crude oil, Persian Gulf to United States	200,000 to 300,000	7.50
Refined petroleum products, Persian Gulf to Europe or Far East	30,000 to 60,000	20
Gases, liquefied--hard to ship:		
U.S. Gulf to Brazil (vinyl chloride)	3,000	52
U.S. Gulf to Korea (vinyl chloride)	9,000	67
U.S. Gulf to Denmark (ammonia)	20,000	26
U.S. Gulf to Venezuela (butane)	5,000	37
Mexico to U.S. Gulf	6,800	17
Algeria to Korea (LPG) 1/	40,000	17
Algeria to United Kingdom (ethylene)	2,350	73
United Kingdom to India (ammonia)	8,000	17

1/ LPG is liquefied petroleum gas.

Source: European Chemical News, Apr. 1, 1985, p. 12.

desirable. 1/ Also, industry observers have indicated that for "infant" industries in developing countries, unless foreign investment is permitted, the initial plants almost need monopoly status if they are to survive, and many countries feel that monopolies should not be in private hands. 2/ In developing countries with mineral resources, especially petroleum, government ownership of companies that exploit these resources is almost universal, and includes downstream manufacturers such as producers of primary petrochemicals (e.g., ethylene, propylene, benzene). Even in countries lacking crude-petroleum resources, the government often owns the petroleum refining and primary petrochemical operations.

Table 12 is a list of some Government-owned companies in the chemical sector; nearly all of the listed petroleum companies also produce petrochemicals. In fact, in many countries they are the only producers of some basic petrochemicals. These, of course, are a small fraction of government-owned companies overall. In Mexico, for example, the State owns 550 companies (in all industries) and, in Argentina, 118 State-owned companies employ about a quarter of the working population and spend roughly 40 percent of the country's GNP. 3/ In Brazil, measured by sales of chemicals and petrochemicals of the top 20 firms in this sector, 81 percent of the industry was Government-owned, 11 percent was foreign-owned, and 8 percent was private Brazilian firms, in 1981. 4/

Government Assistance

Government assistance in developing countries generally takes the form of import protection and investment incentives. Typically in a developing country, a product not domestically produced is imported duty-free while the government offers inducements to potential manufacturers to build a plant to make it. One of the inducements is import protection for the infant industry until it grows to cost-competitive stature. Therefore, when domestic production begins, high duties and other import barriers may be imposed to deter imports of competing products.

Investment incentive programs apply to the private sector and are intended to expand production and stimulate economic growth. They may be defined as government measures to attract and enable domestic or foreign firms to invest in industrial establishments in the given country or in certain regions of the country. In many cases the incentive measures that have been adopted are mainly concerned with removing restrictions and regulations that have heretofore limited such growth. Many countries indebted to the International Monetary Fund, for example, have restricted imports. This has

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1/ U.S. International Trade Commission, Petrochemicals, op. cit. See app. E for additional details on certain developing nations.

2/ The Economist, Feb. 16, 1985, p. 67.

3/ Ibid.

4/ U.S. International Trade Commission, "Foreign Industrial Targeting and Its Effect on U.S. Industries," Phase III, January 1985.

Table 12.--Government-owned companies: Principal products and sales, 1983-84

Company and location	Principal products	Sales	
		1983	1984 1/
		--Million dollars---	
Petromin (Saudi Arabia)	Petroleum	2/	2/
Petroleos Mexicanos (PEMEX)	Petroleum	14,814	16,651/19,405
Kuwait Petroleum Co. (KPC)	Petroleum	12,152	13,591/14/997
Petroleos de Venezuela (PDV)	Petroleum	11,636	13,598
Petrobras (Brazil)	Petroleum; fertilizers; ethyl alcohol exports.		9,974/17,087
Indian Oil	Petroleum	8,300	8,544
Turkey Petrolleri (Turkey)	Petroleum		4,180
Fabricaciones Militares (Argentina)	Weapons, petrochemicals, timber, construction	2,200	2/
Petrogal (Portugal)	Petroleum	1,848	2,161
Hindustan Petroleum (India)	Petroleum	1,940	1,978
ECOPETROL (Colombia)	Petroleum	1,320	1,680/1,907
Philippine National Oil	Petroleum	1,914	1,240
Empresa Nacional del Petroleo (Chile)	Petroleum	2/	1,416
PETROPERU (Peru)	Petroleum	2/	1,310
Pakistan State Oil	Petroleum	839	912
Israel Chemicals Ltd	Chemicals	2/	716
Madras Refineries (India)	Hydrocarbons	648	580
Indian Petrochemicals	Chemicals	371	2/
Quimigal (Portugal)	Chemicals, fertilizer	316	362
National Fertilizers (India)	Fertilizers	299	369
Yacimientos (Bolivia)	Petroleum	258	2/
Rashtriya Chemicals and Fertilizers (India)	Fertilizer, chemicals	248	369
Gujarat State Fertilizers (India)	Fertilizers	157	178
Chinese Petroleum Corp. (Taiwan)	Petroleum	2/	5,943
Pertamina (Indonesia)	Petroleum	2/	2/
Nigerian Nation Petroleum Operation (NNPO)	Petroleum	2/	2/
National Energy Corporation of Trinidad and Tobago	Petroleum, natural gas	2/	2/
Petroleum Authority of Thailand (PTT)	Petroleum	2/	2/
Office Cherifien des Phosphates (OCP, in Morocco)	Phosphate chemicals	2/	2/

1/ Where 2 numbers are shown, the larger is from the Fortune source.
2/ Not available.

Source: Business Week, July 23, 1984, pp. 160-182, and July 22, 1985, pp. 150-176; Fortune, Aug. 19, 1985, pp. 183-211; Forbes, July 29, 1985.

led to a need for increased local investment because of a heightened interest in producing goods that were formerly imported. 1/

The practices in certain nations are discussed below to illustrate how government assistance affects industrial development. The nations chosen were picked because of the availability of public domain information on their practices and because they have been studied in previous Commission studies.

Taiwan

In Taiwan, development of a chemical industry ranked high in priority and, by 1980, Taiwan was the largest producer of chemicals in Asia other than Japan and China. Being still a net importer of chemicals, Taiwan encourages investment in 67 chemicals and petrochemicals with low-interest loans, duty-free importation of equipment, and tax incentives, including 5-year tax holidays or accelerated depreciation. 2/ The ceiling on taxes is limited to 22 percent of taxable income. Examples of the items entitled to these benefits include olefins, paraffins, phosgene, fluorocarbons, serums and vaccines, synthetic dyes and pigments, cyclic intermediates, plastics, and hydrogen fluoride. In addition to these incentives, Taiwan's Petrochemical Stabilization Fund allegedly grants subsidies to the state-owned producer of primary petrochemicals--i.e., ethylene, propylene, butadiene, benzene, and xylenes, which are the raw materials for other companies' production of petrochemicals--when necessary to make this producer price-competitive with possible imports. 3/ Also a state-financed research institute helps local manufacturers maintain quality and solve operational problems, and their expenditures on research and development are tax-deductible. These incentives apply equally to domestic and foreign-owned firms. Only the primary petrochemicals--ethylene, propylene, butadiene, benzene, toluene, and xylene--are made exclusively by the state-owned Chinese Petroleum Co. Other chemicals and petrochemicals are open to all comers. 4/

In recent years, competition has increased from petrochemicals made from natural gas liquids in the United States and from all sources in energy-rich countries, which have had lower production costs than naphtha-based chemicals in Taiwan and other non-petroleum-rich countries. Taiwan has taken several steps to cope with this problem. In 1981, as the cost of Taiwan's locally produced petrochemicals climbed above the prices of imported petrochemicals, the Government reduced the number of import licenses in order to force local users of petrochemicals to buy enough local product to keep the domestic industry operating. Conversely, the Taiwan Government could (and did) subsidize production sufficiently so that prices of domestic petrochemicals could be competitive with imports. 5/ Also, the Government has maintained a

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1/ Business Week, Oct. 1, 1984, p. 75.
2/ Nonclassified communications from The American Institute in Taiwan, March and May 1985.
3/ Ibid.
4/ Ibid.
5/ Journal of Commerce, October 1981; and Chemical Week, May 21, 1980.

"petrochemical stabilization" fund to help Chinese Petroleum Corp. (CPC) with its supply of primary petrochemicals. When production costs are higher than prices of potential imports, a subsidy is granted from the fund to CPC to make it competitive. 1/ This enables the downstream chemical producers to be competitive in both the domestic and the export markets. For all types of domestically produced commodities, Taiwan imposes a number of tariff and nontariff barriers on imports, including the following: 2/

- o A customs valuation "uplift" of 10 percent added to the c.i.f. value of imported goods. This had been 15 percent prior to 1983, and is expected to drop to 5 percent, then zero, in 1985, concurrent with implementation of a value-added tax.

- o Customs duties are relatively high, exceeding 100 percent for many common consumer goods, and are also very high for machinery, word processors, and packaged foodstuffs.

- o Import bans and other non-tariff barriers are applied to chemicals, pharmaceuticals and industrial (including chemical) intermediates. De facto import bans are implemented either by administrative order or by the simple expedient of denying import permits.

- o Importation of pharmaceuticals has been made difficult by the fact that Taiwan does not accept safety standards and certifications of the U.S. Food and Drug Administration. Vitamins and nonprescription drugs are subject to strict registration and labeling procedures that, in some cases, can serve as trade barriers.

To promote exports, in addition to the aforementioned incentives to producers of petrochemicals, the following incentives are available to exporting firms. 3/

- Business taxes are not applied to export sales.
- The enterprise may set aside a tax-free reserve for foreign exchange losses.
- The enterprise may set aside a tax-free reserve (up to 1 percent of prior year's export sales) for losses arising from exporting.
- Stamp taxes are reduced from 0.4 percent to 0.1 percent.
- The allowable income tax deduction for entertainment expenses is increased for export firms.
- A commodity tax, ranging from 3 to 120 percent ad valorem, is levied on 19 types of commodities. This tax is rebated if the goods are used in the manufacture of export items.

1/ American Institute in Taiwan, March 1985.
2/ U.S. Department of Commerce, Business America, Oct. 1, 1984, pp. 29-30.
3/ U.S. International Trade Commission, Targeting, op. cit., pp. 49, 212-214, and 244.

Brazil

In Brazil, the Council of Industrial Development (CDI) is a principal agency used by the Government to control investments. It has the responsibility of awarding tax incentives and tax exemptions on imported products and equipment and of facilitating financing arrangements to approved industries. Most CDI incentives are directed to Brazilian-owned firms. The agency insists that projects result in a net favorable balance of exports over imports. The incentives package can include (a) reduced imports duties, (b) reduced border taxes on imports, (c) a waiver of prior deposit on imports, (d) access to official subsidized credits, (e) exemption from certain value-added taxes for the purchase of domestically produced capital goods, and (f) allowance of accelerated depreciation for income tax purposes for the use of domestic equipment. 1/

Brazil, by far the largest Latin American country, has had some success in meeting the IMF export and import requirements. In chemicals, the negative foreign trade balance grew from -$1.5 billion in 1975 to about -$2.5 billion in 1980. Since then, imports have been reduced and exports increased to achieve a foreign trade surplus in 1984. This was the result of Government action. 2/ The cutback of imports was by Government fiat and had an unfortunate side-effect in that many chemical producers ran short of raw materials needed to run their plants. 3/ The surge in exports--mainly basic chemicals, plastics, synthetic fibers, detergents, and rubber--was stimulated by price controls in the domestic market. The success of the program led to relaxations of curbs on imports and price levels in 1984. Argentina and Venezuela have been following a similar strategy. 4/

Brazil's policies to protect local production and promote exports are illustrated by recent events in its rubber industry. A producer of natural rubber since the early 1800's, Brazil is also a major producer of tires. When the superiority of radial tire technology was acknowledged in the mid-1970s, and its original developer was granted permission to produce radial tires in Brazil, it was necessary to import new tire-making machinery that could not be produced locally at the time. To avoid the very high duties on the machinery, the new tire producer and the three leading firms already established in Brazil--all subsidiaries of large multinational companies-- negotiated agreements with the Government under Brazil's BEFIEX plan, 5/ whereby fiscal exemptions are granted on a country's imports in exchange for a commitment to export a given amount in a specified time. In this case, one company agreed to export one-third of its production for 10 years; another to export $770 million of merchandise over a 10-year period; and a third to export $1.35 billion in 10 years.

1/ U.S. International Trade Commission, Targeting, op. cit., pp. 55, 196.

2/ "Brazil Brings Foreign Trade into Balance," Chemical and Engineering News, Dec. 19, 1983, p. 50; Chemical Week, June 20, 1984, p. 53.

3/ "Brazil's Chemical Firms Face a Cutoff of Supplies," Chemical Week, Oct. 12, 1983.

4/ Chemical Week, June 20, 1984, p. 53; Chemical and Engineering News, Dec. 19, 1983, p. 50.

5/ U.S. International Trade Commission, Targeting, op. cit.

Problems of the tire producers next came with price controls on domestic sales of tires coupled with rising costs of both natural and synthetic rubber raw materials. Brazil produces approximately half of the natural rubber used by its tire industry each year. The price of Brazilian rubber at the end of 1984 was more than double that of natural rubber from Malaysia and other leading rubber producers--7.15 versus 3.2 million cruzeiros per metric ton. However, with imported natural rubber carrying a tax of 30 percent of the f.o.b. price, banking fees, and the Tax for the Organization and Regulations of the Rubber Market, the price of imported rubber in Brazil just equaled the price of the domestic product. With this kind of protection, natural rubber production in Brazil is being expanded, though the tire company profits have been reduced. 1/

Mexico

In Mexico, tax-credit certificates (Ceprofis) are awarded to companies meeting various goals and are issued for the first 5 years of a new investment. They can be used to pay any type of Federal tax. The amount of Ceprofi tax credits for plant and equipment varies from 10 to 20 percent of investment costs, depending on whether they are for a new plant or for expansion. During 1979-81, Ceprofi for chemical products, 1.2 billion pesos, ranked third in value behind those nonmetallic minerals and basic metals. 2/

The Mexican Government has used import licensing more than any other mechanism to achieve protection of the domestic market. 2/ (Tariffs, though sometimes adequate for protective purposes, have served mainly to raise revenue.) Import quotas, or target import levels, have been allocated to products not made in Mexico or for which Mexican production is insufficient. An import permit system encourages payment for imports in currency exchanged at a favorable, controlled-market rate as opposed to payment with currency bought at higher free-market rates. 2/ In the trade agreement negotiations with the United States in April 1985, Mexico promised a complete revision of trade policy and "indicated that it would replace import permits, an insurmountable trade barrier, with tariffs on hundreds of products." 3/

In Mexico, the Fund for Growth of Exports of Manufactured Products (Fomex), a Federal trust fund, subsidizes exports in the short term. Fomex finances both export and import purchases related to preexport activities and import substitution. It also provides risk guarantees for exports. Export sales financing is the largest program. Much of Fomex financing is offered at highly favorable terms. To be eligible for this financing, products must be included on Fomex's list of eligible items and have a minimum of 30 percent local content. The exporter must have commercial risk insurance but need not be a majority Mexican-owned company. In 1983, chemical exports were by far

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1/ Chemical Week, Jan. 2, 1985, p. 53.

2/ U.S. International Trade Commission, Targeting, op. cit.

3/ "A First Step Toward Freer Trade With the U.S.," Business Week, May 6, 1985, p. 61.

the major beneficiaries of Fomex financing, accounting for almost one-quarter of the $1.1 billion of export sales that were so aided. 1/

India

India, with a population in excess of 700 million, is the largest country in Asia except for China, but also one of the poorest. It has substantial debt but few concomitant problems because the funds came from international sources such as the World Bank that lend for long periods at fixed rates rather than from commercial banks at floating rates. Aid to India by the United States in 1984 was $200 million direct and $500 million through multilateral agencies. 2/ India has made great strides in increasing food production, but its progress in manufactures, hobbled by Government restrictions, has been small. 3/ Bureaucratic delays and obstructions in securing investment permits, discouragement of expansion by large companies because of fears of monopoly, barriers to importation of production equipment, and high taxes have all played a part. But on March 16, 1985, the Government announced "a series of sweeping measures aimed at unshackling the private sector and stimulating economic growth." Among the most important new policies are the following: 4/

> Twenty-five industries will no longer be required to seek an industrial license to establish or expand manufacturing capacity. Among these 25 industries are certain drugs and drug intermediates, industrial and medical gases, and soap and cosmetics, including detergents, perfumery and toilet preparations.
>
> The Monopolies and Restrictive Trade Practices Act, which applied to firms with assets of more than 200 million rupees (about 13 rupees per U.S. dollar) and discouraged them from expanding and developing economies of scale, will now apply only to firms with assets exceeding 1 billion rupees--about 50 in number at present.
>
> The maximum corporate tax rate will fall from 55 to 50 percent; the rate for trading and investment companies will fall from 65 to 60 percent; and the rate for companies whose shares are closely held will fall from 65 to 55 percent. Additional 5-percentage-point reductions will occur in 1986 along with reductions in other types of taxes on corporations.

1/ U.S. International Trade Commission, Targeting, op. cit., pp. 49, 212-214, and 244.

2/ Nonclassified communications from American Institute in Taiwan, March and May 1985.

3/ Department of State Bulletin, Feb. 1985, and The Washington Post, Aug. 8, 1984.

4/ Department of Commerce, Business America, Apr. 15, 1985, p. 32; The Economist, Mar. 23, 1985, p. 79.

To improve India's trade competitiveness, the customs duty on imported equipment will be reduced from 65 to 45 percent. It will drop to zero duty on equipment for the fertilizer industry.

Other

Many other developing countries attempt to make the incentives for direct foreign investment attractive enough that potential investing firms are willing to accept the accompanying performance requirements and other restrictions. 1/ Some typical examples are as follows:

Morocco: An associate member of the European Community, Morocco's manufactured goods can enter the Common Market duty free and without limitations on quantities. In addition, it has concluded a network of trade agreements with a large number of African and Arab states that provide considerable potential as export markets. Major economic agreements to improve conditions for U.S. direct investment have been negotiated or concluded, providing basic guarantees, protection, and incentives:

- Agreement for avoidance of double taxation (1977).

- Agreement on investment guarantees with the Overseas Private Investment Corp. (OPIC)--discussed in later section.

- Bilateral investment treaty (initialed 1984).

Incentives to attract foreign investment were augmented by a new, more liberal industrial investment code in 1983. Benefits are granted to investors according to the geographic location of the new industrial facility. the Code allows fully foreign-owned or controlled corporations to set up facilities in Morocco. Equipment bonuses are granted in certain fields. Reimbursement of certain taxes is granted to firms that export. The incentives include the following: 2/

- 10-year corporate income-tax holiday (48 percent).
- Exemption from import duties for machinery and equipment.
- Exemption from product tax (17 percent) levied on capital goods.
- Exemption from business license tax for 5 years.
- Exemption from registration tax on the purchase of industrial land.
- Exemption from stamp tax.

1/ U.S. International Trade Commission, Targeting, op. cit.
2/ U.S. Department of Commerce, Business America, Oct. 1, 1984, pp. 1-8.

- Reduced registration tax on capital investments.
- Guaranteed repatriation of dividends, initial capital, and added value.
- Availability of local financing at subsidized rates-12 percent in 1984.
- Cost-sharing with the government on purchase of industrial land.
- Availability of "blocked currency" at discounted rates.
- Availability of other advantages by special agreement with the government for firms investing more than $5 million in any industrial venture.

Ecuador: Upon the taking of office by a new administration in August 1984, a number of measures were taken to attract foreign investment and technology to achieve economic growth. The government took the unprecedented step for an Andean Common Market country of signing an investment agreement with the U.S. Overseas Private Investment Corp. (after a 13-year absence). Numerous tax incentives have been put in place. Investment terms and benefits are negotiated on a case-by- case basis. Thus, investors may avail themselves of full or partial exoneration from import duties on new machinery and on raw materials. The government offers income-tax deductions for fixed assets and the acquisition of new machinery and equipment. Import trade has been substantially freed of restrictions and import bans have been lifted on most goods, as have prior deposit requirements. 1/

Chile: Foreign direct investment is welcomed, and the government has maintained its nondiscriminatory policy towards foreign investors, who are treated in the same manner as domestic investors. Chile's foreign investment statutes have been said to be the most liberal in Latin America in according guarantees to foreign investors regarding repatriation of profits, access to foreign exchange, and property rights. 2/ A bilateral investment insurance agreement with OPIC was signed in 1983. A charter member of the Andean group, Chile soon withdrew because it wanted to encourage foreign investment.

Countertrade

Countertrade, which has become a favorite mechanism for countries lacking foreign exchange, is essentially the exchange of products for products. In its oldest and simplest form it is known as barter. Other techniques, which can be tailored in a number of ways to meet a country's monetary and trade

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1/ U.S. Department of Commerce, Business America, Apr. 15, 1985.
2/ U.S. Department of Commerce, Business America, June 25, 1984, p. 30.

guidelines, include counterpurchase, compensation, swaps, clearing agreements, switches, and evidence accounts. 1/

Most U.S. chemical companies employing countertrade have found it to be an expensive proposition, adding considerable overhead to the cost of doing business. Not only does the U.S. company have to factor in the cost of prolonged negotiations, but sometimes product quality is noncompetitive. In some cases, buyback commodities have to be refined or upgraded before they can be marketed. Another problem for the U.S. companies is getting their foreign trading partners to offer the kinds of goods that can be readily sold in the United States. The most desirable products from the viewpoint of the U.S. chemical countertrader are those that the developing country can readily sell by itself on the open market, such as petrochemicals, fertilizers, and other large-volume chemicals. However, as might be expected, those countries would rather offer surplus items that they themselves would find difficult to sell. 2/ A detailed examination of the countertrade issue is contained in a recent U.S. International Trade Commission report. 3/

The practice of a U.S. contractor making a sale by creating "offsetting" work in the buying nation had its origin in several projects where fighter plane manufacturers won overseas contracts only after agreeing to allow the importing country to help build the aircraft. More recent is an entirely civilian "offset" in Saudi Arabia. That country's defense system includes U.S.-built Airborne Warning and Control System aircraft (AWACS) supported by a $4 billion not-yet-built electronic communications network, entitled Peace Shield. In addition to the contracts for the military command and control systems, there is provision for the contract winner to provide a $500 million offset of its own money for civilian investments in Saudi Arabia over the next 10 years. Private Saudi interests would match that sum and set up a publicly owned company, managed by U.S. and Saudi executives, to handle joint ventures to implement the projects. 4/

ASSISTANCE FROM DEVELOPED NATIONS TO DEVELOPING COUNTRIES

Investment

Incentives for a company in an industrialized country to move part or all of its production operations offshore to a developing country may include access to local markets, access to key raw materials, and availability of cheap labor, as well as the aforementioned special incentives. Another incentive for U.S. companies to invest offshore has been the recent strength

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1/ "Countertrade, Barter, and Offset," McGraw Hill, Inc., 1985; Chemical Week, Feb. 20, 1985, p. 32.

2/ Chemical Week, Jan. 2, 1985, p. 53.

3/ United States International Trade Commission, "Analysis of Recent Trends in U.S. Countertrade," March 1982, and "Assessment of the Effects of Barter and Countertrade Transactions on U.S. Industries," USITC Pub. 1766, October 1985.

4/ Business Week, Feb. 18, 1985, pp. 138E-138F, and U.S. Department of Commerce, Business America, Mar. 4, 1985, p. 51.

of the dollar, which has raised U.S. production costs for some products to noncompetitive levels in the world market. As a result some companies have completely or partially moved their manufacturing to overseas locations. For example, a leading U.S. chemical company formerly supplied its Latin American market for water-treatment chemicals from facilities in the United States. By the end of 1984 this firm had chosen to supply Latin America from its plant in Europe, where the production cost was less. 1/ Another chemical company closed its U.S. plant and moved the operation to Mexico. Almost every company making such a change attempts to make it potentially reversible in case the dollar falls; however, the companies that have moved offshore are likely to find the change costly to undo if the dollar declines. 2/

Trade Preferences

Trade preferences for developing countries can be traced back to the 1964 UNCTAD meeting at which it was suggested that by reducing tariff barriers facing developing countries, the richer nations could aid the poorer ones in increasing their exports and integrating their economies into the international trading system. 3/ The rationale for granting the tariff preferences was that these countries usually face obstacles not shared by industrial countries. Most developing countries have small local markets that limit economics of scale, and the tariffs in industrial countries, while not high on an average basis, are high on many products that are most important in developing countries' exports. 4/ In an effort to meet these concerns, 20 industrial countries, beginning in 1971, introduced unilateral tariff cuts on developing country exports that have come to be known as the Generalized System of Preferences (GSP). The eligibility requirements, product coverage, and special provisions of the GSP differ from one industrial country to another.

The U.S. GSP program grants duty-free treatment to about 3,000 products, largely manufactured, semi-manufactured, and selected agricultural items, imported from 141 developing countries and territories. 5/ The value of U.S. merchandise imports receiving GSP duty-free treatment was $13 billion in 1984, 3 percent of total U.S. imports. The program also provides for the exclusion of a beneficiary country from GSP eligibility on a product whenever U.S. imports from that country exceed either 50 percent of total U.S. imports of that item or an inflation-adjusted stipulated dollar value--about $64 million in 1984--during the preceding calendar year. 6/ The value of trade so excluded in 1984 amounted to $1.8 billion. These "competitive need"

1/ "How Companies are Coping with the Strong Dollar," Fortune, Nov. 26, 1984, pp. 116-124, and Sen. Russell Long, Congressional Record--Senate, Jan. 31, 1985, p. S861.

2/ Ibid.

3/ Senator Moynihan, Congressional Record, 1980, p. S14497.

4/ International Monetary Fund, op. cit.

5/ U.S. International Trade Commission, Tariff Schedules of the United States Annotated (1985).

6/ Public Law 98-572, Oct. 30, 1984, Trade and Tariff Act of 1984.

provisions operate to limit GSP treatment for highly competitive products and, to the extent possible, to reallocate benefits to other beneficiaries that have not achieved this degree of success in the U.S. market. To this end, the 26 designated least developed developing countries (LDDC's) are not subject to competitive need limits. Because a limited number of the more advanced beneficiary countries have accounted for the majority of GSP imports, the United States instituted a policy of discretionary "graduation" in 1980. Under this policy, seven countries have been removed from GSP eligibility on almost $2 billion in trade in various products in which they were found to be highly competitive.

The EC's GSP program for developing countries is generally similar in coverage to that of the United States. Sixty-five of these developing countries--formerly colonies of European nations in Africa, the Caribbean, and the Pacific (ACP)--are also members of the Lome Convention. The Lome Convention, a negotiated agreement, gives the ACP countries duty-free access for almost all of their industrial products except for certain sensitive products that are limited either by quota or by a somewhat less stringent system of "indicative ceilings." The EC also offers the ACP countries reduced customs duties on almost 400 of the agricultural products they export to the Community. As renegotiated with ACP at the end of 1984, this GSP program is expected to give the ACP nations customs duty concessions worth more than $600 million on their potential exports to the EC of more than $14 billion worth of industrial and agricultural products. 1/

Canada, Japan, Australia, Sweden, and other developed countries also maintain a GSP. In addition to GSP systems, both developed and developing countries have other special arrangements with nations located in the same region or with nations to which the country maintains special ties, such as former colonial relationships.

One such example is the recently enacted Caribbean Basin Economic Recovery Act which provides for duty-free entry into the United States of a wide range of products when exported from a designated Caribbean Basin Initiative (CBI) beneficiary country. The purpose of the program, which was implemented on January 1, 1984, is to promote the economic development of Caribbean Basin Countries. 2/ After its first year of operation, the U.S. Government cited investment of $153 million in 250 projects that created 27,500 new jobs. Total U.S. imports from CBI countries increased 17 percent in 1984 to $3.8 billion, while U.S. exports grew 6 percent, to $5.4 billion. (One of the CBI countries has contended that the smaller countries in the region also need extra aid to build up their infrastructure so they can take advantage of the potential of the CBI.) 3/

1/ U.S. Department of Commerce, Business America, Nov. 14, 1983, p. 14; and Europe, September/October 1984, p. 47, and January/February 1985, p. 26.

2/ U.S. Department of Commerce, Business America, Jan. 7, 1985, pp. 2-16.

3/ Eugenia Charles, Prime Minister of Dominica, speech delivered during a luncheon celebrating the first year of the Caribbean Basin Initiative, Washington, DC, Apr. 29, 1985.

Aid and Assistance

World Bank

The World Bank lends most of its money ($15 billion in fiscal year (FY) 1983) for technological projects--industries, farms, mines--that enable the assisted country to meet domestic needs and increase exports. Noteworthy World Bank success stories include Korea, Taiwan, Singapore, and, in certain respects, Brazil and Mexico. 1/ Its loans have been mostly for 20-25 years and the interest rate in early 1985 was 9.89 percent per annum subject to quarterly change to reflect cost of borrowings in world capital markets. The World Bank's International Development Association (IDA) makes credits on concessional terms to member countries with per-capita GNPs less than $125 (1982 U.S. dollars). No interest is charged, and maturities are 50 years including a 10-year grace period. 2/ (The World Bank's assistance programs are discussed in an earlier section.)

International Monetary Fund

The IMF is complementary to the World Bank and tends to provide short-term balance-of-payment loans (under stringent conditions) as opposed to the long-term, low-interest loans of the World Bank. In 40 years, the fund's membership has grown to 148 nations and its assets to $90 billion. Typically, when a government in trouble seeks assistance, the IMF draws up a financial package. The country gets a loan. Currently, creditor banks are persuaded to wait longer for their money and even to furnish some new loans to a country already falling behind with its interest on old ones--the alternative being less hope of ever collecting. To get this help, the debtor government generally has to agree to certain actions. Usually it has to devalue its currency, which makes its exports easier to sell in other countries, bringing in more money to pay its debts. The devaluation also tends to reduce imports since purchases abroad become more expensive. The borrower also must generally promise to reduce inflation, cut spending, and follow other policies that often result in lower real wages.

United Nations Industrial Development Organization

UNIDO was established in 1965 to promote and accelerate industrialization of the developing countries and became a specialized agency of the United Nations in 1985. Its Investment Promotion Services, intended to provide orientation and information on specific investment and other business opportunities, as well as on incentives, procedures, and business conditions; training; and technical assistance; is headquartered in Vienna, with regional offices in a number of other cities. One of its recently-begun programs, centered in its New York office, is the Caribbean Investment Promotional

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1/ Chemical and Engineering News, Aug. 6, 1984, p. 16.
2/ U.S. Department of Commerce, Business America, Apr. 15, 1985.

Service (CIPS), intended to attract U.S. and Canadian investment, technology and know-how, management and financial resources to the Caribbean nations. The CIPS was established by UNIDO and the participating governments in cooperation with the Caribbean Development Bank, AID, and the United Nations Development Program (UNDP). The United Nations Conference on Trade and Development (UNCTAD) was established in the 1960's as a forum for dialogue between developed and developing countries on commodity prices, debt, and trade. It is believed by some observers that not too much has been accomplished by UNCTAD, since these areas are handled by GATT, the World Bank, and IMF. 1/

Regional banks

The regional banks--Inter-American Development Bank (IDB), Asian Development Bank (ADB), African Development Bank Group (AFDB and AFDF), and International Fund for Agricultural Development (IFAD)--make loans on conventional and concessional terms, provide technical assistance and investment promotion, and (the AFDB) provide credits on concessionary terms. The IDB, for example, established in 1959 and headquartered in Washington, was the first regional bank. Since its start it has made loans of $28 billion and thereby helped to mobilize nearly $100 billion in investments for Latin America's development. Its 43 member countries include 26 Latin American and Caribbean countries, 16 developed countries, and Israel. 2/ The United States reportedly provides about 35 percent of its funds. 3/ IFAD, devoted to lending to low-income farmers in poor food-deficit countries, lent $1.5 billion in 1982-84 and is authorized to make cheap loans worth $600 million during 1985-87. Forty percent of its funds come from OPEC countries; the U.S. share is about 17 percent. 4/

International Finance Corporation

The IFC extends loans and noncontrolling equity capital, provides underwriting and standby commitments, and attracts and acts as a catalyst for outside financing to private firms in developing member countries. In FY1984 it made 62 investment commitments totaling $696 million. 5/ On average, each dollar invested or loaned by the IFC attracts $5 from private sources. It is the architect of the Mexico Fund and the Korea Fund, closed-end investment trusts traded on the New York Stock Exchange. 6/

1/ The Economist, Apr. 13, 1985, p. 73.

2/ IDB 25th anniversary report, prepared by the Inter-American Development Bank, The Washington Post, Mar. 17, 1985, 16 pages.

3/ Fortune, Apr. 29, 1985, p. 10. Information was confirmed by Mr. Brauning, Chief of Press Section of Inter-American Development Bank.

4/ The Economist, Mar. 9, 1985, p. 72, and Department of State Bulletin, November 1984, p. 16.

5/ U.S. Department of Commerce, Business America, Apr. 15, 1985.

6/ Barron's, May 13, 1985, p. 16.

Lome Convention

In addition to its GSP program, discussed above, the Lome Convention also provides compensation to developing countries for reduced export earnings as a result of crop failures, mining production losses, or falling world prices for 44 agricultural products and 6 minerals. These "insurance" payments enable these developing nations to continue purchasing essential imports in times of trade revenue losses. Beginning in 1985, the E.C. member states have agreed to work out the best ways in which supplies of E.C. farm surpluses can be made available to food-deficit countries on a long-term basis; agreements for aid to develop fishing industries have begun to be made; and the system for maintaining mineral production capacity has been extended to include additional ore producers including Niger, Botswana, and Zimbabwe. In addition, the Convention provides for significant financing assistance to the ACP states seeking to initiate new mineral ventures. The negotiated Lome funds for aid for 1985-90 have been boosted to about $6.3 billion, from $4.1 billion in the previous agreement. 1/

Financing of U.S. Exports

As summarized in a recent U.S. Department of Commerce report, the need for competitive financing in today's trade environment has become a major consideration in current trade policy. Without special measures, U.S. companies are likely to be placed at a disadvantage in competing for overseas contracts by noncompetitive financing, and, with developing countries encountering difficulty in repaying their debts, credit commitments by banks for international trade have diminished sharply. Corporations have followed suit by cutting back on existing credit and declining to extend new credit. The strong dollar has exacerbated these problems for U.S. exporters. 2/

While current Administration policy opposes export credit subsidies by any nation, and has had some success in eliminating interest rate subsidies of Organization for Economic Cooperation and Development (OECD) governments' export credit agencies, it acknowledges the need for competitive financing. The following U.S. agencies help to facilitate U.S. exports in various ways:

Export-Import Bank

Eximbank facilitates U.S. exports through credit support in the form of loans, commercial guarantees and insurance, and credits. These are made to foreign buyers (i.e., direct loan program) and exporters and banks in the United States (i.e., guarantees, insurance, and discount loans) to the extent that U.S. goods and services are involved. In those bidding situations where U.S. firms face intense foreign competition backed by officially supported

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1/ "E.C. Signs New Lome Trade-and-Aid Pact," Europe, January/February 1985, p. 26; U.S. Department of Commerce, Business America, Nov. 14, 1983.

2/ Business America, op. cit.

financing, the Bank provides a number of options, one of which is direct credit to the purchaser of 75 percent of the U.S. export value at a fixed, competitive rate. 1/

The Foreign Credit Insurance Association (FCIA), a private sector association of insurance companies, acts in conjunction with, and as an agent for, Eximbank to insure repayment of export credit against nonpayment for political and/or commercial causes. 2/

Agency for International Development

The Agency for International Development (AID) administers a bilateral foreign economic assistance program, including loans, to the governments of developing countries on concessionary terms. Interest rates in early 1985 were 2 percent during the grace period and 3 percent thereafter. In general, AID policy requires that both loan and grant commodity procurement charged against AID dollar appropriations be confined to U.S. sources. 3/

The AID program of assistance to ASEAN countries, for example, during 1979-83, provided $19 million for regional development that financed, and provided training in, eight projects focusing on regional needs in agriculture, energy, and health. In fiscal year 1983, this AID program also provided bilateral assistance to three of the ASEAN countries--$17 million of development assistance to Thailand, $37 million to the Philippines, and $72 million to Indonesia. 4/ In Africa, in fiscal year 1985, about one-fifth of $1 billion in total aid is for Commodity Import Programs (CIP's) in nine countries. CIP's are a form of non-project assistance, administrated by AID, to make dollars available to a country on a loan or grant basis to purchase commodities and capital goods from the United States. 5/

Overseas Private Investment Corporation

The Overseas Private Investment Corp. (OPIC) provides programs of political risk insurance--for inconvertibility, expropriation, and war/revolution/insurrection and civil strife--to encourage U.S. private investment in more than 100 developing countries. It also provides loan guarantees and makes direct loans. 6/

1/ U.S. Department of Commerce, Business America, Apr. 15, 1985, pp. 3-19; The Wall Street Journal, Sept. 19, 1985, p. 1; and Barron's, Sept. 30, 1985, pp. 36, 38.
2/ Ibid.
3/ Ibid.
4/ U.S. Department of Commerce, Business America, Nov. 28, 1983.
5/ U.S. Department of Commerce, Business Anerica, Mar. 4, 1985, p. 44.
6/ U.S. Department of Commerce, Business America, Apr. 15, 1985, pp. 3-19.

Department of Agriculture

The Food for Peace program amounts to about $1 billion per year to supply agricultural commodities to developing countries with food deficits on concessional financing terms, to promote their agricultural development, and to provide food relief for disaster and emergency-stricken countries.

The Commercial Export Programs of the Commodity Credit Corporation (CCC) provide for short-term financing of U.S. agricultural commodities, enabling U.S. exporters to sell on a deferred payment basis. Their funding for FY1983 exceeded $10 billion. 1/

Trade and Development Program

The Trade and Development Program (TDP), which is administered by the International Development Cooperation Agency (IDCA), promotes economic development in developing countries, particularly the middle-income countries, by financing planning services for development projects leading to the export of U.S. goods and services. Through FY1984, about $750 million in foreign contracts were granted to "friendly" countries, as determined by the Department of State, that are planning to allocate substantial resources for procurement of foreign goods and services for major development projects. Projects must indicate a reasonable expectation of either facilitating access to natural resources of interest to the United States or of providing a substantial return to the United States in the form of exports, and indication of valid need for TDP involvement such as competition from a foreign firm being assisted by its government. 2/

U.S. TRADE IN CHEMICALS WITH DEVELOPING COUNTRIES

There is a wide variance in industry opinion as to what effect the entrance of new chemical-producing nations will have on the world chemical market and on individual, established chemical-producing nations, such as the United States, ranging from significant to slight. In general, there is the belief that the established chemical-producing nations cannot help but be negatively affected when the number of countries competing for the world chemical market is increased. The petrochemical industry, most observers believe, may be the most directly impacted because of the energy and feedstock cost advantages conferred on many of the developing nations by their crude petroleum and natural gas resources.

A factor determining the severity of the impact on the established chemical-producing nations will be the method of entry of the new chemical-producing nations into the world market. A traditional entry, wherein the chemicals marketed are produced in response to an increase in demand, would be

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1/ Ibid.
2/ U.S. Department of Commerce, Business America, Apr. 15, 1985, pp. 3-19.

the least disruptive. Such entry could allow established chemical-producing nations to maintain volume while the new chemical-producing nations were producing the volume of product needed to satisfy increases in world demand.

This section analyzes U.S. chemical trade with developing nations to determine the major products traded and the principal sources and markets for U.S. chemical imports and exports.

Chemicals in this report include those in Section 5 of the Standard International Trade Classification (SITC) plus synthetic rubber (SITC 2331), synthetic fibers (SITC 266), and crude fertilizers (SITC 271), conventionally classified as chemicals in U.S. parlance. None of these latter categories is a large item of trade between the United States and developing countries; inclusion or exclusion has little effect on the statistics reported here.

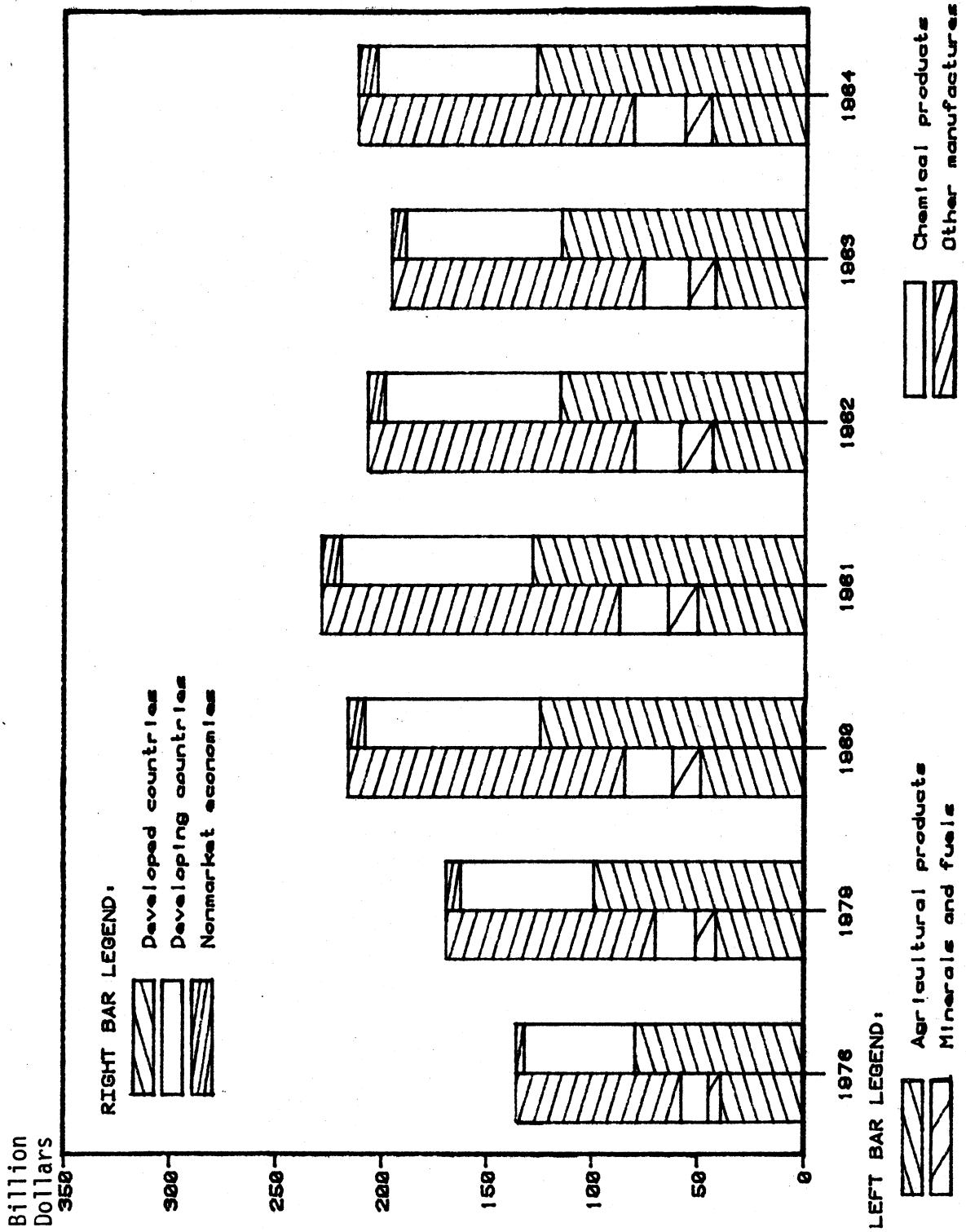
The accompanying charts put the importance of U.S. trade in chemicals into perspective. Figures 1 and 2, for exports and imports respectively, show overall trade divided, in the bar on the left, into chemicals, other manufactured products, and agricultural and mineral primary products. Trading partners, classified by whether they are developed, developing, or Communist or non-market economies, are shown in the bars to the right of the product classification bar. The heights of the two bars are the same for each year because each accounts for total trade in a different, but comprehensive, way, i.e., by product category or by trading partner.

Chemical products accounted for about 10 percent of U.S. exports and 4 percent of U.S. imports during 1978-84. Chemicals' percentage of U.S. exports rose fairly steadily from 9.2 percent in 1978 to 11.2 percent in 1984. Minerals and fuels exports rose from 4.5 percent of total U.S. exports in 1978 to 6.0 percent in 1984, peaking at 7.6 percent in 1982, when there was a boom in coal exports caused by the limited availability and sharp rise in price of competing crude petroleum from the Middle East. Exports of manufactured products other than chemicals were about 60 percent of total exports throughout the period. Fluctuations in this category caused by changing competitive conditions and the changing value of the U.S. dollar relative to other currencies account for most of the fluctuations in total exports. On the import side, nonchemical manufactures rose from 56.3 percent of U.S. imports in 1978 to 65.9 percent in 1984, reflecting the strengthening of the U.S. dollar beginning in 1980. Competition in these products tends to be apparent sooner than with the other major categories of agricultural products, minerals and fuels, and chemicals where specialized production systems with long construction lead times are involved.

Despite the positive balance of trade in chemical products, the charts show clearly the deteriorating overall balance of U.S. trade with imports rising and exports falling particularly in 1983 and 1984.

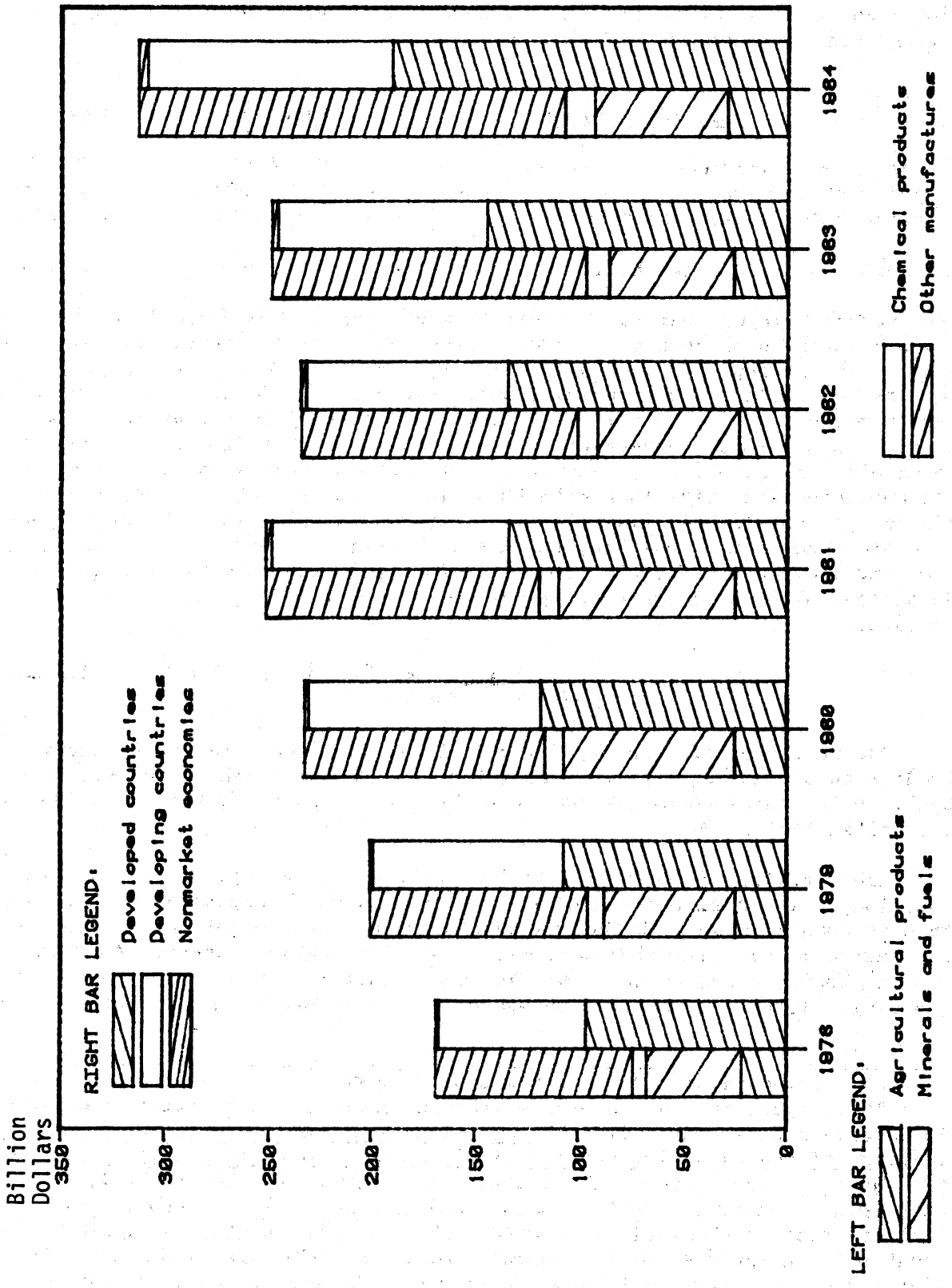
With respect to the development status of the trading partners, the developing countries accounted for a slowly declining fraction of U.S. trade from 1978 to 1984, representing approximately 40 percent of total U.S. imports and 36 percent of total U.S. exports. The developed countries accounted for most of the growth and fluctuations in U.S. international trade.

Figure 1.--U.S. exports, by major categories and destinations, 1978-84.



Source: Compiled from official statistics of the U.S. Department of Commerce.

Figure 2.--U.S. imports, by major categories and origins, 1978-84.



Source: Compiled from official statistics of the U.S. Department of Commerce.

Figures 3 and 4 show U.S. chemicals trade alone on a similar basis. Actual dollar amounts of trade in chemical and allied products in 1984 were as follows (in thousands of dollars): 1/

Trading partners	Exports	Imports
Developing countries	8,768,062	2,029,184
Developed countries	13,932,092	11,511,386
Communist/nonmarket economies	1,050,593	401,798
Total U.S. trade in chemicals	23,750,718	13,942,238

The product category bar to the left at each year in the chart is divided into major categories of chemical product, described in more detail later in this section of the report. The bar to the right in each year shows the type of destination country. Developing countries are a considerably more important export market for U.S. chemicals trade, approximately 38 percent, than as an import source, about 10 percent, for chemicals. This reflects the fact that chemicals manufacture is an industry that has been more associated with mature and developed economies than with those in the early stages of development. Accordingly the bulk of historical U.S. chemicals trade is with the already developed countries. However, the emerging chemical industry, particularly for petrochemicals manufacture, in the crude petroleum and natural gas rich developing nations is expected by most observers to change this historic pattern.

Changes in Chemical Trade

One objective of this study was to investigate how changes in chemicals trade with developing countries have been influenced by their membership in OPEC, their status under the GSP, and their geographic location relative to the United States. 2/

Each developing country is listed in table 13 by regional group, with a notation on its OPEC membership and its GSP status. (Countries with less than $500 in annual trade with the United States in 1984 are omitted.) The regions are basically continental groupings, with North America, Central America, and the Caribbean in one group. The "European" category is a convenience grouping: all are countries with GSP status; some are former island

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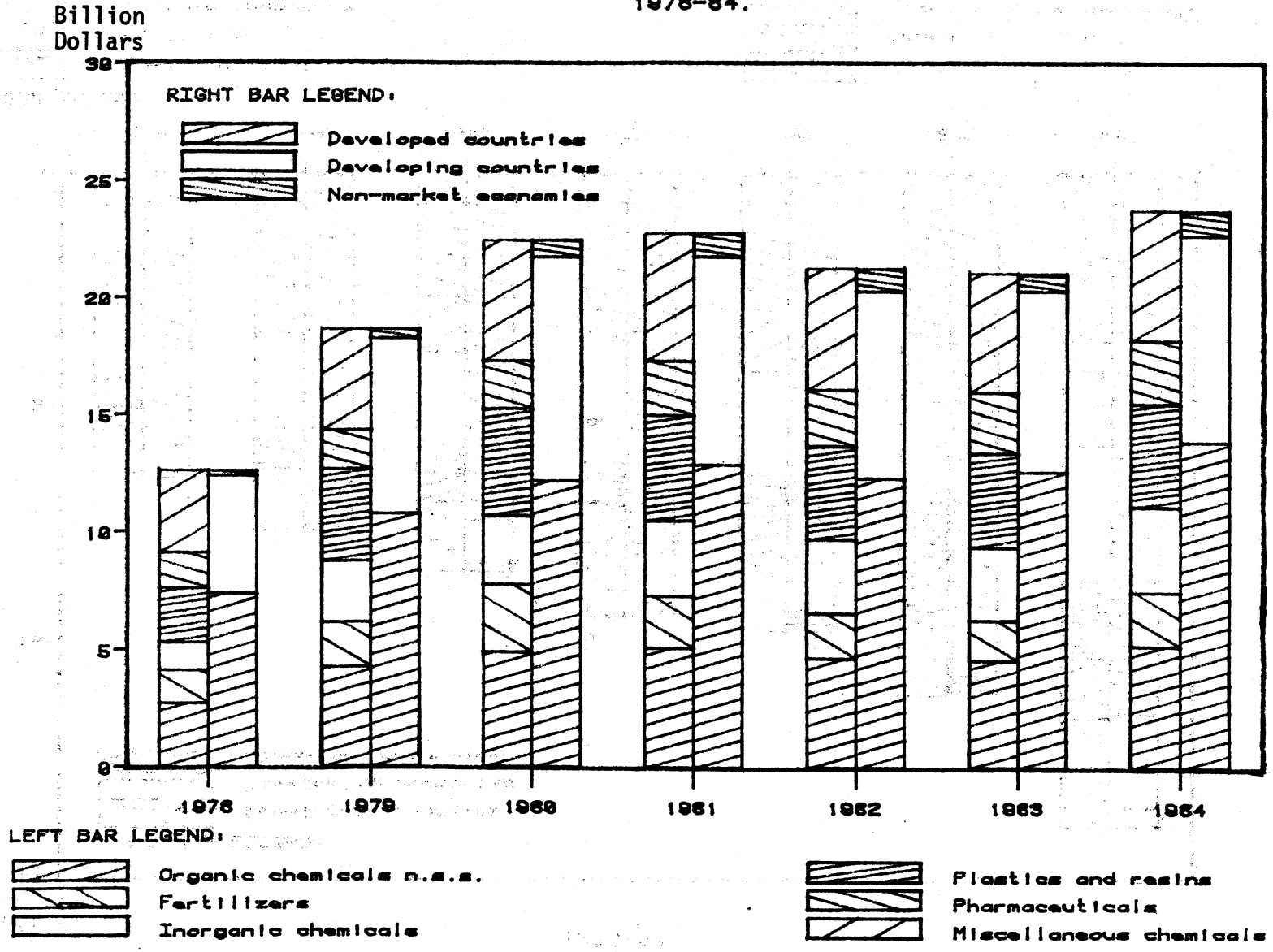
1/ Official data of U.S. Department of Commerce.

2/ The subject of U.S. chemicals trade with energy-rich nations was addressed in detail in USITC Pub. 1370, The Probable Impact on the U.S. Petrochemical Industry of the Expanding Petrochemical Industry in the Conventional-Energy-Rich Nations, April 1983. The distinction between OPEC and non-OPEC developing countries is not of much significance for this study because of the limited trade in chemicals with OPEC members. Saudi Arabia is the only OPEC country in the process of developing a major petrochemical industry. Its new plants are just starting to come on stream. The effects will show up in the future rather than in the historical statistics cited here.

Figure 3.--U.S. chemical exports, by major categories and destinations, 1978-84.



Source: Compiled from official statistics of the U.S. Department of Commerce.

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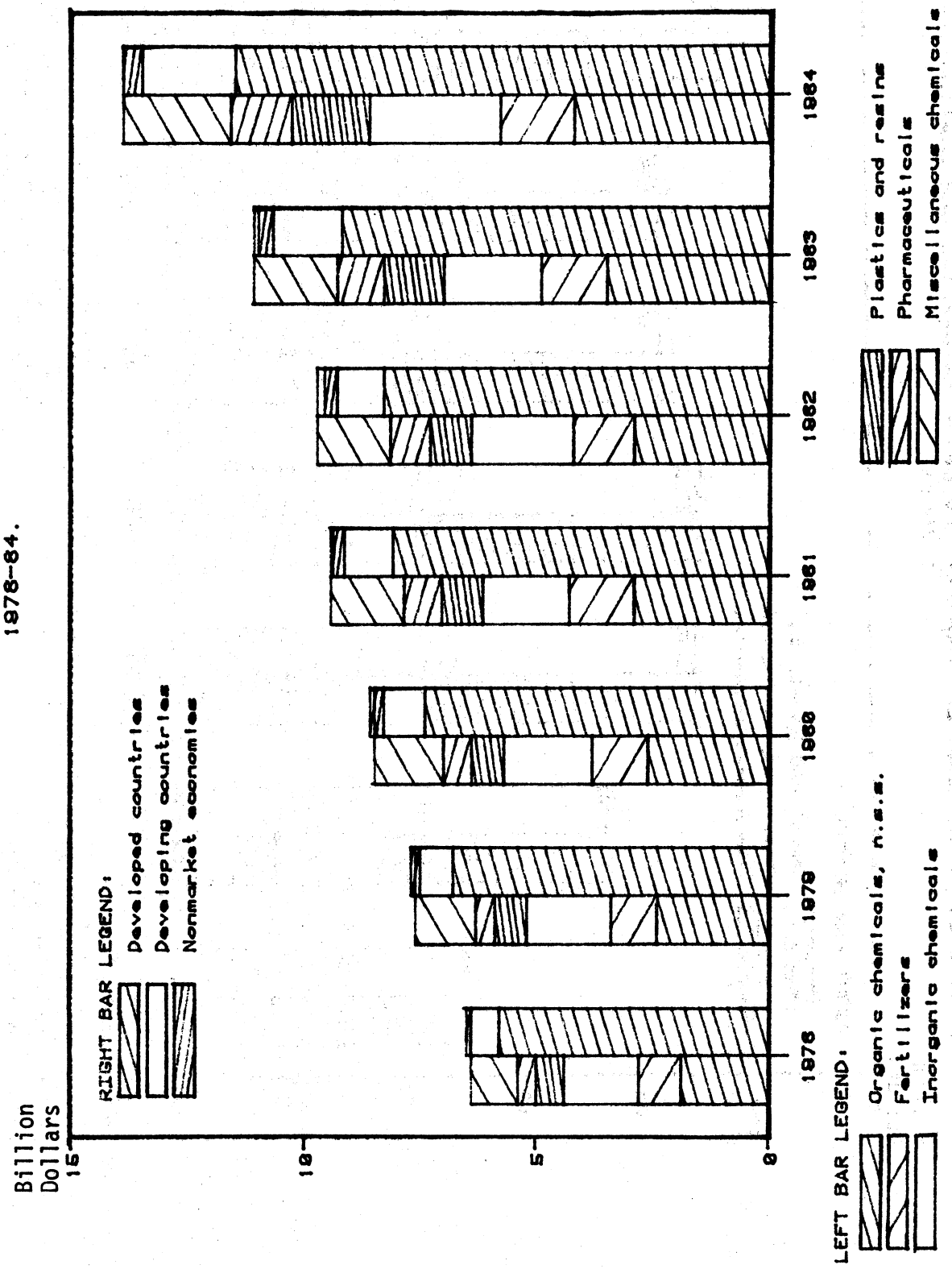
Figure 4.--U.S. chemical imports, by major categories and origins, 1978-84.



Source: Compiled from official statistics of the U.S. Department of Commerce.

possessions of European countries, whereas others are Central European countries that have been accorded GSP status. Table 13 also shows the amount of current (1984) export trade in chemicals to each country from the United States. Regional subtotals for exports and imports are shown in the body of table 13 and again in table 14 which contain subtotals by GSP and OPEC status.

Figures 5 and 6 summarize chemical trade between the United States and the developing countries in three ways. The three bars are the same height because the total is being divided by three criteria as indicated.

OPEC-member countries have accounted for only a stable 2.5 percent of U.S. chemical imports. Their relatively larger share of the U.S. chemical export market declined from 17 percent to 14.8 percent as their self-sufficiency in chemicals has increased. GSP-eligible countries accounted for 99.5 percent of U.S. chemical imports from developing countries, while their share of U.S. chemical exports to developing countries increased from 92.2 percent to 95.6 percent. The regional grouping of trade partners shows similar stability to that of the OPEC/non-OPEC and GSP/non-GSP groupings. To the extent there are changes, North and Central America is the most important swing trading partner region.

An overall conclusion is that historic patterns in trade of chemicals with developing countries have not changed markedly. Furthermore, it is apparent that up until the present neither OPEC membership nor GSP status appear to have been an important determinant of any trends or changes in chemical trading patterns with the United States however important they might be in shaping the basic economic trading environment of the countries involved.

Table 15 shows the average growth rates in U.S. chemical exports and imports, according to destination. The growth rates are based on fitting a regression trend line to the logarithms of the 7 years' trade values between 1978 and 1984, giving weight to the trade flows in the intervening years. Columns 2 and 4 of the table give the upper and lower 95 percent confidence limits around the trend line, and the last column gives the coefficient of determination for the regression equation used to estimate the trend line.

The growth rates for imports are several times larger than the growth rates for exports indicating that the favorable U.S. balance of trade on chemical products is eroding. The 23 percent per year growth rate in exports of chemicals to nonmarket economies and Communist countries is from a low-value base.

Changes in Trade by Major Categories of Chemicals

Tables 16 and 17 show growth rates for U.S. trade in chemicals with developing countries, broken down into basic categories of chemical products:

1. Primary and Intermediate Organic Chemicals. [SITC Division 51] Hydrocarbons (excluding methane and ethane, considered natural gas fuel), alcohols, esters, carboxylic acids and derivatives, and nitrogen function compounds. Most of the chemicals in this group are used for manufacture or synthesis of other products.

Table 13.--Chemical and allied products: U.S. trade and GSP and OPEC status, by geographic regions and individual developing countries, 1984

Countries and regions	GSP status	OPEC status	U.S. chemical trade	
			Exports	Imports
			----1,000 dollars----	
North and Central America and the Caribbean:				
Bahamas	Yes	No	63,754	72,131
Barbados	Yes	No	12,360	8
Belize	Yes	No	4,590	235
Bermuda 1/	Yes	No	14,717	455
British Virgin Islands 1/	Yes	No	13,228	-
Cayman Islands 1/	Yes	No	3,821	234
Costa Rica	Yes	No	92,718	3,703
Dominica	Yes	No	-	8
Dominican Republic	Yes	No	73,061	5,344
El Salvador	Yes	No	61,932	61
French West Indies	Yes	No	4,137	5,756
Grenada	Yes	No	-	16
Guatemala	Yes	No	90,229	1,364
Haiti	Yes	No	17,224	4,840
Honduras	Yes	No	58,103	407
Jamaica	Yes	No	57,227	3,551
Mexico	Yes	No	1,285,866	523,025
Netherlands Antilles 1/	Yes	No	53,588	3,640
Nicaragua	Yes	No	33,683	-
Panama	Yes	No	125,545	1,788
Saint Christopher-Nevis-Anguilla 1/	Yes	No	-	1
Saint Vincent and the Grenadines	Yes	No	-	53
Trinidad and Tobago	Yes	No	55,963	140,595
Turks and Caicos Islands 1/	Yes	No	210	-
Total for region			2,121,956	767,216
South America:				
Argentina	Yes	No	264,526	78,244
Bolivia	Yes	No	7,834	1,985
Brazil	Yes	No	573,841	407,332
Chile	Yes	No	167,823	33,875
Colombia	Yes	No	329,000	21,628
Ecuador	Yes	Yes	111,464	370
French Guiana	No	No	733	175
Guyana	Yes	No	5,016	130
Paraguay	Yes	No	3,509	2,053
Peru	Yes	No	131,565	10,744
Suriname	Yes	No	26,923	-
Uruguay	Yes	No	24,034	1,224
Venezuela	Yes	Yes	557,444	29,071
Total for region			2,203,712	586,831

See footnote at end of table.

Table 13.--Chemical and allied products: U.S. trade and GSP and OPEC status, by geographic regions and individual developing countries, 1984--Continued

Countries and regions	GSP status	OPEC status	U.S. chemical trade	
			Exports	Imports
			----1,000 dollars----	
Middle East:				
Bahrain	Yes	No	6,355	-
Gaza Strip	No	No	2	134
Iran	No	Yes	7,004	242
Iraq	No	Yes	11,626	6
Israel	Yes	No	60,838	128,298
Jordan	Yes	No	10,379	402
Kuwait	No	Yes	22,009	1,538
Lebanon	Yes	No	10,283	252
Oman	Yes	No	4,464	60
Qatar	No	Yes	4,182	-
Saudi Arabia	No	Yes	240,655	10
Syria	Yes	No	6,532	16
United Arab Emirates	No	Yes	43,081	999
Yemen (Aden)	No	No	1,554	-
Yemen (Sanaa)	Yes	No	2,024	-
Total for region			430,986	131,957
Asia:				
Afghanistan			911	18
Bangladesh	Yes	No	34,749	68
Bhutan	Yes	No	149	-
Brunei	Yes	No	1,465	-
Burma	Yes	No	3,862	-
Hong Kong 1/	Yes	No	338,840	16,170
India	Yes	No	434,794	25,997
Indonesia	Yes	Yes	239,554	15,664
Korea	Yes	No	713,171	78,721
Macao 1/	Yes	No	56	1,411
Malaysia	Yes	No	162,809	8,482
Nepal	Yes	No	619	2
Pakistan	Yes	No	95,568	61
Philippines	Yes	No	201,755	10,501
Singapore	Yes	No	302,173	15,824
Sri Lanka	Yes	No	3,881	866
Taiwan	Yes	No	772,508	205,108
Thailand	Yes	No	157,509	10,910
Total for region			3,464,373	389,802
Africa:				
Algeria	No	Yes	12,622	2,503
Angola	Yes	No	2,991	-
Benin	Yes	No	333	-

See footnote at end of table.

Table 13.--Chemical and allied products: U.S. trade and GSP and OPEC status, by geographic regions and individual developing countries, 1984--Continued

Countries and regions	GSP status	OPEC status	U.S. chemical trade	
			Exports	Imports
			----1,000 dollars----	
Africa--Continued				
Botswana	Yes	No	10	-
British Indian Ocean Territory 1/	Yes	No	1	59
Burundi	Yes	No	91	-
Cameroon	Yes	No	2,498	-
Central African Republic	Yes	No	7	-
Chad	Yes	No	4,172	-
Comoros	Yes	No	2	21
Congo	Yes	No	130	-
Djibouti	Yes	No	74	-
Egypt	Yes	No	107,992	2,327
Ethiopia	No	No	1,317	566
French Indian Ocean areas 1/	Yes	No	3	82
Gabon	No	Yes	786	-
Gambia, The	Yes	No	85	-
Ghana	Yes	No	1,747	5
Guinea	Yes	No	606	-
Guinea-Bissau	Yes	No	2,302	-
Ivory Coast	Yes	No	5,545	510
Kenya	Yes	No	10,139	946
Lesotho	Yes	No	42	8
Liberia	Yes	No	3,687	1
Libya	No	Yes	3,247	1,617
Madagascar	Yes	No	875	1,852
Malawi	Yes	No	335	-
Mali	Yes	No	103	-
Mauritania	Yes	No	60	-
Mauritius	Yes	No	345	-
Morocco	Yes	No	3,290	1,179
Mozambique	Yes	No	869	100
Namibia	No	No	309	-
Niger	Yes	No	1	368
Nigeria	No	Yes	43,451	105
Rwanda	Yes	No	118	-
Saint Helena 1/	Yes	No	7	62
Senegal	Yes	No	2,991	-
Seychelles	Yes	No	7	-
Sierra Leone	Yes	No	416	48
Somalia	Yes	No	914	-
Sudan	Yes	No	10,908	427
Swaziland	Yes	No	29	295

See footnote at end of table.

Table 13.--Chemical and allied products: U.S. trade and GSP and OPEC status, by geographic regions and individual developing countries, 1984--Continued

Countries and regions	GSP status	OPEC status	U.S. chemical trade	
			Exports	Imports
			----1,000 dollars----	
Africa--Continued				
Tanzania	Yes	No	13,514	-
Togo	Yes	No	688	-
Tunisia	Yes	No	2,597	40
Uganda	Yes	No	628	20
Upper Volta	Yes	No	515	-
Zaire	Yes	No	2,891	1,414
Zambia	Yes	No	6,236	-
Zimbabwe	Yes	No	16,453	-
Total for region			268,984	14,556
Europe:				
Cyprus	Yes	No	15,758	241
Gibraltar 1/	Yes	No	32	131
Malta and Gozo	Yes	No	357	44
Portugal	Yes	No	26,267	29,574
Romania	Yes	No	28,953	79,460
Turkey	GSP	No	156,013	4,638
Yugoslavia	GSP	No	42,987	24,341
Total for region			270,365	138,428
Oceania and Pacific countries:				
Fiji	Yes	No	-	8
French Polynesia	No	No	-	308
Nauru	Yes	No	1,315	-
New Caledonia 1/	Yes	No	1,170	46
Pacific Islands, Trust Territory of the U.S. 1/	Yes	No	3,240	-
Papua New Guinea	Yes	No	800	-
Solomon Islands	Yes	No	614	-
Tonga	Yes	No	-	1
Western Samoa	Yes	No	548	32
Total for region			7,687	395
Total for all developing countries			8,768,062	2,029,185

1/ Not an independent country. Because of its GSP status, this territory has been treated as a separate entity for statistical purposes in this study.

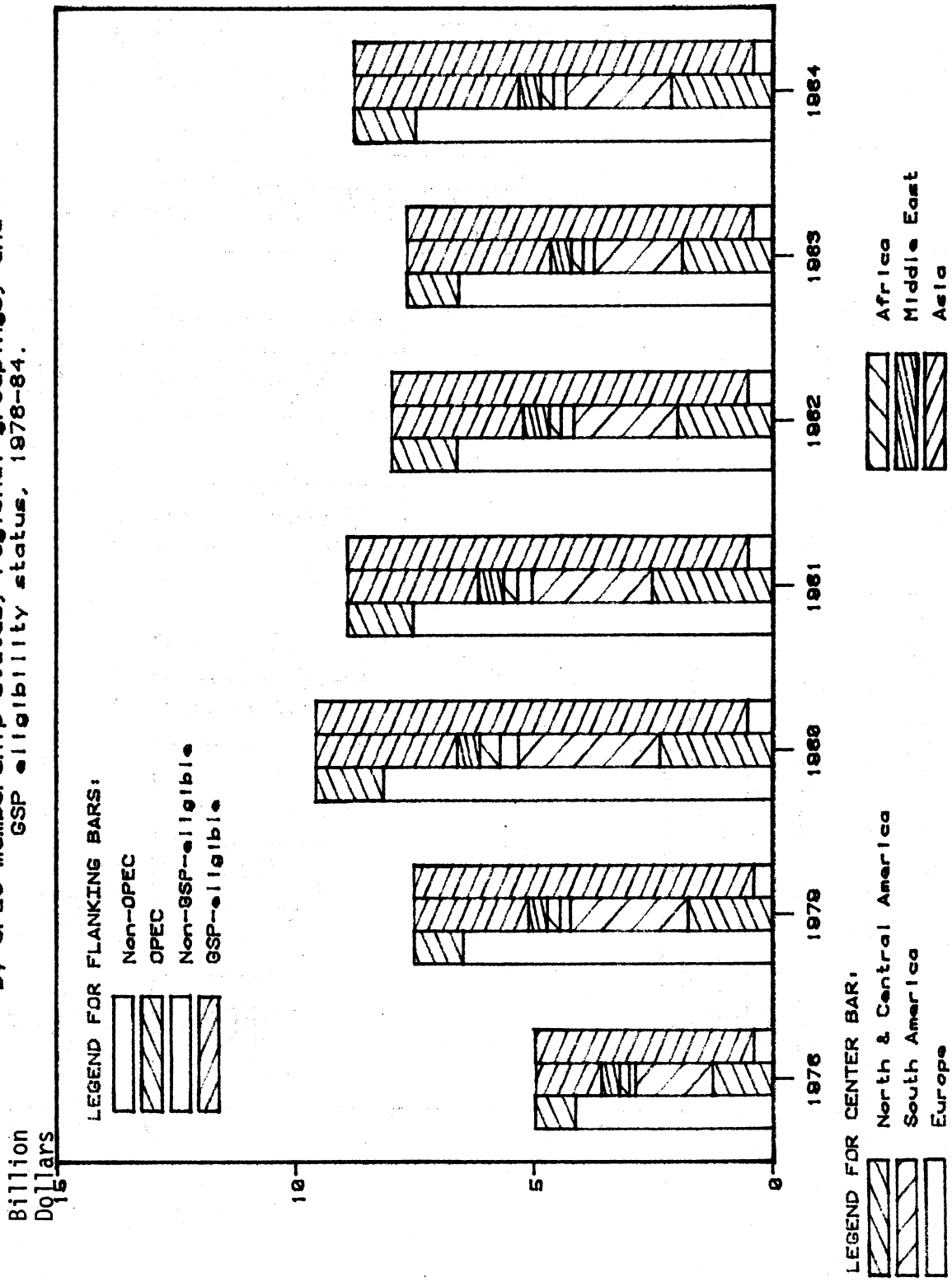
Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 14.--Chemicals and allied products: Summary of U.S. trade, by geographic regions, by GSP status, and by OPEC status, 1984

Geographic regions and status groups	Exports	Imports
	----1,000 dollars-----	
Regional subtotals:		
North and Central America, and the Caribbean region	2,121,956	767,216
South America	2,203,712	586,831
Middle East	430,986	131,957
Asia	3,464,373	389,802
Africa	268,984	14,556
Europe	270,365	138,428
Oceania and Pacific countries	7,687	395
Total, all developing countries	8,768,062	2,029,185
Subtotals by status under the Generalized System of Preferences (GSP):		
GSP developing countries	8,369,822	2,015,432
Non-GSP developing countries	398,240	13,754
Total, all developing countries	8,768,062	2,029,185
Subtotals by membership in the Organization of Petroleum Exporting Countries (OPEC):		
OPEC member countries	1,297,122	52,126
Non-OPEC member countries	7,470,940	1,977,059
Total, all developing countries	8,768,062	2,029,185

Source: Compiled from official statistics of the U.S. Department of Commerce.

Figure 5.--U.S. chemical exports to developing countries, by OPEC membership status, regional groupings, and GSP eligibility status, 1978-84.



Source: Compiled from official statistics of the U.S. Department of Commerce.

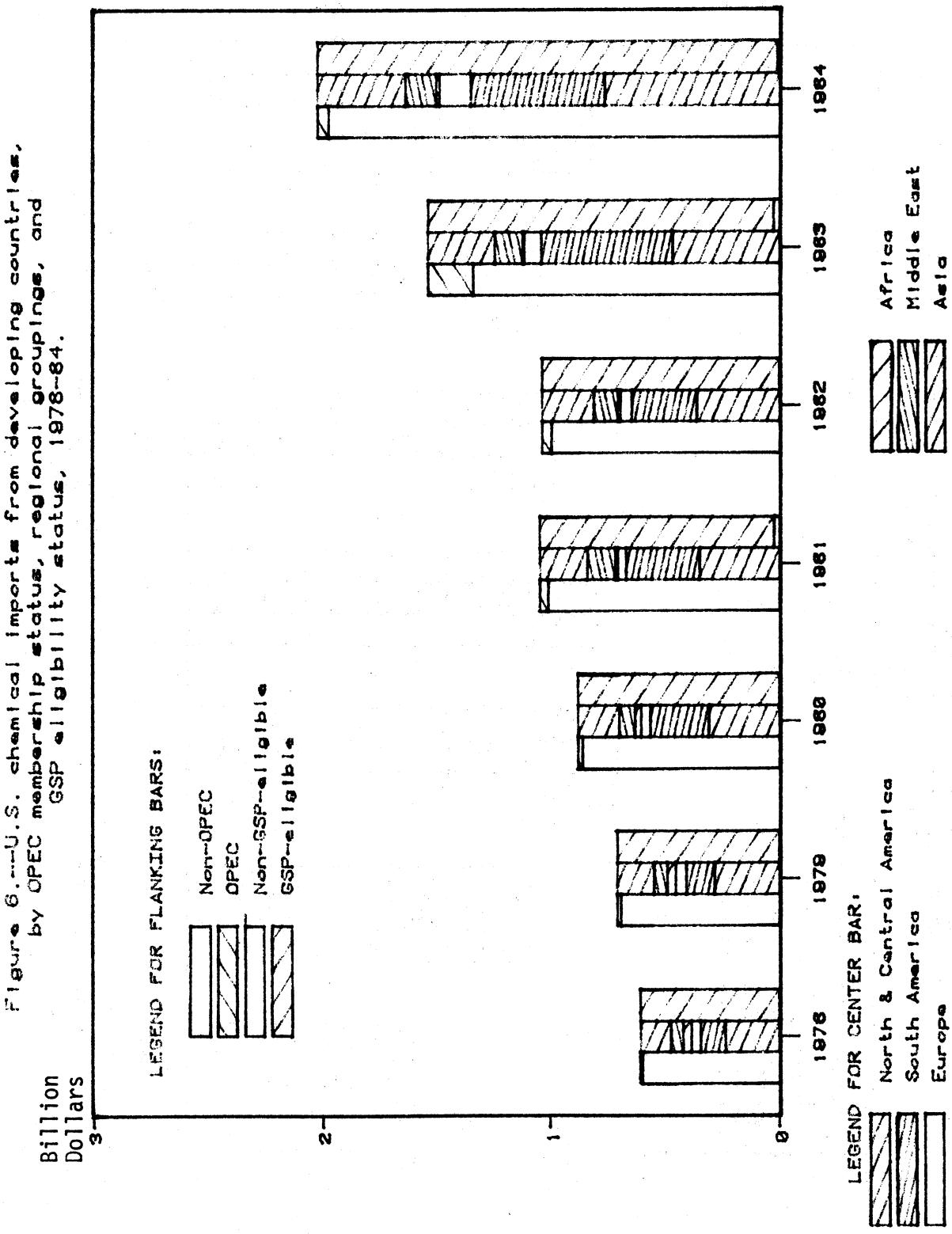


Figure 6.--U.S. chemical imports from developing countries, by OPEC membership status, regional groupings, and GSP eligibility status, 1978-84.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 15.--Chemicals: Average growth rates in U.S. trade, by developing countries, developed countries, GSP status countries, and OPEC countries, 1978-84

Country group		Upper confidence limit	Growth rate	Lower confidence limit	Coefficient of determination
	Million dollars	Percent per year			Percent
			Exports		
OPEC countries	1,297	13.1	4.9	-3.2	19.9
Non-OPEC developing countries	7,471	15.1	5.7	-3.8	16.3
GSP countries	8,370	15.2	5.9	-3.4	18.8
Non-GSP developing countries	398	7.1	.1	-7.0	1/ -20.0
Total, developing countries	8,768	14.6	5.5	-3.5	17.3
Developed countries	13,932	14.2	8.0	1.8	59.9
Nonmarket economy countries	1,051	40.4	22.8	5.1	60.0
All countries	23,751	15.0	7.5	-.1	45.0
			Imports		
OPEC countries	52	59.1	33.2	7.3	59.6
Non-OPEC developing countries	1,997	23.0	18.0	13.0	92.7
GSP countries	2,015	23.3	18.8	14.3	94.6
Non-GSP developing countries	14	57.4	22.7	-11.9	20.8
Total, developing countries	2,029	23.4	18.9	14.3	94.5
Developed countries	11,511	12.3	9.9	7.5	94.4
Nonmarket economy countries	402	28.1	18.7	9.2	78.8
All countries	13.942	13.7	11.1	8.6	94.9

1/ Negative values are artifacts of the SAS Institute, Inc. statistical routines.

Source: Derived from official data of the U.S. Department of Commerce.

Table 16.--Chemicals: Average growth rates of U.S. exports of major categories to developed and developing countries, by GSP status and OPEC status countries, 1978-84

Country group and category	1984 trade	Upper confidence limit	Growth rate	Lower confidence limit	Coefficient of determination
	Million dollars	Percent per year			Percent
OPEC developing countries:					
Intermediates	240	17.1	6.4	-4.2	16.4
Fertilizers	55	21.1	-3.6	-28.3	1/ -17.0
Inorganics	170	23.7	14.0	4.3	65.9
Plastics	260	14.6	4.1	-6.5	1/ -1.7
Pharmaceuticals	129	10.0	5.5	1.0	57.5
Miscellaneous	443	11.6	3.3	-4.9	1/ -.4
All items	1,297	13.1	4.9	-3.2	16.9
Non-OPEC developing countries:					
Intermediates	2,054	17.7	9.0	.4	48.2
Fertilizers	1,055	16.7	0.8	-15.1	1/ -19.6
Inorganics	757	19.1	5.4	-8.3	1/ -1.2
Plastics	1,298	18.1	5.3	-7.5	.3
Pharmaceuticals	547	9.4	6.0	2.6	74.5
Miscellaneous	1,760	11.3	5.4	-.6	39.4
All items	7,471	15.1	5.7	-3.8	16.3
GSP developing countries:					
Intermediates	2,268	17.8	9.0	.2	47.1
Fertilizers	1,093	17.0	1.0	-15.1	1/ -19.5
Inorganics	901	19.7	6.7	-6.3	9.2
Plastics	1,481	18.0	5.4	-7.3	1.4
Pharmaceuticals	609	9.5	6.3	3.2	79.3
Miscellaneous	2,018	11.5	5.4	-.7	38.2
All items	8,370	15.2	5.9	-3.4	18.8
Non-GSP developing countries:					
Intermediates	26	6.4	-6.5	-19.4	8.2
Fertilizers	17	16.0	-14.3	-44.7	5.4
Inorganics	27	14.4	6.2	-1.9	30.0
Plastics	77	8.6	.5	-7.6	1/ -19.5
Pharmaceuticals	66	8.3	2.3	-3.8	1/ -2.5
Miscellaneous	185	11.2	1.1	-9.0	1/ -18.3
All items	398	7.1	.1	-7.0	1/ -20.0

See footnote at end of table.

Table 16.--Chemicals: Average growth rates of U.S. exports of major categories to developed and developing countries, by GSP status and OPEC status countries, 1978-84--Continued

Country group and category	1984 trade	Upper confidence limit	Growth rate	Lower confidence limit	Coefficient of determination
	Million dollars	Percent per year			Percent
Total, developing countries:					
Intermediates	2,294	17.5	3.6	0.0	54.7
Fertilizers	1,110	16.7	6.6	-15.3	0.2
Inorganics	928	19.3	6.7	-6.0	25.0
Plastics	1,558	17.3	5.1	-7.2	17.1
Pharmaceuticals	676	8.6	5.8	3.1	81.8
Miscellaneous	2,203	11.2	4.9	-1.3	42.9
All items	8,768	15.6	5.5	-3.5	31.1
Developed countries:					
Intermediates	2,816	13.1	5.7	-1.8	29.3
Fertilizers	851	10.3	2.0	-6.3	1/ -12.3
Inorganics	2,427	27.5	15.0	2.4	55.5
Plastics	2,510	13.5	6.7	-.1	45.0
Pharmaceuticals	2,037	14.2	11.7	9.1	95.4
Miscellaneous	3,292	11.3	7.1	2.8	72.4
All items	13,932	14.2	8.0	1.8	59.9
All countries:					
Intermediates	5,189	15.0	7.1	-.9	38.3
Fertilizers	2,278	14.7	3.2	-8.2	-9.6
Inorganics	3,571	25.6	13.3	1.0	50.2
Plastics	4,419	16.4	6.7	-3.1	23.3
Pharmaceuticals	2,725	12.4	10.1	7.7	94.9
Miscellaneous	5,568	11.4	6.3	1.2	57.2
All items	23,751	15.0	7.5	-.1	45.0

1/ Negative values are artifacts of the SAS Institute, Inc. statistical routines.

Source: Derived from official data of the U.S. Department of Commerce.

Table 17.--Chemicals: Average growth rates of U.S. imports of major categories from developed and developing countries, by GSP status and OPEC status countries, 1978-84

Country group and category	1984 trade	Upper confidence limit	Growth rate	Lower confidence limit	Coefficient of determination
	Million dollars	Percent per year			Percent
OPEC developing countries:					
Intermediates	3	119.2	49.9	-19.4	26.0
Fertilizers	19	158.2	109.6	61.0	83.1
Inorganics	9	131.2	40.8	-49.5	3.6
Plastics	4	155.9	70.4	-15.1	33.9
Pharmaceuticals	3	19.6	8.9	-1.8	34.4
Miscellaneous	15	16.4	6.3	-3.9	17.5
All items	52	59.1	33.2	7.3	59.6
Non-OPEC developing countries:					
Intermediates	657	30.6	22.0	13.4	86.5
Fertilizers	327	18.7	15.4	12.1	95.5
Inorganics	193	18.0	11.5	5.1	75.1
Plastics	381	38.5	30.7	22.9	93.9
Pharmaceuticals	134	20.5	16.0	11.4	92.5
Miscellaneous	285	16.3	10.1	4.0	72.0
All items	1,977	23.0	18.0	13.0	92.7
GSP developing countries:					
Intermediates	658	32.2	24.6	17.0	91.1
Fertilizers	338	19.4	16.1	12.7	95.8
Inorganics	199	18.3	11.9	5.6	77.1
Plastics	385	38.7	30.8	22.9	93.8
Pharmaceuticals	136	20.8	16.0	11.3	91.9
Miscellaneous	299	15.8	10.0	4.1	73.0
All items	2,015	23.3	18.8	14.3	94.6
Non-GSP developing countries:					
Intermediates	2	97.5	26.1	-45.3	1/ -3.4
Fertilizers	7	135.0	80.4	25.8	66.7
Inorganics	3	384.0	66.5	-251.0	1/ -14.0
Plastics	0	197.9	-29.2	-256.2	1/-17.7
Pharmaceuticals	0	32.5	-15.5	-63.4	1/ -6.7
Miscellaneous	1	34.7	-2.6	-39.9	1/ -19.3
All items	14	57.4	22.7	-11.9	20.8

See footnote at end of table.

Table 17.--Chemicals: Average growth rates of U.S. imports of major categories from developed and developing countries, by GSP status and OPEC status countries, 1978-84--Continued

Country group and category	1984 trade	Upper confidence limit	Growth rate	Lower confidence limit	Coefficient of determination
	Million dollars	Percent per year			Percent
Total, developing countries:					
Intermediates	660	32.1	24.5	16.9	91.1
Fertilizers	346	20.1	16.8	13.5	96.3
Inorganics	202	18.1	11.9	5.8	78.3
Plastics	385	38.7	30.8	23.0	93.9
Pharmaceuticals	137	20.4	15.8	11.2	92.2
Miscellaneous	300	15.7	9.9	4.2	73.7
All items	2,029	23.4	18.9	14.3	94.5
Developed countries:					
Intermediates	3,471	13.1	10.0	6.9	90.9
Fertilizers	1,089	9.3	5.0	0.6	53.3
Inorganics	2,532	11.2	7.2	3.1	74.6
Plastics	1,347	18.2	13.0	7.8	86.0
Pharmceuticals	1,107	23.5	18.9	14.3	94.4
Miscellaneous	1,966	13.8	10.8	7.8	92.7
All items	11,511	12.3	9.9	7.5	94.4
All countries:					
Intermediates	4,189	14.9	11.7	8.5	92.8
Fertilizers	1,643	12.1	8.5	4.8	83.8
Inorganics	2,768	11.0	7.5	3.9	80.7
Plastics	1,737	21.4	15.6	9.8	87.6
Pharmaceuticals	1,276	23.0	18.6	14.2	94.6
Miscellaneous	2,330	13.8	10.7	7.6	92.1
All items	13,942	13.7	11.1	8.6	94.9

1/ Negative values are artifacts of the statistical routines of the SAS Institute, Inc.

Source: Derived from official data of the U.S. Department of Commerce.

2. Fertilizers. [SITC Division 56 + Sub Group 271, crude natural fertilizers] Potash, phosphates, nitrogenous fertilizers, and mixed and prepared fertilizers.

3. Inorganic chemicals. [SITC Division 52] Includes chemical elements, mineral acids, such as sulfuric and hydrochloric acids, metallic salts and oxides, and radioactive materials, whether in organic or inorganic form (excluding uranium, thorium, plutonium for nuclear use).

4. Plastics and polymers. [SITC Division 58 + Sub Group 233, synthetic rubber + Sub Group 266, synthetic fibers] Artificial or synthetic polymeric materials generally, excluding further manufactured products, such as molded articles, rubber tires, spun yarn or fabrics. This category does not include natural polymers, such as wood, natural fibers or rubber, carbohydrates, proteins, etc, unless specially purified or processed primarily by chemical means.

5. Pharmaceuticals and allied products. [SITC Division 54] Vitamins, antibiotics, insulin and other hormones, medicaments, and bandages. Not included in the trade figures reported here is the value of smuggled narcotics and illicit drugs, which may have a high value "on the street" in the United States and may be important factors in the economies of the developing countries from which they originate.

6. Miscellaneous chemicals. [SITC 53, 55, 59] Dyes, pigments, soaps and detergents, essential oils, perfumery and toiletry preparations, etc. (As an "all other" category, this is large; no component or series of related components is as large or significant as the separately classified categories listed above.)

The growth rates of exports to developed countries are greater than the growth rates of exports to developing countries, indicating that the margin in favor of trade with developed countries is increasing. It is noteworthy that the growth rate of pharmaceuticals, among the most sophisticated and high-valued of chemical products, to developed countries is relatively high compared with that of other chemicals, whereas the growth rate of exports of pharmaceuticals to developing countries is only half as high and in line with growth of other chemical exports. This finding casts doubt on whether developing countries represent large export market opportunities for health care products despite the wide gap between their general level of health care structure and those of the industrialized countries.

OUTLOOK FOR U.S. CHEMICAL TRADE

As discussed below, the U.S. international trade position in chemicals is being and will continue to be affected by at least three developments:

(a) OPEC and other petroleum-rich nations are expanding and diversifying their production of commodity petrochemicals on a base of relatively inexpensive raw materials that the United States cannot come close to matching.

(b) The International Monetary Fund (IMF) and other banking organizations, in extending credit and additional loans, and in rescheduling debt repayment, have been generally requiring the debtor countries to promise (1) to adhere to a rigorous anti-inflation austerity program; (2) to increase their exports rapidly and substantially in order to earn more dollars and other hard currency; and (3) to reduce their imports promptly, in order to conserve their foreign-exchange reserves. 1/

(c) Developing nations with natural resources other than petroleum and natural gas are likewise interested in adding value to these raw materials before exporting them, i.e., upgrading such resources to exportable commodities. Examples are Morocco's large-scale phosphoric acid and phosphatic fertilizer plants utilizing its phosphate rock deposits; Israel's output of potash and high-unit-value bromine derivatives of Dead Sea salts; and petrochemical production by Singapore and Taiwan. The last two countries, though lacking reserves of crude petroleum or natural gas, import crude petroleum and operate refineries that produce the byproduct naphtha which is upgraded to petrochemicals.

U.S. International Trade Commission Studies

The recent U.S. International Trade Commission studies on petrochemicals include estimates of worldwide petrochemical production to the 1990s, supply-demand scenarios for the major petrochemicals, and, using the U.S. Department of Labor's input-output model of the U.S. economy, their possible effects on the U.S. chemical industry and industry in general. 2/ Although a few developing countries in Latin America, Europe, and Asia had produced petrochemicals for some years, and a number of countries were making ammonia and nitrogenous fertilizers from natural gas, the developing countries' major entry into petrochemicals accelerated after 1973 as the OPEC countries began nationalizing their petroleum industries. In addition to replacing imports with domestic production, the petroleum-rich countries have planned to export their petrochemicals, which can be looked upon as additional exports of crude petroleum or natural gas in a value-added form.

The Commission's studies have emphasized production of ethylene, ammonia, and methanol--the major building-block or primary petrochemicals for the manufacture of a large share of all petrochemicals. They are made from natural gas and its components, which are readily available and are often priced below worldwide price levels in the newly emerged petrochemical-producing nations. (In the beginning the most ambitious plans were those of Saudi Arabia and Iran. Saudi Arabia's construction goals have been achieved

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1/ "Chemical Exports: At Stake in the International Banking Rescue," Chemical Week, June 20, 1984, p. 53, and "Fresh Fears about Mounting Debts," Time, Apr. 29, 1985, p. 62.

2/ U.S. International Trade Commission, Petrochemicals, 1983-85, op. cit.

on schedule, but Iran's timetable was disrupted first by the revolution and then by the war with Iraq.)

In a "business-as-usual" base scenario, the value of U.S. production and the trade balance for commodity and specialty petrochemicals is projected in the Commission studies to be as follows, in billions of 1980 dollars:

	Production	Imports	Exports	Trade balance
1980	110.5	8.3	18.3	10.0
1990	120.7	17.4	19.0	1.6

As tabulated according to the base scenario, the diminished trade balance projection for 1990 masks the prospect of a negative trade balance of $700 million in 1990 for the commodity petrochemicals. These are the products made from feedstocks for which the United States industry, prior to the first petroleum price shock during 1973-74, had the most abundant and least expensive resources of any nation in the world, which resulted in large and rapidly increasing U.S. exports through the 1970's. Other scenarios--low-growth and high-growth--give a wide range of 1990 projections.

The changing foreign trade prospects of petrochemicals are projected to slow the future growth of the entire U.S. chemical and allied products industry, as follows:

	Sales (Billions of dollars)	10-year increase (Percent per year)
1960	$26.6	
1970	49.3	6.4
1980 1/	162.5	12.6
1990 1/	192.3	1.8
1995 1/	238.4	5.1

1/ 1980 dollars.

The average annual 10-year growth rates cannot be strictly compared. Chemical prices almost tripled during 1970-80 but showed, and would be expected to show, little change during the other decades. Comparing projected base-scenario growth rates for 1980-90 with those for 1985-95, it should be noted that these are not forecasts but computations generated by the input-output economic model. (One might speculatively infer from the projections that the petrochemicals of oil-rich countries could achieve most of their penetration of the world market during 1985-90 and that U.S. chemical sales could resume a more normal rate of growth subsequent to that. Other influences affecting the above projections could include an expected fall in the value of the dollar and/or some recessionary years during 1985-90. These could have affected the projected growth rate of 1980-90.)

Other Studies

Petrochemicals

A U.S. Department of Commerce study, setting an arbitrary index scale of 100 for developed countries' plant capacity to produce petrochemicals in 1980, forecasted that those countries' capacities in 2000 would remain between 87 and 109 (average about 99). 1/ However, using the same scale, the forecast of petrochemical capacity for the energy-rich developing countries shows a steady buildup from less than 10 in 1980 to some point between 43 and 59 by 2000. If all this transpires, there could be in the neighborhood of 20 percent excess world capacity over forecasted world demand by 2000. Because most of the new petrochemical capacity will be built in developing countries, and will be export oriented, competition for world markets could be severe. However, the competition will not be across the board of petrochemicals but largely confined to certain large-volume and fungible primary and intermediate petrochemicals, along with a few plastics, that are sold primarily on the basis of price rather than quality or performance. These are referred to as commodity petrochemicals. The less-affected and unaffected segments of the industry include (1) chemicals that are differentiated, designed to perform a physical or chemical function, and sold to performance standards; (2) the small-volume specialty petrochemicals, such as high-performance or "engineering" plastics and synthetic elastomers, adhesives, dyes and organic pigments, pesticides, and "fine" or high- specification chemical intermediates; and (3) the many chemicals that are indistinguishable from the commodity petrochemicals except that they are made in small quantities.

Ethylene and methanol.--The first U.S. International Trade Commission petrochemical study, published in April 1983, included production estimates for the major primary petrochemicals for 1990, which were compiled from information from industry and consultants that was collected mostly in late 1982. Corresponding estimates, published by the Chemical Marketing Research Association in 1985, are much more conservative and seem to indicate lessened expectations for growth in petrochemicals than previously expected. This phenomenon was highlighted at the March 1985 meeting of the Chemical Marketing Research Association (CMRA), where its president opened the proceedings by noting that his firm--one of the top three petrochemical producers of the world--had lowered its growth expectations by 23 percent in only 3 years; i.e., its earlier estimate of world ethylene capacity of 59 million metric tons in 1990 had been reduced to only 45.5 million metric tons in 1990. 2/ As indicated in tables 18 and 19, for ethylene, and table 20, for methanol, the reduced estimates of growth are rather uniformly distributed over all regions of the world.

Parenthetically, as shown in table 19, the new ethylene plants are being built mostly in the developing countries.

1/ "Department of Commerce Competitive Assessment of the U.S. Petrochemical Industry," presentation to the American Chemical Society, August 1983; also Chemical Week, Mar. 28, 1984, p. 34.

2/ CMRA Newsletter, May 1985, p. 1.

Table 18.--Production by developed, developing, and nonmarket-economy countries, 1980 and 1990

Countries	1980 1/	1990 forecast, from 1982 estimates 1/	1990 forecast, from 1985 estimates 2/
	Million of metric tons		
United States	13.3	16.7	14.9
Canada	1.2	3.1	1.9
Western Europe	11.3	15.7	12.5
Japan	4.2	5.8	3.8
Developing countries:			
Latin America	1.3	3.2	2.4
Middle East and Africa	.1	2.9	2.8
Asia and Oceania	1.3	2.5	2.2
Total	2.7	8.6	7.4
Total free world	32.4	49.9	40.4
Nonmarket economies	3.4	6.5	6.0
Total world	35.8	56.4	46.4

1/ U.S. International Trade Commission, Petrochemicals, April 1983, op. cit., p. 150, base scenario.

2/ R. Dodge, DeWitt & Co., "Ethylene and Co-products, Supply and Trade Shifts," presentation to Chemical Marketing Research Association, March 1985.

Table 19.--Ethylene: New plant capacity in developed, nonmarket-economy, and developing countries, 1985-90

	Developing countries		Developed countries		Nonmarket-economy countries	
	1985-86	Planned	1985-86	Planned	1985-86	Planned
	Millions of metric tons					
Canada			.68	1.38		
Western Europe			.55	.54		
Japan			.30			
Nonmarket-economy countries					1.67	1.40
Mexico and South America	.92	1.92				
Middle East, North Africa, and Turkey	2.64	.98				
Asia and Australia	.94	1.35				
Total	4.50	4.25	1.53	1.92	1.67	1.40
Percent of total	57		23		20	

Source: R. Dodge DeWitt & Co., "Ethylene and Co-products, Supply and Trade Shifts," presentation to Chemical Marketing Research Association, March 1985.

Table 20.--Methanol: Production and forecasted demand in developed, developing, and nonmarket-economy countries in 1980 and 1990

Region	Methanol		
	Production	Demand	
	1980	1990, from 1982 estimates 1/	1990, from 1985 estimates 2/
	Millions of metric tons		
United States	3.5	7.8	4.85
Canada	.4	.5	.35
Western Europe	3.4	6.3	4.50
Japan	1.1	2.1	1.75
Developing countries	1.2	2.4	NA
Nonmarket economies	3.1	4.3	NA
Total world	12.7	23.4	16.65 or 20

1/ U.S. International Trade Commission, The Probable Impact on the U.S. Petroleum Industry of the Expanding Petrochemical Industries in the Conventional-Energy-Rich Nations, USITC Publication 1370, April 1983, p. 174.

2/ R. E. Simmons, Tenneco Oil Co., presentation to Chemical Marketing Research Association, March 1985. The demand of 16.65 assumes 3 percent per year growth in chemical usage but only current levels of usage for fuel consumption. If fuel usage also grows, demand could reach 20 million metric tons.

Table 20, for methanol, is similar in format to table 18 for ethylene above; it also shows diminished expectations for growth to 1990.

Production capacity for methanol has exceeded world consumption by at least 3 million metric tons per year (mtpy) since 1980, and the excess has continued to grow. The capacity increase of 7 million mtpy, constructed during 1984-88 mostly in developing countries with cheap natural gas, has been offset in part by shutdown of more than 3 million mtpy of capacity in

developed countries that now are importing part of their requirements. 1/ The supply-demand balance for 1980 and projections for 1985 and 1990 are shown in table 21. If fuel (gasoline) applications develop as hoped by the industry, the 1990 surplus could be cut at least in half.

New methanol plant construction in 1984-88 is and will be located as follows (in millions of metric tons per year of capacity): 2/

Developed countries (New Zealand)	.4
Nonmarket economies	2.2
Developing countries	(4.2)
Saudi Arabia (1984)	.6
Bahrain (1985)	.3
Libya (1985)	.3
Trinidad (1984)	.4
India (1985)	.2
Burma (1985)	.2
Malaysia (1985)	.6
Yugoslavia (1985)	.2
Argentina (1986-88)	.8
Chile (1986-88)	.6
Total	6.8

The great imponderable, as stated, is fuel use in vehicles. This application includes methanol-gasoline blends (with appropriate co-solvents) as well as use of neat (90+ percent) methanol. In the U.S. about 300,000 metric tons of methanol was so used in 1984. If by 1990 just 10 percent of U.S. gasoline contains 4.75 percent methanol with a cosolvent, that would require more than 1.4 million metric tons of methanol. In Western Europe, in 1984, about 510,000 metric tons was so used. Methanol could also replace diesel fuel. Methanol is also used to make methyl tertiarybutyl ether (MTBE), a gasoline octane enhancer. This use is growing rapidly. MTBE, almost 90 percent of which is produced in the United States and Western Europe, consumed about 450,000 metric tons of methanol in 1984, and this use is projected to increase to about 2 million tons of methanol in 1990. 3/

1/ Tenneco Oil Co., op. cit. See also "World Methanol Plant Utilization Reporter, July 29, 1985, p. 5.

2/ Ibid.

3/ Ibid.

Table 21.--Methanol: Supply and demand, by developed countries, developing countries, and nonmarket-economy countries, 1980, 1985, and 1990

Source	1980		1985		1990	
	Supply	Demand	Potential supply 1/	Demand 2/	Potential supply 1/	Demand 2/
	Millions of metric tons per year					
United States	3.3	3.2	3.0	4.2	2.1	4.9
Other developed countries	4.0	4.6	5.7	5.7	4.8	6.6
Developing and nonmarket economy countries	3.0	3.4	11.1	4.5	15.9	5.2
Total world	10.3	10.3	19.8	14.4	22.8	16.7
Surplus	-	-	5.4		6.1	

1/ Supply calculated at 90 percent of nameplate capacity.

2/ Demand assumes current levels of usage for fuel applications and 3 percent per year growth in chemical demand.

3/ Estimated by the staff of the U.S. International Trade Commission.

Polyethylene. 1/--Polyethylene is the major consumer of ethylene--accounting for more than 50 percent of the ethylene produced in the United States. A recent forecast gives the buildup in production capacity to 1989 and 1994. As shown in table 22, this forecast projects that the developing countries' capacity will increase 34 percent during 1983-89 compared with increases of 12 percent for developed countries and 47 percent for nonmarket economies. Middle East capacity, in particular, is more than tripling during 1983-89 and is primarily for export sale and will adversely affect U.S. exports. As compiled, these figures are moderately flawed because Mexico's production is in the North America total and Japan's and Australia's are in the Far East's and possibly the nonmarket economies' totals.

The reduced expectations for growth in demand for petrochemicals referred to earlier in this section does not seem to have been matched by cutbacks in construction of new plants in developing countries. Although large construction projects have been postponed in Nigeria, Mexico, and Indonesia, these are a small part of the total. This may portend increased competition in export markets.

Fertilizers and sulfur

According to industry forecasts, 2/ worldwide effective capacities (85 percent of nameplate capacity) of ammonia, phosphate rock, and potash will be failing to meet production needs by the early 1990's. The Florida phosphate rock industry will be beginning to rapidly deplete its existing mines by those years. By the year 2000, about 200 new world-scale fertilizer plants will be required, costing $66 billion in 1984 dollars.

Developing countries have increased their consumption of fertilizers from 9 percent of the world total in 1965 to 20 percent at the present time and will continue to increase 6 percent per year to 2000 while the growth in the developed countries will be only 2.3 percent per year. During 1985-2000, consumption of nitrogen fertilizer (derived from ammonia) likely will grow 13.5 percent per year, phosphorus 3.1 percent per year, and potassium (potash) 3.5 percent per year. The forecast, in millions of metric tons, is summarized as follows:

	Consumption		
	1965	1984	2000
Developing countries	9	51	80
Developed countries	27	49	71
Nonmarket economy countries	5	25	60
Total	41	125	211

1/ "Polyethylene: The Newcomer's Dilemma", L. A. Carmichael and K. B. Sinclair, SRI International, presentation to Chemical Marketing Research Association, March 1985.

2/ G.P. Giusti, Texasgulf Inc., D.K. Arnott, Cansulex Ltd., R. Boyd of British Sulphur Corp., and others; see "Global Outlook for Fertilizer Raw Materials," Chemical and Engineering News, Feb. 25, 1985.

Table 22.--Polyethylene: Production capacity of developed, developing, and nonmarket-economy countries, and percent of increase, 1983, 1989, and 1994

Region	1983	1989 forecast	1994 forecast	Increase, 1989 over 1983
	-Millions of metric tons per year-			Percent
Developed countries:				
North America	8.00	9.83	-	
Western Europe	8.21	8.36	-	
Total	16.21	18.19	-	12
Developing counties:				
South America	1.15	1.26	-	
Far East	3.29	3.66	-	
Middle East	.27	1.21	-	344
Africa	.28	.59	-	
Total	4.99	6.71	-	34
Non-market economies	2.80	4.10	--	47
Grand total	24.00	29.01	36.00	21

The need for new capacity by 2000, also in millions of metric tons, is shown in the following tabulation:

Source	Year 2000				
	Nitrogen	Phosphate rock	Phosphate (as P_2O_5)	Potash (as K_2O)	Total
World annual demand	135.1	245.1	63.0	47.0	490.2
Current annual capacity	115.7	189.2	47.6	35.3	387.8
Additional capacity required 1/	43.2	99.2	26.5	20.0	188.9
Number of new plants required	75	25	76	23	199

1/ Based on an 85-percent operating rate.

The United States is the third largest producer of nitrogen products, following the U.S.S.R. and China, with Middle Eastern producers becoming increasingly important world-trade suppliers.

In international trade, U.S. fertilizers have maintained a large and growing positive balance of trade even though this country imports about 80 percent of its potash requirements even though imports of all fertilizers enter duty free. The record for the past 6 years is summarized in the following tabulation (in billions of dollars): 1/

Year	U.S. imports	U.S. exports	Trade balance
1978	.95	1.60	.65
1984	1.69	2.69	1.00

In future years, the preceding paragraphs and earlier sections of this report suggest that the positive balance of trade will be eroded. In real terms this erosion has already begun. The real trend of U.S. exports, using price- or inflation-adjusted dollars, was a 2.2 percent-per-year decrease during 1978-84, while that for U.S. imports was a 3.1 percent-per-year growth during those years.

1/ These data are TSUS classifications. In SITC, the import and export values for 1984 are $1.64 and $2.28 billion, respectively.

Sulfur, a crucial ingredient for processing phosphate, will similarly see constraints on availability. 1/ A few decades ago, most sulfur was mined directly from the ground in pure form by the Frasch process, and the United States was the leading producer. As the Frasch reserves diminished, the leading source of sulfur became recovery from "sour" natural gas, particularly in Alberta, Canada. However, Canada likely will cease to be the dominant world producer by 1990. Western European countries as a group then will lead, closely followed by the U.S.S.R., toward the end of the 1990's, as the Soviets recover sulfur from their Caspian Sea oil and gas; and the Middle East will also be an important producing region, recovering sulfur from the natural gas that once was flared. Canadian reserves are still large, both in present oil and gas production and also in the potential form of recovery from ultrahigh sour gas currently under research and development.

Fermentation ethyl alcohol

Brazil's large output of ethyl alcohol was cited in the competitiveness section, above. Five new distilleries funded by a World Bank loan were approved in early 1985. 2/ Almost 90 percent of Brazil's ethyl alcohol consumption (including exports) is for motor vehicle fuel. 3/ Brazil's production in 1984 was 2.5 billion gallons, while U.S. production was about 430 million gallons. 3/ About 137 million gallons of the Brazilian alcohol was imported by the United States. A consortium of U.S. producers filed antidumping and countervailing duty (i.e., antisubsidy) petitions with the U.S. International Trade Commission and the U.S. Department of Commerce against these imports, and a Customs reclassification in mid-1985 has ensured that imported ethyl alcohol pays a 60-cents-per-gallon duty when used in automotive fuel. (Non-beverage ethyl alcohol otherwise is subject to a 3 percent ad valorem duty.)

A number of Caribbean Basin nations--Costa Rica, the Dominican Republic, El Salvador, Guatemala, Haiti, Nicaragua, and Panama--are building and are planning to build ethyl alcohol plants, with capacities up to 30,000 gallons per day, utilizing surplus sugar or molasses. Part of their production is intended for export to the United States as a motor fuel blending component in gasohol. Under the Caribbean Basin Initiative, imported alcohol from these countries (excepting Nicaragua) is eligible for the 60 cents per gallon federal subsidy for this use, yet is exempt from the offsetting 60 cents per gallon tariff on such material that is paid on imports from other countries. 4/ 5/

1/ Texasgulf, op.cit., and "Sulfur, Tightening Supplies for the Long Term," Chemical Week, Mar. 27, 1985. pp. 26-32.

2/ "Battle Rages over Imports of Fuel Ethanol, "Chemical and Engineering News", Apr. 22, 1985, pp. 9-15.

3/ Ibid.

4/ Ibid.

5/ "The Caribbean Basin's Incentives for Ethanol," Chemical Week, Oct. 9, 1985, p. 13.

6/ "Possible Effects Of And Recommendations Concerning the Proposed Tariff Reclassification of Catalytic Naphtha And Other Motor Fuel Blending Stocks," the U.S. International Trade Commission, USITC Publication 1686, April 1985, pp. 41-46.

Another incentive is potential consumption in their own economies, including gasohol. In late 1984, for example, with cane prices running below $18 per ton, refined sugar selling for less than 12 cents per pound, and molasses for less than 40 cents per gallon, the prospect of using sugar as a feedstock for a more economically viable product, such as ethyl alcohol, which was being sold for at least $1.35 per gallon in parts of the region, was arousing interest among sugar producers. 1/

In addition to production of ethyl alcohol, Jamaica is building, and other Caribbean countries are planning to build, simple distillation or "drying" units and reportedly intend to import "wet" alcohol containing about 5 percent water from Brazil, Spain, and other sources; remove that water; and reexport the "dried" or anhydrous ethyl alcohol duty-free to the United States for motor fuel use. (This is permitted by the Caribbean Basin Initiative (CBI) regulations that currently allow duty-free status when 35 percent of the product's value has been added in the Caribbean country.) The National Corn Growers Association and other U.S. organizations have been attempting to have ethyl alcohol excluded from duty-free status in the Caribbean Basin Initiative. 2/

In the Philippines, a plant to make ethyl alcohol from cane sugar is reportedly planned. The project is part of an established program to make use of the country's current overcapacity of sugar by converting it to anhydrous alcohol for use in motor fuel. 3/

The Government of Argentina reportedly plans to produce up to 228,000 metric tons per year of ethyl alcohol for gasoline blending. This capacity will be attainable by mid-1986, and the Argentine alcohol will be produced from grain sorghum rather than corn or sugar cane. 4/

The Issue of Protectionism

One of the uncertainties about future years is the issue of protectionism. Because petroleum and natural gas cost so little to produce in energy-rich countries (see Competitiveness section), they are selling or transferring materials from these sources (e.g., natural gas) to industrial users in their own countries at prices substantially below the export selling price or world prices in general. Petrochemical and other commodities made from those cheap raw materials and energy sources, and priced accordingly, have been able in many cases to easily penetrate U.S. and other markets. Many U.S. industries have been concerned about the implications of those low-priced exports in U.S. and world markets and have argued that such products are in effect subsidized.

1/ "Central American Sugar and Ethanol Production," Chemical Week, Dec. 12, 1984, p. 24.

2/ "Battle Rages . . . Fuel Ethanol," op. cit. Also "The Caribbean Basin's Incentives for Ethanol," op. cit.

3/ Chemical Week, May 29, 1985, p. 27.

4/ European Chemical News, Feb. 11, 1985, p. 22.

In 1984 they pursued congressional legislative remedies. The natural resource subsidy proposal that emerged from these efforts was only narrowly defeated in the 98th Congress; however, the issue has remained a subject of debate. 1/

Similar complaints exist in Western Europe. While products of Mexico have been the principal issue thus far in the United States, Saudi Arabia has reportedly been planning to export 20 percent of its large petrochemical output to the United States, 22 percent to Europe, 20 percent to Japan, and 28 percent to other countries and therefore has more at stake. It is reported that if the Europeans succeed in blocking Saudi petrochemicals from their market, the Saudis hope to sell to others and "plan to watch their Asian and other customers prosper by using Saudi raw materials to make much cheaper fertilizers and other products than the Europeans can make from the output of their high-cost, tariff-protected petrochemical industries." 2/

The issue of U.S. imports of ethyl alcohol from Brazil and the Caribbean countries was discussed in the previous section.

Effect of Debt Restructuring and Shortage of Funds

The debt of seven Latin American countries exceeded $300 billion in early 1985, compared with $80 billion owed by 42 sub-Saharan African countries. 3/ The cumulative external debt of all developing countries exceeded $700 billion, in 1980 dollars, in 1984. 4/ Their efforts to meet IMF requirements have already had an effect on U.S. exports of chemicals to Mexico and South America, which had more than quadrupled during 1973-80, but then, during 1980-84, decreased almost one-fourth. Other factors, of course, such as the strong U.S. dollar have also played a part. U.S. chemical exports to Africa, with even greater economic problems, dropped almost 40 percent during 1980-84 and were less than 10 percent of the value of those to Latin America. In contrast, U.S. chemical exports to the rest of the world (i.e., to developed and non-market-economy countries), which had more than tripled during 1973-80, rose about 14 percent during 1980-84. 5/

1/ U.S. International Trade Commission report, May 1985, op. cit.

2/ The Economist, Jan. 26, 1985, p. 68, and Mar. 9, 1985, p. 67.

3/ Debt was $102 billion for Brazil, $96 billion for Mexico, $48 billion for Argentina, $35 billion for Venezuela, $13.5 billion for Peru, $4.7 billion for Nicaragua, and $3.5 billion for Bolivia. Other Latin American countries are also substantially in debt. Of the African debt, only $6 billion was with U.S. banks. From "Fresh Fears About Mounting Debts," Time, Apr. 29, 1985, p. 62.

4/ The debt was $703.0 billion in 1984, in 1980 dollars, according to the World Bank. See The Economist, July 6, 1985, p. 70.

5/ Chemical Week, June 20, 1984, p. 53, and U.S. Department of Commerce official statistics.

APPENDIX A

GLOSSARY/ACRONYMS

GLOSSARY/ACRONYMS

ANDEAN. Member countries in the Andean Common Market are Bolivia, Colombia, Ecuador, Peru, and Venezuela. Chile was a charter member but withdrew in the 1970's.

ASEAN. Members of the Asssociation of Southeast Asian Nations (ASEAN), formed in 1967, are Brunei, Indonesia, Malaysia, the Philippines, Singapore, and Thailand. (Brunei became a member in 1984.) Its program is the promotion of regional economic, social, and cultural cooperation--especially cooperative activities in industrial development and trade (e.g., tariff preferences and joint industrial projects).

BEFIEX. The (Brazilian) Commission for the Granting of Fiscal Benefits for Special Export Programs was established in 1972. Its program offers a package of tax benefits to foreign companies investing in Brazil. In exchange for the tax benefits, the companies and BEFIEX negotiate an agreement covering the export commitment of the company, the level of imports, additional investments to be made by the company, and the net foreign exchange earnings for Brazil (i.e., the amount left over after imports, profit remittances, etc.).

Burkina Faso. Upper Volta (Africa).

CBI.--Caribbean Basin Initiative. The main part of its program, authorized by the Caribbean Basin Recovery Act, effective Jan. 1, 1984, provides for duty-free U.S. imports of most commodities provided that the direct costs of processing operations performed in a beneficiary country or countries is not less than 35 percent of the appraised value of such article at the time it is entered (into the United States). The following countries and territories are beneficiaries:

Antigua and Barbuda
Bahamas
Barbados
Belize
Costa Rica
Dominica
Dominican Republic
El Salvador
Grenada
Guatemala
Haiti
Honduras
Jamaica
Montserrat
Netherlands Antilles
Panama
Saint Christopher-Nevis
Saint Lucia
Saint Vincent and the Grenadines
Trinidad and Tobago
Virgin Islands, British

CMA. Chemical Manufacturers Association. The leading trade association of the U.S. chemical industry. (Its members include U.S. subsidiaries of foreign countries.)

CMRA. Chemical Marketing Research Association, 139 Chestnut Avenue, Staten Island, New York 10305. This is a professional organization, most of whose members are employed by U.S. chemical companies; some are employees of academia and the U.S. Government.

De facto. Actually existing, especially when without lawful authority.

Entrepot.--Countries such as Hong Kong and Singapore which serve for the distribution and transshipment of goods within a limited region.

Essential oils. Volatile oils derived from the leaves, stems, flowers, or twigs of plants, and usually carrying the odor or flavor of the plant. Some are nearly pure single compounds: e.g., oil of wintergreen is methyl salicylate. Others are mixtures such as oil of bitter almond (benzaldehyde, hydrocyanic acid). Some contain resins in solution and are called oleoresins or balsams.

FET. Foreign Economic Trends and Their Implications for the United States: Bulletins on countries and regions published by the International Trade Administration (ITA) of the U.S. Department of Commerce.

GCC. Gulf Cooperation Council. The GCC was formed in 1981 by Saudi Arabia, Kuwait, the United Arab Emirates, Oman, Qatar, and Bahrain, to provide for mutual defense and economic cooperation.

GDP. Gross domestic product. See GDP section.

GNP. Gross national product. See GDP section.

GSP. Generalized system of preferences. The GSP of the United States provides for duty-free treatment of eligible articles imported directly from 114 designated beneficiary developing countries. Most of the OPEC countries are excluded from this program. Similar programs exist in Western Europe and Japan.

IMF. International Monetary Fund. See Incentives section.

LDDC's. Least developed developing countries, as follows:

Bangladesh	Lesotho
Benin	Malawi
Bhutan	Maldives
Botswana	Mali
Burkina Faso	Nepal
Burundi	Niger
Cape Verde	Rwanda
Central African Republic	Somalia
Chad	Sudan
Comoros	Tanzania
Gambia	Uganda
Guinea	Western Samoa
Haiti	Yemen Arab Republic (Sanaa)

mtpy. Metric tons per year.

Malagasy Republic. Madagascar.

NIC. Newly industrialized countries: those developing countries which are approaching "developed" status. Although universal agreement does not exist, most lists include Taiwan, Hong Kong, and Korea.

OPEC. The Organization of Petroleum Exporting Countries (OPEC) was founded in 1960 by Iran, Iraq, Kuwait, Saudi Arabia, and Venzuela in order to permit the crude petroleum-exporting countries to present a unified front in their dealings with the major international petroleum countries. By the end of 1975, OPEC had reached its current 13-member status, as follows:

Algeria	Libya
Ecuador	Nigeria
Gabon	Qatar
Indonesia	Saudi Arabia
Iran	United Arab Emirates
Iraq	Venezuela
Kuwait	

Only Ecuador, Indonesia, and Venezuela have been designated as beneficiary developing countries in the United States' GSP program.

SITC. Standard International Trade Classification system, for imports and exports. This is the basic system for nearly all of the world. Although the United States has its own classification system (TSUS for imports and schedule B for exports), it converts its trade statistics to a close approximation of SITC categories and publishes them regularly as schedule A (imports) and schedule E (exports).

UNIDO. United Nations Industrial Development Organization. See Incentives section.

APPENDIX B

CHEMICALS: PRODUCTION, IMPORTS, EXPORTS, AND APPARENT CONSUMPTION OF INDIVIDUAL DEVELOPING COUNTRIES, 1979

Table B-1--Chemicals: Production, imports, exports, and apparent consumption in market economy developing countries, 1979

(In millions of dollars)

Country or region	Production	Imports 1/	Exports 1/	Apparent consumption
Developing countries	78,896	32,663	8,637	102,922
Mexico and South America	25,305	6,772	1,860	30,217
Argentina	1,600	600	225	-
Bolivia	40	60	17	-
Brazil	15,000	2,813	432	-
Chile	824	240	417	-
Colombia	1,770	107	48	-
Ecuador	170	190	4	-
Falkland Islands	-	.3	-	-
French Guiana	-	13	-	-
Guyana	6	32	5	-
Mexico	3,000	1,205	447	-
Paraguay	3/ 30	32	14	-
Peru	900	270	18	-
Suriname	3/ 100	3/ 30	3/ 94	-
Uruguay	3/ 85	175	34	-
Venezuela	1,780	1,005	105	-
Caribbean and Central America	1,612	1,676	575	2,713
Antigua	3/ .1	3/ 4	.1	-
Bahamas	3/ 180	3/ 45	3/ 90	-
Barbados	41	35	10	-
Belize	3/ 3	8	3	-
Bermuda	3/ 10	14	8	-
British Virgin Islands	-	-	.02	-
Costa Rica	142	226	58	-
Dominica	3	-	2.6	-
Dominican Republic	138	139	40	-
El Salvador	123	207	42	-
French West Indies (Guadeloupe)	.3	-	.3	-
Grenada	-	-	-	-
Guatemala	170	276	90	-
Haiti	11	20	10	-
Honduras	90	110	25	-
Jamaica	340	138	17	-
Martinique	2	52	1	-
Netherlands Antilles	3/ 40	3/ 75	38	-
Nicaragua	118	76	31	-
Panama	61	132	4	-

See footnotes at end of table.

Table B-1--Chemicals: Production, imports, exports, and apparent consumption in market economy developing countries, 1979--Continued

(In millions of dollars)

Country or region	Production	Imports 1/	Exports 1/	Apparent consumption
Developing countries--Continued:				
Caribbean and Central America--Continued				
St. Christopher-Nevis, Montserrat, and Saint Vincent and the Grenadines	-	-	-	-
Saint Lucia	.4	-	.3	-
Trinidad and Tobago	140	119	105	-
Middle East	5,370	4,107	954	8,523
Bahrain	3/ 4	131	4	-
Iraq	340	200	38	-
Iran	3/ 1,000	1,100	-	-
Israel	3/ 3,100	555	621	-
Jordan	10	101	25	-
Kuwait	3/ 200	198	144	-
Lebanon	3/ 100	130	3/ 50	-
Oman	-	47	-	-
Qatar	80	57	71	-
Saudi Arabia	-	923	-	-
Syria	500	295	-	-
United Arab Emirates	3/ 35	3/ 260	-	-
Yemen (Aden)	.2	12	-	-
Yemen (Sana)	3/ 1	98	1	-
South Asia	5,897	1,820	222	7,495
Bangladesh	190	179	.2	-
Bhutan, and Maldives	2/	2/	2/	-
Burma	3/ 5	36	1	-
India	5,600	900	170	-
Macao	2	13	1	-
Nepal	2/	2/	2/	-
Pakistan	40	572	17	-
Sri Lanka	60	120	33	-
East Asia	13,780	9,399	3,244	20,735
Brunei	-	27	-	-
Hong Kong	3/ 200	1,367	674	-
Indonesia	3/ 600	1,012	84	-
Korea	3/ 5,050	1,984	494	-
Malaysia	800	810	61	-

See footnotes at end of table.

Table B-1--Chemicals: Production, imports, exports, and apparent consumption in market economy developing countries, 1979--Continued

(In millions of dollars)

Country or region	Production	Imports 1/	Exports 1/	Apparent consumption
Developing countries--Continued:				
East Asia--Continued:				
Philippines	1,310	734	113	-
Singapore	3/ 520	1,008	520	-
Taiwan	3/ 5,100	1,400	1,260	-
Thailand	200	1,057	38	-
Africa	2,833	4,675	580	6,928
Algeria	-	519	-	-
Angola	-	100	-	-
Benin	-	15	-	-
Burkina Faso (Upper Volta)	-	37	-	-
Burundi	-	10	-	-
Cameroon	20	134	7	-
Cape Verde	-	2	-	-
Central African Republic	120	9	-	-
Chad	-	3/ 25	.3	-
Comoros	-	1	.3	-
Congo	3/ 1	26	.8	-
Egypt	370	339	31	-
Ethiopia	32	86	.6	-
French Indian Ocean Areas (Reunion)	9	72	8	-
Gabon	-	45	-	-
Gambia	-	6	-	-
Ghana	36	150	-	-
Guinea-Bissau	-	3	-	-
Ivory Coast	226	213	23	-
Kenya	411	193	48	-
Liberia	2	34	2	-
Libya	63	217	69	-
Madagascar	40	74	6	-
Malawi	2	40	1.4	-
Mali	-	22	.05	-
Mauritania	-	6	-	-
Mauritius	31	35	-	-
Morocco	300	322	170	-
Mozambique	12	25	.3	-
Niger	-	3/ 13	-	-
Nigeria	500	1,002	-	-
Rwanda	7	9	-	-

See footnotes at end of table.

Table B-1--Chemicals: Production, imports, exports, and apparent consumption in market economy developing countries, 1979--Continued

(In millions of dollars)

Country/region	Production	Imports 1/	Exports 1/	Apparent consumption
Developing countries--Continued:				
Africa--Continued				
Senegal	40	83	18	-
Seychelles	-	4	-	-
Sierra Leone	-	15	-	-
Somalia	4	12	.4	-
Sudan	50	95	-	-
Tanzania	17	140	4	-
Togo	2	23	.15	-
Tunisia	320	201	175	-
Uganda	-	20	-	-
Zaire	8	85	2	-
Zambia	80	83	3	-
Zimbabwe	130	130	10	-
Equatorial Guinea, Guinea, Djibouti, Botswana, Lesotho, Swaziland, and Sao Tome and Principe	-	-	-	-
Europe	17,269	4,095	1,200	20,164
Cyprus	28	88	8	-
Malta	11	57	6	-
Portugal	1,230	801	202	-
Romania	3/ 8,000	3/ 200	3/ 300	-
Turkey	3/ 3,500	954	24	-
Yugoslavia	4,500	1,995	660	-
Oceania	30	119	-	147
Fiji	14	33	1.6	-
French Polynesia	.3	28	.2	-
Kiribati	-	1	-	-
New Caledonia	-	21	-	-
Papua New Guinea	15	24	-	-
Solomon Islands	-	4	-	-
Tonga	-	2	-	
Tuvalu	-	-	-	-
Vanuatu and Nauru	-	3/ 3	-	-
Western Samoa	-	3	.05	-

1/ SITC group 5 only.
2/ Not available.
3/ Estimates, or modified from available data.

Source: United Nations Yearbook of International Trade Statistics, 1981; private communication from World Bank; Republic of China Statistical Yearbook, 1984; and estimates of the staff of the U.S. International Trade Commission.

APPENDIX C

POPULATION AND GROSS DOMESTIC PRODUCT OF INDIVIDUAL DEVELOPING COUNTRIES, 1977, 1980, 1982, AND 1983

Table C-1.—Population (1981) and gross domestic product of individual developing countries, selected years

Country	Population 1981	Population growth, 1970–81	Gross domestic product—					Former or present colony of 1/	Year independent	Per capita GDP in 1981
			1977	1980	1982	1983, actual	1983, based on 1980 prices			
	Millions	Percent per year	Billion dollars							
Mexico and South America:										
Argentina	28.2	1.6	51.0	2/	83.5					42,560
Bolivia	5.7	2.6	3.4	6.1	8.8					600
Brazil	120.5	2.1	164.2	253.0	294.0	242.0				2,220
Chile	11.3	1.7	11.5	27.6	25.6					2,560
Colombia	26.4	1.9	19.5	33.6	39.2	37.7	21.0		1810	1,380
Ecuador	8.6	3.4	6.5	11.7	14.2	13.2	7.0			1,180
Falkland Islands	.002							UK		
Guyana	.8	1.0	.4	.6	.5	.5	.4	UK	1966	720
Mexico	71.2	3.1	74.2	186.3	189.9	147.1				2,250
Paraguay	3.1	2.6	2.1	4.5	5.9	5.7	4.6			1,630
Peru	17.0	2.6	10.6	17.3	21.0	17.4				1,170
Suriname	.4	-.7	.7	1.0	1.2	1.3		NE	1975	3,030
Uruguay	2.9	.4	4.2	10.2	9.8	5.4				2,820
Venezuela	15.4	3.4	35.8	59.2	67.9	66.4	56.5	SP	1821	4,220
Caribbean and Central America:										
Bahamas	.24		1.0	1.2	1.4			UK	1973	
Barbados	.25	.5	.5	.8	1.0			UK	1966	3,500
Belize	.15	2.0	.1	.17	.17	.18	.16	UK	1981	1,080
Bermuda	.06							UK		
British dependencies 3/	.18		.12					UK		
Costa Rica	2.3	2.8	3.1	4.8	2.6	-	-			1,430
Dominica	.08		.03	.06	.07				1978	
Dominican Republic	5.6	3.0	4.5	6.6	7.9					1,260
El Salvador	4.7	2.9	2.9	3.6	3.6	3.9	3.1			650
Grenada	.11	1.6	.05	.09	.11			UK	1974	850
Guadeloupe, Martinique	.63		1.9					FR		
Guatemala	7.5	3.1	5.5	7.9	8.7	8.7	7.7			1,140
Haiti	5.1	1.7	1.3	1.5	1.5	1.6	1.4	FR	1804	300
Honduras	3.8	3.4	1.5	2.5	2.8	2.9	2.5			600
Jamaica	2.2	1.5	3.3	2.6	3.3	3.6		UK	1960	1,180
Netherlands Antilles	.25		.7					NE		
Nicaragua	2.8	3.9	2.2	2.1	3.0	3.6	2.4			860
Panama	1.9	2.3	2.2	3.6	4.3	4.4	3.9	COL	1903	1,910
Trinidad and Tobago	1.2	1.4	3.5	6.4	7.3					5,670
Saint Lucia	.13		.07	.11	.13	.14	.12	UK	1979	
Saint Vincent and the Grenadines	.12		.04	.06	.08	.09	.07	UK	1979	

See footnotes at end of table.

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Table C-1.--Population (1981) and gross domestic product of individual developing countries, selected years--Continued

Country	Population 1981	Population growth, 1970-81	Gross domestic product--					Former or present colony of 1/	Year independent	Per capita GDP in 1981
			1977	1980	1982	1983, actual	1983, based on 1980 prices			
	Millions	Percent per year	Billion dollars							
Middle East:										
Bahrain	.36	5.1	1.7	3.6	4.0					8,960
Iran	40.1	3.1	60	89.2	89.2					
Iraq	13.5	3.4	19.3		19.3			UK	1932	-
Israel	4.0	2.6	14.7	21.9	24.4	28.6		UK	1948	5,160
Jordan	3.4	3.5	1.5	3.3	3.8	4.1	3.4	UK	1946	$1,620
Kuwait	1.5	6.3	13.4	27.5	19.9	21.3		UK	1961	20,900
Lebanon	3.0		3.0		2.0			FR	1943	
Oman	.9	3.1	2.6	5.7	7.2					5,920
Qatar	.22	3.0			1.0			UK	1971	
Saudi Arabia	9.3	4.5	63.4	116.0	153.1	120.0	109.3		1932	12,600
Syria	9.3	3.7	6.5	13.2	18.3	19.7	15.5	FR	1946	1,570
United Arab Emirates	1.1	16.6	13.9	29.6	29.7			UK	1971	24,660
Yemen (Aden)	1.9				.5			UK	1967	
Yemen (Sanaa)	7.3	3.0	2.6	3.2	3.5					460
South Asia:										
Bangladesh	90.7	2.6	8.5	11.2	12.0	11.7		PAK	1971	140
Bhutan	1.3		.1		.1					
Burma	34.1	2.2	3.8	5.9	6.0	6.2	5.7	UK	1948	190
India	690.1	2.1	102.0	162.2	174.0			UK	1947	260
Maldives	.15				.1			UK	1965	
Nepal	15.0	2.6	1.4	1.9	2.3	2.3				150
Pakistan	84.5	3.0	17.4	24.0	27.3	27.8	21.7	UK	1947	350
Sri Lanka	15.0	1.7	3.4	4.0	4.8	5.2		UK	1947	300
East Asia:										
Brunei	.23	1.5			2.0			UK	1984	5/ 22,000
Hong Kong	5.2	2.4	10.8	22.7	4/ 26.3					5,100
Indonesia	149.5	2.3	45.1	72.5	89.9	79.9		NE	1945	530
Korea	38.9	1.7	35.4	62.5	72.3	76.9	60.3		1948	1,700
Malaysia	14.2	2.5	13.1	23.8	26.2	29.3	26.8	UK	1957	1,840
Philippines	49.6	2.7	20.8	35.4	39.9	35.3		US	1946	790
Singapore	2.4	1.5	6.5	11.3	14.9	16.6	14.5	MAL/UK	1965	5,240
Taiwan	18.0		23.0	40.0	48.3	48.9				
Thailand	48.0	2.5	18.8	33.5	36.8	40.4	34.9			770
Africa:										
Algeria	19.6	3.3	19.7	42.1	44.9			FR	1962	2,140
Angola	7.8	2.5	3.6	6.3	4/ 6.5			PO	1975	840
Benin	3.6	2.7	.6	1.2	1.1			FR	1960	320
Botswana	.9	3.7	.4	.89	.72	.89	.83	UK	1966	1,010
Burkina Faso	6.3	2.0	.7	1.3	1.1	1.1		FR	1960	240
Burundi	4.2	2.2	.5	.96	1.02	1.12		BE	1962	230
Cameroon	8.7	2.2	3.2	6.4	6.2			FR	1960	880
Cape Verde	.3	1.0	.05	.06				PO	1975	340

See footnotes at end of table.

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Table C-1.—Population (1981) and gross domestic product of individual developing countries, selected years—Continued

Country	Population 1981	Population growth, 1970–81	Gross domestic product— 1977	1980	1982	1983, actual	1983, based on 1980 prices	Former or present colony of 1/	Year independent	Per capita GDP in 1981
	Millions	Percent per year	Billion dollars							
Africa—Continued:										
Central African Republic	2.4	2.3	.50	.80				FR	1960	320
Chad	4.5	2.0	.54	.50				FR	1975	110
Comoros	.37							FR	1975	
Congo	1.7	2.9	.77	1.8				FR	1960	$1,110
Djibouti	.42		.1					FR	1977	
Egypt	43.3	2.5	16.8	24.0	29.1	31.8		UK	1953	650
Ethiopia	32.0	2.0	3.3	4.1	4.4	4.8	4.6			140
Gabon	.7	1.3	2.8	4.3	3.6	3.2		FR	1960	3,810
Gambia	.6	2.7	.1	.23				UK	1965	370
Ghana	11.8	3.0	9.7	14.9	31.2	52.8	10.9	UK	1957	400
Guinea	5.4	2.9	1.3	1.6				FR	1958	300
Guinea Bissau	.8		.09	.14				PO	1974	190
Ivory Coast	8.5	5.0	6.3	10.5	7.6	7.0		FR	1960	1,200
Kenya	17.4	4.0	4.6	7.1	6.2	5.7	4.3	UK	1963	420
Lesotho	1.4	2.4	.2	.39	.35			UK	1966	540
Liberia	1.9	3.5	.7	.92	.83				1847	520
Libya	3.1	4.1	19.4	35.1				IT	1951	8,450
Madagascar	9.0	2.6	1.9	3.3	4/ 3.0			FR	1960	330
Malawi	6.2	3.0	.9	1.4	1.3	1.4	.96			200
Mali	6.9	2.6	.8	1.3				FR	1960	190
Mauritania	1.6	2.3	.5	.7				FR	1960	460
Mauritius	1.0	1.4	.8	1.1	1.1			UK	1968	1,270
Morocco	20.9	3.1	10.4	17.9	15.0	13.4		FR	1956	860
Mozambique	12.5	4.2	2.8	3.9	4/ 4.5			PO	1975	360
Niger	5.7	3.3	.9	1.9				FR	1960	330
Nigeria	87.6	2.5	50.2	79.2	66.7			UK	1960	870
Reunion	.50	1.4						FR		
Rwanda	5.3	3.4	.8	1.2	1.4			FR	1962	250
Sao Tome and Principe	.12	1.9	.04	.04				PO	1975	370
Senegal	5.9	2.7	2.0	3.0				FR	1960	430
Seychelles	.07			.14	.15			UK	1976	
Sierra Leone	3.6	2.6	.7	1.1	1.3	.96		UK	1961	320
Somalia	4.4	2.8	1.0	1.5				UK	1960	280
Sudan	19.2	3.1	6.4	8.1	6.6			UK	1956	380
Swaziland	.6	3.2	.4	.60	.53			UK	1968	760
Tanzania	19.1	3.4	3.5	5.0	5.2			UK	1964	280
Togo	2.7	2.5	.8	1.1	.82	.72		FR	1960	380
Tunisia	6.5	2.3	5.0	8.7	8.2	8.2		FR	1956	1,420
Uganda	13.0	2.6	6.6					UK	1962	220
Upper Volta—see Burkina Faso										
Zaire	29.8	3.0	4.5	6.2	5.4			BE	1960	210
Zambia	5.8	3.1	2.6	3.8	3.8	3.4		UK	1964	600
Zimbabwe	7.2	3.2	3.6	5.3	6.6			UK	1980	870

See footnotes at end of table.

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Table C-1.—Population (1981) and gross domestic product of individual developing countries, selected years—Continued

Country	Population 1981	Population growth, 1970–81	Gross domestic product—					Former or present colony of 1/	Year independent	Per capita GDP in 1981
			1977	1980	1982	1983, actual	1983, based on 1980 prices			
	Millions	Percent per year	Billion dollars							
Europe:										
Cyprus	.6	.3	1.1	2.1	2.1	2.1		UK	1960	$3,740
Malta	.36	1.1	.6	1.1	1.1	1.1	1.0	UK	1964	3,600
Portugal	9.8	.8	16.3	24.7	23.7	21.1				2,520
Romania	22.3									
Turkey	45.5	2.3	47.8	58.7	52.8	51.5				1,540
Yugoslavia	22.5	.9		64.6	59.1	45.9				2,790
Oceania:										
Fiji	.6	1.9	.8	1.2	1.2	1.1		UK	1970	2,000
French Polynesia (New Caledonia, etc.)	.15	1.7						FR		
Kiribati	.63	.4						UK	1979	
Nauru	.008							UK	1968	
Papua New Guinea	3.1	2.1	1.6	2.5	2.4	2.4	2.2	AUS	1975	840
Solomon Islands	.23	.08						UK	1978	
Tonga	.10	.05						UK	1970	
Tuvalu	.008					.003		UK	1978	
Vanuatu	.12							UK	1980	
Western Samoa	.16	.1						NZ	1962	

1/ UK-United Kingdom, FR-France, NE-Netherlands, PO-Portugal, COL-Colombia, MAL-Malaysia, BE-Belgium, PAK-Pakistan, IT-Italy, AUS-Australia.

2/ The World Bank reported 281,700.0 billion Argentina pesos with a foreign exchange rate of 1837.16 pesos per U.S. dollar (annual average) or 153 billion dollars in 1980. Howeve,r the same type of calculation in 1981 results in a per capita GDP that is 1.7 times the $2,560 also reported by the World Bank and recorded in the last column.

3/ Antigua and Barbuda, Anguilla, British Virgin Islands, Montserrat, Saint Kitts-Nevis, Turks and Caicos Islands, and others.

4/ 1981 data.

5/ 1984 data.

Source: World Book, World Tables, 3d ed.; International Monetary Fund, International Financial Statistics; United Nations Yearbook of National Accounts Statistics, 1979.

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APPENDIX D

NATURAL GAS AND CRUDE PETROLEUM: PROVED RESERVES, PRODUCTION, AND PETROLEUM REFINING CAPACITY, 1984-85

Table D-1.--Natural gas and crude petroleum: Proved reserves and refining capacities as of January 1985, and gas and petroleum production in 1984, by source

Source	Natural gas		Crude petroleum		
	Reserves	Production	Reserves	Production	Refining capacity
	Billions of cubic feet		Million barrels	Thousand barrels per day	
Developing countries:					
Mexico and South America:					
Argentina	24,628	653	2,266	467	678
Bolivia	4,270	90	158	20	47
Brazil	2,840	173	1,976	437	1,305
Chile	2,360	180	736	38	141
Colombia	3,786	189	624	165	211
Ecuador	3,000	17	1,400	254	82
Mexico	77,000	1,373	48,600	2,743	1,269
Paraguay	-	-	-	-	8
Peru	1,100	44	670	201	175
Suriname	-	-	-	.5	-
Uruguay	-	-	-	-	45
Venezuela	55,367	610	25,845	1,724	1,224
Total	174,351	3,239	82,275	6,050	5,185
Caribbean and Central America:					
Bahamas	-	-	-	-	350
Barbados	-	-	1	1.7	3
Costa Rica	-	-	-	-	16
Dominican Republic	-	-	-	-	44
El Salvador	-	-	-	-	16
Guatemala	30	1	500	5	16
Honduras	-	-	-	-	14
Jamaica	-	-	-	-	36
Martinique	-	-	-	-	13
Netherlands Antilles	-	-	-	-	740
Nicaragua	-	-	-	-	15
Panama	-	-	-	-	100
Trinidad	10,550	122	540	169	320
Total	10,580	85	1,041	176	1,683
Middle East:					
Bahrain	7,260	178	170	41	250
Iran	478,600	360	48,500	2,166	530
Iraq	28,800	18	44,500	1,218	319
Israel	8	2	1	.1	170

Table D-1.--Natural gas and crude petroleum: Proved reserves and refining capacities as of January 1985, and gas and petroleum production in 1984, by source--Continued

Source	Natural gas		Crude petroleum		
	Reserves	Production	Reserves	Production	Refining capacity
	Billions of cubic feet		Million barrels	Thousand barrels per day	
Developing Countries--Continued:					
Middle East--Continued:					
Jordan	-	-	-	-	100
Kuwait	36,645	144	92,710	1,135	669
Lebanon	-	-	-	-	17
Oman	7,377	146	3,500	404	50
Qatar	1/ 150,000	156	3,350	404	56
Saudi Arabia	127,415	240	171,710	4,755	840
South Yemen	-	-	-	-	178
Syria	1,280	8	1,450	161	229
United Arab Emirates	31,970	264	32,490	1,130	190
Total	2/ 869,355	1,533	398,381	11,414	3,598
South Asia:					
Bangladesh	7,000	-	-	-	31
Burma	170	17	288	30	26
India	15,000	102	3,500	543	705
Pakistan	15,760	355	82	18	129
Sri Lanka	-	-	-	-	50
Total	37,930	474	3,610	571	941
East Asia:					
Brunei	7,300	312	1,400	160	9
Indonesia	40,000	732	8,650	1,332	630
Korea	-	-	-	-	776
Malaysia	50,000	120	3,000	462	205
Philippines	12	-	16	12	286
Singapore	-	-	-	-	1,072
Taiwan	540	60	5.7	2.6	543
Thailand	5,900	78	156	19	172
Total	103,752	1,302	13,228	1,988	3,693
Africa:					
Algeria	109,100	1,260	9,000	608	465
Egypt	7,000	108	3,200	790	369
Libya	21,200	150	21,100	1,090	330
Morocco	-	4	-	.2	80
Tunisia	2,224	18	1,514	114	34

See footnotes at end of table.

Table D-1.--Natural gas and crude petroleum: Proved reserves and refining capacities as of January 1985, and gas and petroleum production in 1984, by source--Continued

Source	Natural gas		Crude petroleum		
	Reserves	Production	Reserves	Production	Refining capacity
	Billions of cubic feet		Million barrels	Thousand barrels per day	
Developing Countries--Continued:					
Africa--Continued:					
Angola	1,650	12	1,800	207	32
Benin	-	-	100	6.9	-
Cameroon	4,150	-	550	125	43
Congo	2,118	1	480	118	21
Ethiopia	-	-	-	-	15
Gabon	550	5	510	150	20
Ghana	4	-	4	.6	28
Ivory Coast	3,000	-	108	22	90
Kenya	-	-	-	-	95
Liberia	-	-	-	-	15
Mozambique	-	-	-	-	17
Nigeria	35,600	72	16,650	1,414	250
Senegal	-	-	-	-	30
Sierra Leone	-	-	-	-	10
Sudan	-	-	300	-	24
Tanzania	200	-	-	-	14
Togo	-	-	-	-	20
Zaire	30	-	110	27	17
Zambia	-	-	-	-	25
Total	186,826	1,629	55,426	4,673	2,044
Europe and Oceania:					
Cyprus	-	-	-	-	16
Papua New Guinea	500	-	50	-	2/
Portugal	-	-	-	-	290
Romania	10,000	1,240	2/	2/	-
Turkey	600	40	294	41	460
Total	11,100	1,280	2/ 344	2/ 41	2/ 766
Total, developing countries	1,393,894	9,580	554,305	24,933	17,732
United States	198,000	18,068	27,300	8,750	15,400
Other developed countries	322,731	10,060	32,962	5,480	23,240

See footnotes at end of table.

Table D-1.--Natural gas and crude petroleum: Proved reserves and refining capacities as of January 1985, and gas and petroleum production in 1984, by source--Continued

Source	Natural gas		Crude petroleum		
	Reserves	Production	Reserves	Production	Refining capacity
	Billions of cubic feet		Million barrels	Thousand barrels per day	
Nonmarket economies:					
China	30,900	420	19,100	2,250	2,150
U.S.S.R	1,450,000	20,240	63,000	12,230	12,200
Other	16,500	993	2,000	490	3,150
Total	1,487,400	21,653	84,100	14,970	17,500
World 3/	3,402,025	59,932	698,667	54,090	74,910

1/ Estimated by U.S. International Trade Commission staff (because of suspected error in the source journal).

2/ Romania and Yugoslavia are not included in oil statistics; they are in the nonmarket economy group.

3/ In the Oil and Gas Journal source, figures do not add to totals shown.

APPENDIX E

CHEMICAL INDUSTRY DEVELOPMENT IN CERTAIN ENERGY-RICH AND NON-ENERGY-RICH DEVELOPING COUNTRIES

CHEMICAL INDUSTRY DEVELOPMENT IN CERTAIN ENERGY-RICH AND NON-ENERGY-RICH DEVELOPING COUNTRIES

Brazil

The Federative Republic of Brazil, with an area of 3.3 million square miles, is the fifth largest country in the world. The population in 1982 was estimated at 127 million. 1/ The climate varies from hot and wet in the tropical rain forest of the Amazon basin to temperate in the savannah grasslands of the central and southern uplands, which have warm summers and mild winters. In Rio de Janeiro temperatures are generally between 63° F and 85° F. Brazil's natural resources include deposits of crude petroleum, particularly from the continental shelf, 2/ and exploration for new domestic petroleum sources continues. Iron and manganese reserves are large, and they provide important sources of industrial raw materials and export earnings. Deposits of nickel, tin, chromite, bauxite, beryllium, copper, lead, tungsten, and zinc are also available. 3/

Other resources include the combination of climate and arable land which, for example, has already given Brazil the world leadership in sugar cane production; much of this cane is used to produce ethyl alcohol. It also leads the world in the production of castor beans, which are used to produce castor oil and sebacic acid.

Some of the large amount of ethyl alcohol produced is used as fuel for motor vehicles, while some is also exported. Of 9 million metric tons of ethanol produced in 1984, about 300,000 metric tons (100 million gallons) were exported to the United States.

The gross domestic product (GDP) of Brazil increased from $208 billion in 1979 to $295 billion in 1982, a 42 percent increase. The per capita GDP during this period increased from $1,748 to $2,360. Then, in a reversal in 1983, with the cruzeiro depreciating by 289 percent and a recession in which industrial production declined by 6 percent, GDP dropped to $210 billion and per capita GDP was $1,648. GDP for 1984 is estimated at $212 billion and per-capita GDP is estimated at $1,618. 4/

The local chemical industry

The chemical industry of Brazil began its expansion on an organized basis shortly after World War II. From 1950 to 1962, the industry showed a greater growth rate than the manufacturing sector of the economy as a whole. 5/ By 1962, Brazil's petrochemical industry was producing ammonia, fertilizers,

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1/ The Europa Yearbook 1984: A World Survey, London, vol. I, 1984, p. 1212.
2/ The Statesman's Yearbook 1982-83, New York, N.Y., p. 236.
3/ U.S. Department of State, Background notes-Brazil, December 1982, p. 5.
4/ U.S. Department of Commerce, FET, Brazil, January 1985, p. 1.
5/ Delphi Marketing Services, Inc., The Brazilian Chemical Industry, p. 11.

ethylene, propylene, styrene, polystyrene, styrene-butadiene rubber, polyethylene, and acetone. 1/ The creation of two institutions between 1963 and 1967 have had an important impact on the development of the petrochemical industry. The Executive Group of the Chemical Industry (GEIQUIM), a Government office that was established by executive decree in 1964, oversees the execution of a master plan for the industry's development. It has evolved into a small but efficient organization that passes on the merits of all new chemical projects of vital interest to the nation. 2/ In 1968, Petrobras Quimica S/A (PETROQUISA) was created to negotiate with national or foreign companies in order to develop petrochemical facilities. PETROQUISA is a subsidiary of Petroleo Brasileiro S/A (PETROBRAS), the company responsible for administering the Government monopoly in the petroleum industry. 3/

In 1983, the installed capacity of the Brazilian chemical industry was 23.7 million metric tons per year. The following tabulation shows the chemical sectors with the largest plant capacities: 4/

Chemical sector	Metric tons per year
Inorganic products	7,523,088
Intermediates for fertilizers	5,481,769
Basic petrochemicals	3,423,205
Organic products	2,207,829

Brazil's plastics industry has been affected by the domestic recession, high taxes, and the high cost of raw materials. The sector was operating at 70 percent of capacity at the end of 1984, and for the first 6 months of 1984 production was 10 percent below the levels for the same period in 1983. According to industry sources, the greatest market potential is in the agricultural sector, where the use of plastics in the construction of silos and the packaging of agricultural products may increase in the future. However, despite the relatively poor domestic market performance, plastic products exports for 1984 are believed to have reached $120 million, which is considerably more than the $50 million value for plastic products exports in 1983.

The market for the fine chemicals sector is estimated to have been about $3.9 billion in 1984, with a 70 percent dependency on imports. Brazilian capital participation in this sector is about 20 percent. Sales estimates for the sub-sectors in 1984 were as follows: (1) pharmaceuticals, $1.8 billion; (2) agrochemicals, $0.8 billion; (3) other chemical additives, $1.3 billion. 5/

1/ Source: U.S. Department of State, Brazil's Petrochemical Industry, airgram, Reference No. A-4, Mar. 28, 1984, p. 4.

2/ Delphi Marketing Services, Inc., The Brazilian Chemical Industry, p. 8.

3/ Source: U.S. Department of State, Brazil's Petrochemical Industry, airgram, Reference No. A-4, Mar. 28, 1984, pp. 3-5.

4/ Ibid, appendix 9.

5/ U.S. Department of State, Study of Changes in U.S. Trade in Chemicals and Related Products With Developing Countries, incoming telegram Ref: State 018037, Jan. 1985, p. 2-3.

Government involvement

The Brazilian Government and private cooperation stimulated the development of the petrochemical industry in Brazil. An example of this stimulation is the construction of large petrochemical complexes. Although Brazil's first petrochemical complex, near Sao Paulo, evolved as a result of local market potential, the petrochemical complex in Bahia was the result of the industrial decentralization program of the Federal Government. A third petrochemical complex in Rio Grande do Sul was a thoroughly planned undertaking, motivated by the Government's desire to decentralize economic activity and promote the regional development of the South. 1/

These projects were created to foster the development of second generation "downstream" petrochemical projects. The second generation projects were based on a "tripartite" development model whose basic rule is that the Brazilian Government or national shareholding in any petrochemical project would never be less than that of a foreign stockholder. 2/ PETROQUISA manages the Government interest, and foreign participation in a project is usually through some form of technology transfer licensing. A general investment guideline is that the Brazilian Government through PETROQUISA, a private Brazilian company, and a foreign investor, each has about one-third interest in a project. 3/

The Brazilian petrochemical industry can be characterized as existing in a government-controlled environment. 4/ Investments are encouraged from the Brazilian private sector and foreign sources as well. Petrochemical raw materials come from the Government-controlled petroleum industry. Prices are controlled by the Conselho Interministerial de Precos (CIP). GEIQUIM, an office of the Planning Ministry, along with PETROQUISA, plans activities in the petrochemical sector. The economic characteristics of the petrochemical industry are that (1) it is world scale, (2) it is competitive, based on imported technology, (3) it is historically growing at 10 percent a year, (4) its new facilities investment is about 120 percent of comparable investment in the U.S. gulf coast, and (5) it is geographically dispersed. 5/

On October 3, 1984, the Brazilian Government issued Portaria Interministerial No. 4, which reserves the fine chemical products market for Brazilian companies. 6/ Multinational companies, which have played such an important role in bringing advanced technology to the Brazilian chemical and petrochemical sectors, have protested this move. 7/ The following tabulation shows the investors in the fine chemicals sector by percentage: 8/

1/ U.S. Department of State, Brazil's Petrochemical Industry, airgram Ref. No. A-4. Mar. 28, 1984, p 5.
2/ Ibid.
3/ Ibid.
4/ Ibid.
5/ Ibid.
6/ U.S. Department of State, incoming telegram Ref: State 018037, January 1985, p. 2.
7/ Ibid.
8/ Ibid.

Fine chemicals sector	Brazilian private	Brazilian Government	Foreign
Pharmaceuticals-----	22	-	78
Agrochemicals--------	22	1	77
Other chemical additives----------	20	1	79

Now all new fine chemical projects must be Government approved. As of November 3, 1984, all raw material fabricators for the fine chemicals sector were obligated to present the following information to the Government: (1) plant location; (2) chemical substances produced; (3) plant capacity; (4) plant start-up date; (5) quantity of raw materials consumed. By January 3, 1985, the Brazilian Government was to have published a list of all fine chemicals producers, to be followed periodically by the publication of a list of raw materials cleared for import. And finally, in those companies where the Brazilian ownership is very low, there could be initiated a plan of progressive nationalization.

Trade practices

Brazil is in the third year of an economic adjustment program supported by an extended arrangement with the IMF. The objective of the program is to reduce the requirements for foreign financing by implementing major structural adjustments in the economy. Major features of the program include a large cut in the public sector deficit, reductions in subsidies, realignment of sectoral prices to improve the trade balance and encourage agricultural production, positive real interest rates to encourage domestic saving, and a tight monetary policy to contain inflation. 1/

A small trade surplus of $800 million in 1982 was increased to $6.5 billion in 1983 and more than $13 billion in 1984. The trade surplus in 1983 was due primarily to import substitution. Imports declined $4 billion and exports increased $1.7 billion from 1982 levels. In 1984, the reverse was true. The strong trade surplus was due primarily to exports, which increased $4.5 billion while imports declined $1.0 billion from 1983 levels. In 1984, Brazil's chemical sector was expected to show a surplus of $200 million. Chemical exports were forecast at $1.5 billion and chemical imports at $1.3 billion. 2/

The following tabulation shows the value of U.S. chemical trade with Brazil since 1980 (in millions of dollars): 3/

1/ U.S. Department of Commerce, Foreign Economic Trends and their implications for the United States, "Brazil," January 1985, p. 2.

2/ U.S. Department of State, Study of Changes in U.S. Trade in Chemicals and related products with developing countries, incoming telegram Ref: State 018037, January 1985, p. 1.

3/ Trade data compiled from official statistics of U.S. Department of Commerce.

Year	U.S. imports	U.S. exports
1980----------	$110	$1,145
1981----------	112	740
1982----------	97	626
1983----------	181	491
1984----------	337	541

During the period covered, organic chemicals and related products were at least 60 percent of U.S. chemical imports from Brazil. Over 60 percent of U.S. chemical exports to Brazil consist of organic and inorganic chemicals, fertilizers, and fertilizer materials. 1/ Brazil had a deficit of over $100 million in chemical trade with the United States during 1984 although its total chemical trade was expected to show a surplus of $200 million.

Brazil's chemical export success was fortunate because the domestic market was encountering difficult economic times. In 1984 some excess ethyl alcohol was exported to the United States to avoid an increase in U.S. duty that took effect on January 1, 1985. The export sector was also prodded by the IMF requirement that Brazil achieve a surplus trade balance. The petrochemical industry is currently exporting some 40 percent of its output. However, there is concern in this sector about maintaining the industry's export competitiveness in light of Saudi Arabian petrochemical plants that are expected to come onstream in 1985 and 1986. Brazilians fear the Saudis will be able to offer quality products at lower prices on the international market. 2/ Chemical industry officials reportedly are also concerned about the ability of Brazil to maintain its chemical exports because of some recent Government measures affecting this industry, including the following: (1) a proposal to remove import restrictions on 182 chemicals and petrochemical products; and (2) Resolution No. 882, which reinstates as of April 1985 the obligation of petrochemical producers to pay the excise tax on the manufacture or importation of industrialized products.

The Brazilian Government has exercised its control over imports, exports, and foreign investment principally with two devices, namely, import substitution and export incentive programs. Throughout most of the post-World War II period, the Government has emphasized import substitution policies to develop the domestic market. This was achieved by raising tariffs, screening foreign investment, expanding the number and scope of State enterprises and maintaining an overvalued exchange rate. 3/ However, as the need for foreign currency became acute in the late 1970's and the 1980's, an export-led policy was adopted which involved frequently adjusting the exchange rate and placing more resources in Brazil's export incentive programs.

For the last 4 years the Brazilian Government has attempted to limit imports without stopping the flow of necessary fuel supplies, raw materials,

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1/ Ibid.

2/ U.S. Department of State, incoming telegram Ref: State 018037, January 1985, p. 2.

3/ U.S. International Trade Commission, Foreign Industrial Targeting and its effects on U.S. Industries-Phase III, USITC Pub. No. 1632, January 1985, p. 37.

and capital equipment. This effort is reflected in the decline of imports from $22 billion in 1980 to less than $15 billion in 1984. 1/

One tool for limiting imports is high tariff rates, which range from a low of 0 to a high of 205 percent ad valorem, with most products falling in the 30 to 85 percent range. In addition to tariffs, Brazil has also added tariff surtaxes of 10 to 30 percent on several thousand categories of imports. 2/ Imports are further limited by requiring import licenses for most products. These licenses are issued by the trade department of the Banco do Brasil (CACEX) and are granted only to companies on the CACEX registry of importers. These companies must provide origin and price information for their imports and prove they have fulfilled the exchange regulations. 3/ Annual import programs are another way imports can be restricted. They are effected through a CACEX requirement that major importers (enterprises with more than $100,000 worth of imports) limit the value of their firm's imports to a level based on a prior year. As prices increase, this restriction reduces the volume of imports allowed. 4/

The Brazilian Law of Similars (local content), applied through the import licensing system administered by CACEX, can be used to limit import items that are considered superfluous or luxurious or that are already made in Brazil. Although many exceptions to this policy exist in practice, the Government can be quite strict in applying it. 5/ After a 4-year period of strict enforcement of the Law of Similars, the Government of Brazil announced in September 1984 that the law will not be applied to imports that receive overseas financing for a period of more than 1 year.

Brazil's exports climbed from $8 billion in 1973 to $21.9 billion in 1984, or at an average annual rate of about 10 percent. During this period, the composition of these exports shifted from basic agricultural and mineral exports (coffee, soybean, and iron ore) to industrial products (cars, trucks and parts, steel, chemicals, footwear, and petroleum derivatives). The principal markets for exports in 1983 were the European Community (26 percent), the United States (20 percent), and the member states of the Latin American Integration Association (14 percent). Over one-half of the increases in Brazil's exports during 1982 and 1983 went to the United States. During that time, the United States consumed over 20 percent of the Brazilian production of coffee, cocoa, sugar, orange juice, electronic equipment, steel, chemicals, footwear, and petroleum derivatives. 6/

The Government of Brazil promotes industrial exports through three programs: The Commission for the Granting of Fiscal Benefits for Special Export Progams (BEFIEX), the Credito Premio, and the duty-drawback. 6/ The BEFIEX program offers a package of tax benefits to foreign companies investing

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1/ Ibid.
2/ Ibid., P. 39.
3/ Ibid., p. 39.
4/ Ibid, pp. 37 and 39.
5/ Ibid, p. 40.
6/ Ibid, p. 42.

in Brazil. In exchange for the tax benefits, the companies and BEFIEX negotiate an agreement covering the export commitment of the company, the level of imports, additional investments to be made by the company, and foreign exchange earnings for Brazil. 1/ The Credito Premio, scheduled to be phased out in 1985, is an export subsidy that provides exporters with a cash grant equal to a share of the value of their exports. The duty-drawback system allows the Brazilian authorities to suspend or reimburse import duties and other taxes on certain imports. To qualify, the import must be used in the manufacturing of a product for export. The program is run by the Bank of Brazil's CACEX. 2/

Brazilian foreign investment policy encourages foreign equity investment that can contribute to domestic industry development and to a more favorable balance of payments. Brazilian law grants foreign investments essentially the same treatment as domestic capital. Many of the import, financial, and tax incentives available to domestic investors are also available to foreign investors. However, some sectors of the economy, including transportation, communications, public utilities, and most banking, have been restricted entirely to Brazilian investors. 3/ Brazil's foreign investment policy and its position as one of the largest and wealthiest markets among the LDC's have enabled it to attract extensive amounts of foreign capital. As of June 30, 1983, the value of foreign direct investment in Brazilian chemicals and pharmaceuticals was over $3.8 billion. 4/ The largest source of this investment was the United States (approx. $1.3 billion).

Energy and feedstock supplies

Brazil is the third leading producer of hydroelectric power in the world, with a generating capacity of over 40,000 megawatts. Hydroelectric plants currently provide over 80 percent of the nation's electricity, and it is estimated that only 10 percent of Brazil's hydroelectric potential is being utilized. 5/

In June 1984, Brazilian domestic petroleum production reached a milestone of 500,654 barrels per day. Exploration for new domestic petroleum sources continues as Brazil continues to reduce crude oil imports. 6/ Also in short supply is high quality coal, especially of the coking grade, which the country's growing steel industry requires. However, the Government is implementing coal extraction and gasification projects to use Brazil's ample deposits of low-grade coal in the South. 7/

1/ Ibid.
2/ Ibid, p. 47.
3/ Economic Handbook of the World: 1981, New York, 1981, p. 69.
4/ U.S. Department of Commerce, I.T.A., "Foreign Direct Investment in Brazil," March 1984, table A.3. Brazil: Foreign Investment.
5/ U.S. Department of State, Background notes-Brazil, December 1982, p. 5.
6/ U.S. Department of Commerce, FET, Brazil, January 1985, p. 6.
7/ U.S. Department of State, Background notes-Brazil, December 1982, p. 5.

The overall dimensions of Brazil's nuclear program have been sharply reduced by financial constraints. Angra I, a 626-megawatt pressurized water reactor built by an American firm, began preliminary operations in early 1982. It has experienced several operational problems requiring shut-downs, but when fully operational it will supply about 0.6 percent of the country's electricity. 1/ Angra II, a 1,245-megawatt pressurized water reactor, is under construction but will not be operational in this decade. There is no definite timetable for the construction of additional nuclear reactors. Brazil's proven uranium reserves are slightly over 300,000 metric tons, with favorable prospects for discovery of additional reserves. 2/

The Brazilian Government has embarked on an ambitious program to reduce dependence on imported crude petroleum. In addition to developing hydroelectric, nuclear, and coal resources, Brazil has become a world leader in the development of alcohol fuel derived from sugar cane. Brazilian gasoline is a mixture containing up to 20 percent ethyl alcohol, and the Government's objective is to promote 100 percent alcohol-powered vehicles. Alcohol production for 1984 was estimated at 2.5 billion gallons. 3/ The substitution of alcohol for petroleum reportedly has saved nearly $6 billion since 1975. 4/

Proven mineral resources are extensive, and known reserves are increasing with additional exploration. Iron and manganese reserves are especially large, providing important sources of industrial raw materials and export earnings. The estimated value of Brazilian mineral production increased from $8.3 billion in 1983 to $10.8 billion in 1984, a 30 percent increase. Deposits of nickel, tin, chromite, bauxite, beryllium, copper, lead, tungsten, and zinc are available. 5/

Israel

The State of Israel lies in western Asia, or the Middle East, occupying a 7,850 square mile strip of territory, about the size of New Jersey, on the eastern shore of the Mediterranean Sea. 6/ The population in 1983 was estimated at 4.1 million, of which 83 percent were Jewish (3.4 million), and 17 percent were nonJewish (mainly Arab). All of Israel's land frontiers are with Arab countries, the longest being with Egypt to the west and with Jordan to the east. Lebanon lies to the north, and Syria to the northeast. Israel's natural resources include copper, phosphate, bromine, potash, clay, sand, sulfur, bitumen, and manganese. The per-capita income in 1983 was $5,609. 7/

1/ U.S. Department of Commerce, FET, Brazil, Jan. 1985. p. 6.
2/ Ibid.
3/ Chemical and Engineering News, Apr. 22, 1985, p. 13.
4/ U.S. Department of Commerce, op. cit.
5/ U.S. Department of State, Background notes-Brazil, December 1982, p. 5.
6/ Department of State, Background notes-Israel, October 1984, p. 1.
7/ Department of State, Background notes-Israel, October 1984, p. 1.

The GDP of Israel increased slightly from $24.1 billion in 1982 to $24.3 billion in 1983. The per-capita GDP during this period increased from $5,580 to $5,928. 1/

The local chemical industry

Israel has a highly developed chemical industry primarily based on processing domestic and imported crude petroleum, Dead Sea brine, and Negev phosphate deposits. The organic chemical industry has developed largely as a result of the expansion of the Government-controlled crude petroleum refining industry. At present two oil refineries, one in Haifa and the other in Ashdod, are capable of refining 10 million tons of crude petroleum per year. The main petrochemicals produced include ethylene, polyethylene, carbon black, polyvinyl chloride, methanol, and ammonia; the production facilities are privately owned. The inorganic chemical industry is primarily dependent upon Israel's two major mineral resources, Dead Sea brine and Negev phosphate deposits. Potash, bromine, and magnesium oxide are extracted from Dead Sea brine. Negev phosphate deposits are exported as natural raw material or calcined phosphates, or they are processed as fertilizers at other local plants. 2/ Among other inorganic chemicals produced are potassium nitrate, ammonium sulfate, granulated superphosphates, chlorine, caustic soda, and phosphoric acid.

There are over 120 local manufacturers that produce a wide range of chemical products and intermediates. As Israel's agriculture has advanced, crop protection chemicals and pesticides have been developed and field tested in formulations to suit geographic and climatic conditions worldwide.

The Israeli pharmaceutical industry manufactures about 2,000 sophisticated medicinal products. These include drugs for human and veterinary use, and feed additives. Other chemical products produced in Israel include detergents and soaps, paints, glues, and cosmetics as well as chemicals for the textile, food, metal, and construction industries. 3/

Israel's chemical-related production totaled $2.9 billion in 1983, including $969 million from mining and minerals, $558 million in plastic and rubber products, $552 million in basic chemicals, $192 million in pesticides and $189 million in pharmaceuticals. Exports accounted for 55 percent of basic chemical output, 51 percent of pesticides and 22 percent of pharmaceutical output. 4/

1/ U.S. Department of Commerce, "Foreign Economic Trends and their implications for the United States," Israel, August 1984, p. 2.

2/ U.S. Department of State, Changes in U.S. Chemical Trade with Developing Countries, Israel, airgram, Reference American Embassy, Tel Aviv 03652, p. 1.

3/ Ibid.

4/ Ibid.

Government involvement

Israel Chemicals Limited (ICL) is the parent company of a group of chemical enterprises engaged in the development of Israel's major natural resources. ICL is Government owned and was established to coordinate and promote Israel's inorganic chemicals industry. Effective January 1, 1985, ICL acquired Wilhelm Stodiek & Co., a West German fertilizer producer with 200,000 metric tons per year (mtpy) capacity. Stodiek is the third European fertilizer subsidiary acquired by ICL. As a result, ICL will now control about 50 percent of the West German market for partly acidulated fertilizers. Stodiek will also give ICL an outlet for up to 70,000 mtpy of phosphate rock and 25,000 to 30,000 mtpy of potash. 1/ The deputy managing director for international operations at ICL says the Government-controlled holding company is interested in acquiring further outlets for its phosphate rock production. 2/

ICL plans to spend during the next 5 years (1985-89) $1 billion in Israel on expansions and new projects that will ultimately double the company's exports. Major expansions at ICL subsidiaries include an investment of $150 million at Dead Sea Works, Ltd., to increase potash capacity from 2.1 million to 3.0 million mtpy; $100 million at Negev Phosphates Ltd. to increase phosphate production from 3 million to 5 million mtpy; $200 million at Rotem Fertilizers Ltd. to double complex fertilizer production from 250,000 to 500,000 mtpy and increase phosphoric acid production to 360,000 mtpy; and $150 million at Dead Sea Bromine Co., Ltd. and Bromine Compounds Ltd. to expand bromine and bromine compound production to 120,000 and 100,000 mtpy, respectively. ICL's Israeli-based exports are expected to total $375 million for the fiscal year ending March 31, 1985. 3/

Trade practices

Israel's economic goals are to improve the country's balance of payments and fight inflation while maintaining moderate growth and avoiding any increase in unemployment. 4/ During 1983 the Government of Israel continued to implement the "New Economic Program" that it had introduced in September 1982 to restrain inflation. The major element of this program consisted of holding the devaluation rate of the shekel against European and U.S. currencies below the differential rates of inflation between Israel and its major trading partners. Also, the subsidy level on basic commodities was held constant as a percentage of their sales price. However, as the year progressed the over-valuation of the shekel (which the slowdown of the devaluation caused) led to further export decline and a continual increase in imports. Because of these developments and the ensuing complaints of Israeli manufacturers, the Finance Ministry introduced several measures in 1984 to improve export profitability and slow imports. These included a 1 percent tax on foreign exchange

1/ Chemical Week, Jan. 16, 1985, p. 17 and European Chemical News, Jan. 28, 1985, p. 4.
2/ European Chemical News, Jan. 28, 1985, p. 4.
3/ Chemical Week, Mar. 13, 1985, p. 17.
4/ U.S. Department of State, Background notes-Israel, October 1984, p. 6.

purchases, a 2.2 percent drop in the premium for foreign exchange insurance, and a lowering of company payments to the National Insurance Institute. By June 1984, the Government also introduced a 15 percent deposit on many imports and began to accelerate the shekel devaluation to rates slightly faster than the rate of inflation.

The United States remains Israel's largest single trading partner, although Israel's trade with the European Community as a whole is larger. 1/ The following tabulation shows the value of U.S. chemical trade with Israel since 1980 (in millions of dollars): 2/

Year	U.S. imports	U.S. exports
1980----------	$20	$96
1981----------	31	80
1982----------	37	79
1983----------	47	64
1984----------	68	65

During the period covered, the value of U.S. chemical imports from Israel more than tripled. At the same time, U.S. chemical exports to Israel have decreased by 32 percent. During 1984, the United States had a negative chemical trade balance with Israel for the first time.

Two trade preference systems have helped Israel. Israel's agreement with the European Community (EC) permits Israeli manufacturers duty-free access to the Common Market for nonagricultural exports. Israel has also been a major beneficiary of the U.S. GSP, under which 2,800 categories of products enter the United States without payment of duty. 3/ In 1983, Israel ranked seventh among the beneficiary countries and obtained nearly four percent of all GSP benefits. 4/ In April 1985, the United States and Israel formally signed an agreement to establish free trade between the two countries. Under the agreement, duties were removed, effective September 1, 1985, on imports from Israel in the majority of product classifications in the U.S. Tariff Schedules; and the duties on the remainder will be gradually removed over the next 10 years. 5/

Energy and feedstock supplies

Israel's Energy Ministry has approved a project to build a 300-to-1,000 barrels per day shale oil demonstration plant at Mishov Rotem in the Negev Desert. The project is expected to be the forerunner of a full-scale unit to

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1/ U.S. Department of Commerce, "Foreign Economic Trends and Their Implications for the United States," Israel, August 1984, p. 3.

2/ Trade data compiled from official statistics of U.S. Department of Commerce.

3/ U.S. Department of Commerce, FET, Israel, August 1984, p. 7.

4/ Ibid.

5/ "US, Israel Sign Accord on Free Trade," The Journal of Commerce, April 23, 1985.

produce 20,000-40,000 barrels per day in the 1990's. There are also plans to build a shale-oil-fired plant for the generation of electricity. 1/ Other alternatives to oil fuel are being developed and emphasized for long-term projects. As the use of nuclear power poses several problems, conversion to coal has progressed substantially. Solar energy utilization also offers a practical alternative and is being explored.

Morocco

The Kingdom of Morocco, with an area of 172,000 square miles, is about the size of Oregon and Washington combined. The population in 1981 was estimated at 21.3 million with an annual growth rate of 3.25 percent. 2/ Morocco is located in the northwest corner of Africa with only the Strait of Gibraltar separating it from Europe. Its coastline extends nearly 1,200 miles along the Mediterranean Sea and the Atantic Ocean. The Atlas and Rif mountains divide the country, separating plains and plateaus along the coast from desert regions in the south and southwest. 3/ Islam is the State religion of the predominantly Arab (two-thirds) and Berber (one-third) population. 4/ Morocco's natural resources include deposits of phosphate, iron, manganese, lead, cobalt, silver, copper, and oil shale. 5/ The per-capita income in 1981 was $800.

The GDP of Morocco increased from $14.9 billion in 1981 to $15.0 billion in 1982. In 1983, GDP decreased 13 percent to $13.0 billion. The Moroccan Government is committed to long-term expansion in the domestic processing of the country's mineral wealth. The phosphate industry is one of Morocco's most important economic assets. 6/ Morocco possesses more than 60 percent of the world's proven phosphate deposits and is the largest phosphate exporter.

The local chemical industry

Most phosphates are still exported in rock form as mined, but steps are being taken to greatly increase Morocco's capacity to locally produce phosphate intermediates such as phosphoric acid and fertilizers. Office Cherifien des Phosphates (OCP) is the State mining firm with a monopoly for the mining, processing, and exporting of phosphates. OCP sold 19.5 million metric tons of raw phosphate in 1983, of which 28 percent (5.5 million metric tons) was converted into phosphoric acid in domestic plants. This ratio is up from 22 percent in 1982 and 17 percent 1981. 7/ OCP's goal is to domestically convert more than one-third of the phosphate rock output to phosphoric acid and its fertilizer derivatives. 8/ The consumption of sulfur, which is used

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1/ "A Shale Oil Project Goes Ahead in Israel," Chemical Week, October 3, 1984, p. 18.
2/ U.S. Department of State, Background notes-Morocco, April 1982, p. 1
3/ Economic Handbook of the World: 1981, New York, 1981, p. 299.
4/ Ibid.
5/ U.S. Department of State, Background notes-Morocco, April 1982, p. 1.
6/ Ibid, p. 6.
7/ Chemische, November 1984, pp. 721-723.
8/ Ibid.

in the production of sulfuric acid to convert phosphate rock to phosphoric acid, rose to 1.35 million metric tons in 1983 versus 1.02 million metric tons in 1982. To facilitate exports, Morocco has 10 phosphoric acid tankers with a total of 160,000 metric tons of capacity. 1/

The pharmaceutical market in Morocco is estimated at $150 million a year. Morocco meets 80 percent of its drug demand with domestic production and imports 50 percent of the raw materials. 2/ The following tabulation shows the value in millions of dollars of U.S. chemical trade with Morocco since 1980: 3/

Year	U.S. imports	U.S. exports
1980----------	$0.1	$16.3
1981----------	.4	8.7
1982----------	.1	7.0
1983----------	.3	7.0
1984----------	.4	3.5

During the period covered, U.S. chemical imports from Morocco remained below $500,000. U.S. chemical exports to Morocco decreased from over $16 million in 1980 to less than $4 million in 1984. This decrease was due mainly to Moroccan austerity measures designed to reduce the large budget deficits.

Government involvement

Morocco operates a mixed economic system with both the public and private sectors playing important roles. Phosphate production and utilities are State controlled. Private enterprise in the commercial and industrial sectors is encouraged except where the resources of the State are required to develop capital-intensive projects considered essential to the economy. 4/

Because of the importance of phosphates to the world's fertilizer industry, Morocco's economic planners intend to stimulate and prolong economic development based on its phosphate resources. The current 5-year development plan (1981-85) calls for an investment of $4 billion to expand the phosphate industry. Some of the major goals of the plan are increasing phosphate rock production to 27 million metric tons in 1985 from 21 million metric tons in 1980, and the construction of additional phosphoric acid and fertilizer plants as well as extraction of uranium (yellow cake) from phosphate rock. 5/ In addition to the phosphate industry, Moroccan economic planners also have based

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1/ Ibid.

2/ IMS Pharm N, Feb. 20, 1984, p. 10.

3/ Trade data compiled from official statistics of U.S. Department of Commerce.

4/ U.S. Department of Commerce, "Marketing in Morocco," Overseas Business Reports, OBR-79-46, December 1979.

5/ U.S. Department of State, Background notes-Morocco, April 1982, pp. 6 and 7.

their rapid industrialization strategy on exploiting and domestically processing the country's other mineral wealth. Five new mining operations as follow were opened or expanded in 1982: 1/

- o An expansion of the Omnium Nord Africain's copper mine at Bleida, which quadrupled Morocco's production to more than 63,000 tons of 35 percent concentrate;
- o The mines of Tiouit and Asfalou, where the combined annual production will be 2,640 tons of concentrate, containing 289 kilograms of gold, 6 tons of silver, 565 tons of copper, and 202 tons of zinc;
- o The silver mine of Zgounder will extract 73,000 tons of ore per year. After treatment, the ore will yield 32 tons of silver annually;
- o The mine of Sidi Lahcen which will produce annually 5,567 tons of lead concentrate and over 1,000 tons of zinc concentrate;
- o The mine of Zelmou, producing 110,000 tons of barite entirely for export; and
- o In addition to phosphate rock, Morocco also produces significant amounts of minerals that are classified as chemicals or are used to make chemicals. These include antimony ore, cobalt ore, salt, and fluorspar.

Trade practices

The Moroccan Government encourages foreign investment in selected export oriented industries (mining, tourism). Moroccanization decrees require that specified businesses be 50 percent Moroccan owned and that a majority of board directors as well as the board chairmen be Moroccan. 2/ As a result of the financial agreement with the International Monetary Fund, in operation since September 1983, trade liberalization policies limiting customs duties to 100 percent and eliminating the prior deposit of 20 percent on imports have come into effect. 3/

Energy and feedstock supplies

Despite continuous exploration since the 1950's, no substantial deposits of crude petroleum have yet been found. At present, domestically produced

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1/ U.S. Department of State, Morocco Minerals Report-1982, airgram, Jan. 23, 1984, pp. 2 and 3.

2/ U.S. Department of Commerce, "Marketing in Morocco," Overseas Business Reports, OBR-79-46, December 1979, p. 12.

3/ U.S. Department of Commerce, Business America, Mar. 4, 1985, p. 51.

crude petroleum supplies less than 4 percent of the country's energy requirements. Attention has shifted to the exploitation of oil shale, uranium (extracted from phosphate deposits), and natural gas. Morocco expects to build a nuclear power station sometime in the 1990's to take advantage of the uranium to be extracted from phosphates. 1/

Morocco consumes more energy than it produces. Crude petroleum imports provide over three-fourths of the country's energy needs and were 27 percent of total imports in 1983. About 85 percent of the coal mined in Morocco is used to fuel thermal electric plants. The present plant at the Jerrada anthracite coal mine permits the extraction of 1 million tons per year. Approximately 700,000 tons are immediately consumed at the mine mouth by an electrical generation station that produces over 1 billion kilowatts per hour. 2/ Morocco has continued to explore the natural gas field in the Essaouira Basin but has not yet announced the importance of the find. International companies continue to explore offshore for hydrocarbons. A Renewable Energy Research Center has been established in Marrakech to evaluate renewable energy sources, especially solar energy. 3/

Taiwan

Taiwan has an area of 14,000 square miles (about one-third the size of Ohio) and is separated from the Chinese mainland by the Taiwan (Formosa) Strait which is about 90 miles wide. The population in 1981 was estimated at 18 million, with an annual growth rate of 1.9 percent. 4/

The terrain is largely mountainous, and its mild climate is one of rainy summers and mild winters. The official language of Taiwan is Northern Chinese (Mandarin). Taiwan's natural resources include small deposits of coal, marble, gold, petroleum, and natural gas. 5/

The GNP of Taiwan increased from $46.2 billion in 1981 to an estimated $58.9 billion in 1984, or at an average annual increase of 8.5 percent. During this time, per-capita GNP increased from $2,570 to $3,112--an annual increase of 7 percent. 6/

The local chemical industry

The chemical industry in Taiwan is characterized as a vigorous growth industry by the Chairman of the Board of China Petrochemical Development

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1/ U.S. Department of Commerce, "Foreign Economic Trends and Their Implications for the United States," Morocco, September 1984, p. 12.

2/ U.S. Department of State, Morocco Minerals Report, airgram Reference No. A-01, Jan. 23, 1984, p. 7.

3/ U.S. Department of Commerce, FET 84-92, September 1984, p. 12.

4/ U.S. Department of State, Background notes-Taiwan, September 1983, p. 1.

5/ Ibid.

6/ U.S. Department of Commerce, "Foreign Economic Trends and Their Implications for the United States," Taiwan, November 1984, p. 2, and U.S. Department of State, Background notes-Taiwan, September 1983, p. 1.

Corporation. 1/ Total product value in 1983 amounted to $16.9 billion; from January through June 1984 it was $9.5 billion. Taiwan's chemical industry, which began in 1945 after World War II, was originally based on inorganic chemicals, such as acids and alkalies, but today it is more oriented toward petrochemicals. The value of petrochemical and related products make up about 61 percent of the value of total chemical industry production. 2/

The development of the petrochemical industry was given top priority in the mid-1970's, and the state-owned Chinese Petroleum Corporation (CPC) invested in naphtha-cracker facilities to produce ethylene, propylene, and butadiene. Benzene, toluene, and mixed xylenes are also produced during crude petroleum refining operations. In addition, the Chinese Petrochemical Development Corporation, a wholly owned subsidiary of CPC, set up facilities to produce dimethyl terephthalate, a raw material for polyester fibers. 3/

With the start-up of a 350,000 mtpy ethylene plant during the second half of 1984, Taiwan raised its ethylene capacity by 60 percent to 920,000 mtpy, propylene capacity to 410,000 mtpy, and butadiene capacity to 123,000 mtpy. 4/ In November 1984, plans were made to build another ethylene plant. Construction of the $200 million plant is scheduled to begin in July 1986 and be completed by 1990. This fifth ethylene plant will have an ethylene capacity of 400,000 mtpy, propylene capacity of 220,000 mtpy, butadiene capacity of 60,000 mtpy, and aromatics capacity of 170,000 mtpy. 5/

In addition to the primary petrochemicals, plants have been built to produce many of their downstream derivatives including the following: 6/

Chemicals.--Vinyl chloride, styrene, caprolactam, acrylonitrile, dimethyl terephthalate, terephthalic acid, ethylene glycol, polyethylene glycol, dioctyl phthalate, polypropylene glycol, and methyl methacrylate.

Plastics and synthetic rubber.--Polyvinylchloride, polyethylene (high and low density), polypropylene, polystyrene, acrylonitrile-butadiene-styrene (ABS plastic), polyvinyl alcohol, styrene-butadiene rubber, butadiene rubber (polybutadiene), and acrylonitrile-butadiene copolymer.

1/ "PAC CHEM '84 Probes Future of Pacific Basin Chemical Industries," Chemical and Engineering News, Jan. 7, 1985, p. 18.

2/ Ibid.

3/ U.S. International Trade Commission, Foreign Industrial Targeting and Its Effects on U.S. Industries- Phase III, USITC Pub. No. 1632, Jan. 1985, p. 275.

4/ "Chinese Petroleum started up a 350,000 mtpy Ethylene Plant," Chemical Engineering, Sept. 3, 1984, p. 30.

5/ U.S. International Trade Commission, Foreign Industrial Targeting-Phase III, USITC Pub. No. 1632, January 1985, p. 275.

6/ U.S. Department of State, Changes in U.S. Chemical Trade with Developing Countries, Taiwan, airgram, Reference American Embassy, Taipei 01284, March 1985, p. 1.

CPC will reportedly also invest $775 million in the construction of a liquefied natural gas (LNG) receiving terminal in Hsinta and in the construction of related inland transportation systems, storage facilities, and long-distance gas supply pipelines. 1/

Production of pharmaceuticals in Taiwan is growing steadily. There are over 800 producers of drugs for human use and about 120 producers of veterinary drugs on the island. Most Taiwan drug producers are small to medium-size family run businesses. 2/

The following tabulation shows the value in millions of dollars of U.S. chemical trade with Taiwan since 1980: 3/

Year	U.S. imports	U.S. exports
1980	$36.8	$509.1
1981	41.0	473.6
1982	39.5	461.6
1983	61.3	692.0
1984	82.0	704.5

During the period covered, U.S. chemical imports from Taiwan remained below $100 million while U.S. chemical exports to Taiwan increased irregularly from $509 million to over $700 million.

Government involvement

Until the 1979 petroleum price increases, the Taiwan petrochemical industry prospered, partly because of Government protection. During the mid to late 1970's, domestically produced chemical intermediate products increasingly displaced imported goods. However, the petroleum price increases and global recession that followed in 1982 caused problems for the Taiwan petrochemical industry and its major customers, the textiles and plastics companies. 4/ In order to maintain demand for CPC-supplied basic feedstocks, the authorities required intermediate producers to purchase at least 70 percent of their feedstocks from CPC. At that time, however, worldwide overcapacity and declining demand were causing world petrochemical prices to drop, making it increasingly difficult for Taiwan's intermediate firms to compete. Because they were required to buy relatively more expensive midstream products, Taiwan's plastics and textiles manufacturers--two of

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1/ U.S. Department of Commerce, "Opportunities for U.S. Exports Brighten; Sustained Economic Recovery Reactivates Many Major Projects," Taiwan, Business America, Oct. 1, 1984, p. 30.

2/ U.S. International Trade Commission, Foreign Industrial Targeting-Phase III, USITC Pub. No. 1632, January 1985, pp. 275 and 276.

3/ Trade data compiled from official statistics of U.S. Department of Commerce.

4/ U.S. International Trade Commission, Foreign Industrial Targeting-Phase III, USITC Pub. No. 1632, January 1985, p. 275.

Taiwan's leading export industries--began to lose their edge in global markets. 1/ In October 1981, a complete reversal of previous policy was adopted. The new policy called for an immediate adjustment of basic feedstock and intermediate petrochemical prices to world levels. Almost all import restrictions on petrochemicals were lifted. 2/

Intermediate petrochemical producers criticized the plan, noting that the CPC had not lowered feedstock prices sufficiently to allow them to compete in an open market. In response, the Ministry of Economic Affairs lowered the price of CPC products by tying them to prices of U.S.-made products. 2/

In 1984, the chairman of the board of China Petrochemical Development Corp., a subsidiary of CPC, said a national consensus on future goals of the Taiwan chemical industry has been reached. The plan for the chemical industry covers the period from 1984 to 1994 and calls for producing or expanding production of products in 10 categories: organic fluoro compounds, organic silicon compounds, new commodity plastics, engineering plastics, synthetic rubbers, specialty chemicals and their intermediates, insecticides, coal-tar chemicals, oxo chemicals, and petrochemical basic raw materials. 3/

Two of the targets Taiwan hopes to achieve for the chemical industry by 1990 are as follows: 4/

(1) Added values of all chemical products to reach 10 percent of the added values for all manufactured goods. Currently, the figure is 7.4 percent.

(2) The values added as a percentage of product values in the chemical industry to increase to 20 percent from the current 14.5 percent.

Trade practices

Because Taiwan is not a member of the General Agreement on Tariffs and Trade (GATT), its tariffs are not bound by multilateral trade agreements. Domestic legislation allows the authorities to raise or lower tariffs by 50 percent. 5/ It is noteworthy that, in 1979, the United States and Taiwan agreed to follow the code-of-conduct principles adopted during the Tokyo round of multilateral trade negotiations in their trade dealings with each other. In December 1981, the United States and Taiwan also exchanged tariff concessions. Both countries made these concessions available on a most-favored-nation basis. 6/

1/ Ibid.
2/ Ibid.
3/ "PAC CHEM '84 Probes Future of Pacific Basin Chemical Industries," Chemical and Engineering News, Jan. 7, 1985, p. 18.
4/ Ibid.
6/ U.S. International Trade Commission, Foreign Industrial Targeting-Phase III, USITC Pub. No. 1632, January 1985, p. 238.

Incentive programs

The Taiwan authorities provide assistance to the development of the chemical and petrochemical industries in the form of tariff protection, non-tariff barriers, encouragement for research and development, and tax incentives. Tariff rates for 10 categories of chemical and petrochemical imports (1984) are as follows (in percent): 1/

Item	Ad valorem rates
Primary petrochemicals and organic intermediates	5-30
Synthetic detergents and surfactants	25
Synthetic rubber	7.5-12.5
Plastics	20-30
Ammonia	20
Urea for agricultural purposes	5
Urea for nonagricultural purposes	20
Synthetic fibers	35
General pharmaceuticals	10-30
Fertilizers	0-20
Inorganic chemicals	0-25
Dyes, pigments, paints, flavor chemicals, and essential oils	10-35
Cosmetics	55

Taiwan also employs a customs valuation uplift of 10 percent added to the cost, insurance and freight (c.i.f.) value of imported goods. The Government intends to eliminate the uplift in 1985 concurrent with implementation of a proposed value added tax. 2/ Defacto import bans are imposed on chemical intermediates under an "orderly marketing arrangement." These import bans are supplemented either by administrative order or by denying import permits. Investment in chemicals is encouraged with low interest loans, duty-free importation of equipment, and tax incentives. 3/

Energy and feedstock supplies

Energy supplies are a problem for Taiwan. With very small deposits of coal, petroleum, and natural gas, Taiwan is heavily dependent on imported energy resources. In 1983, almost 90 percent of energy requirements were supplied by imports--mostly petroleum, plus some coal--and nuclear power

1/ U.S. Department of State, Changes in U.S. Chemical Trade With Developing Countries, Taiwan, airgram, Reference American Embassy, Taipei 01284, December 1984, p. 2.
2/ Ibid, p. 3.
3/ Ibid.

supplied the remainder. Taiwan is also dependent on imports of petroleum and liquefied natural gas as feedstocks for its petrochemical industry.

Singapore

Singapore is a small city state (like Hong Kong), consisting of one large and several smaller islands with an area of 224 square miles. With a population of only 2.5 million, Government policy favors capital-intensive industries. The per-capita income was second highest in Asia in 1982 (after Japan), amounting to more than $6,000. Its GNP expanded rapidly after Singapore gained independence from Great Britain in 1959. Singapore's strategic location and industrious population have given the country an economic importance in Southeast Asia out of proportion to its small size. Average growth in GNP during the 1970's was 24 percent per year. GNP amounted to $13.6 billion in 1981 and $16.6 billion in 1983. Singapore's six petroleum refineries comprise the largest industry, accounting for more than one-third of manufactured output and about 30 percent of total trade. 1/

With a small market and no natural resources, Singapore's economic survival depends on its ability to act as an entrepot for Southeast Asia including trade, banking, commerce, maintenance, transportation, and tourism. 2/

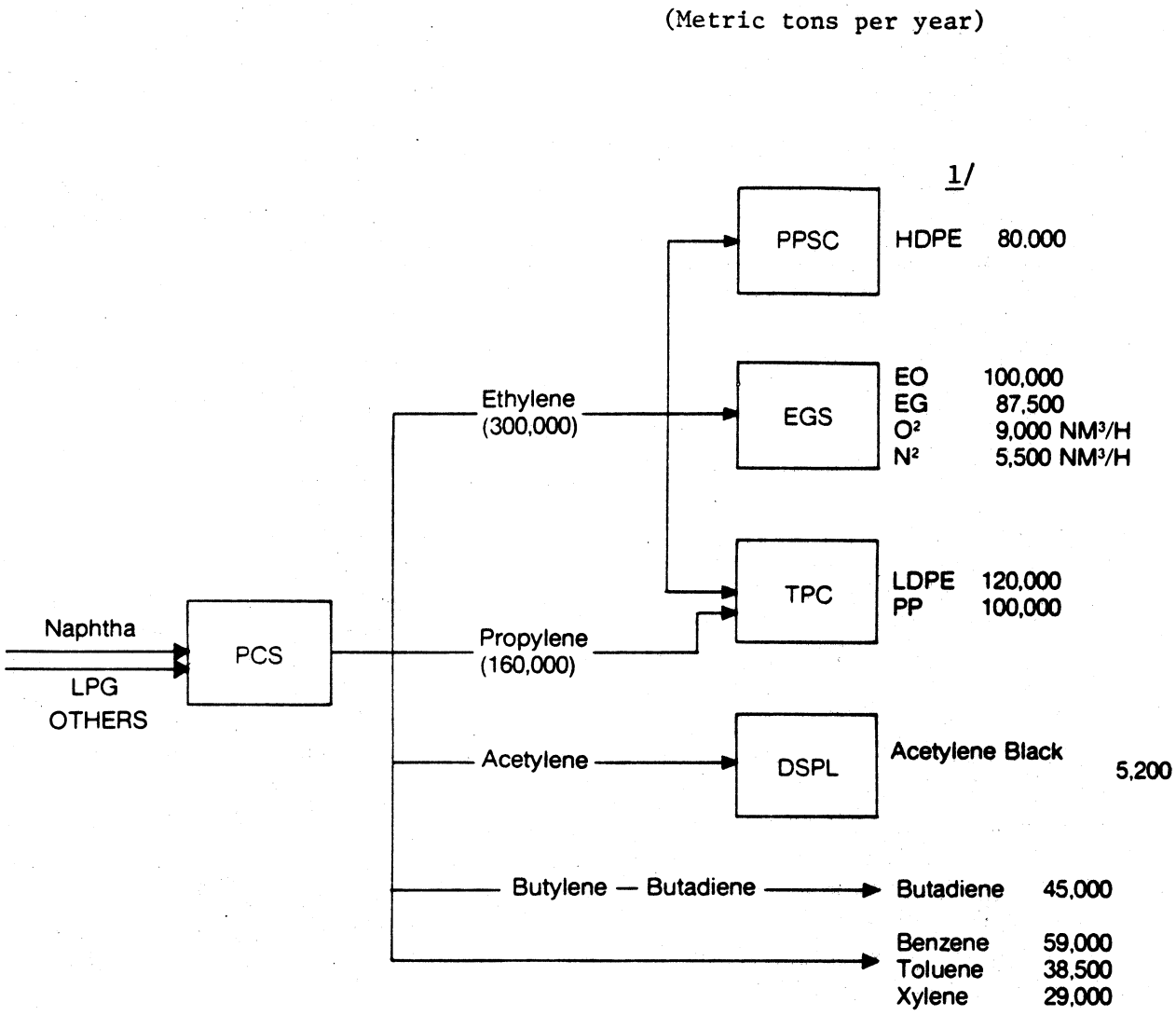
The local chemical industry

The chief feature of Singapore's chemical industry is its new integrated petrochemical complex, located on one of the small islands and consisting of the interconnected plants of five different companies that began operations in February 1984. 3/ An "upstream" plant "cracks" feedstocks, such as naphtha, liquefied petroleum gas (LPG), or mixtures of the two purchased from local refineries and/or the spot market. The cracking operation produces primary petrochemicals--mainly ethylene and propylene--which flow to nearby "downstream" plants to serve as raw materials for chemicals and plastics, principally high density polyethylene (HDPE), ethylene oxide (EO), ethylene glycol (EG), low density polyethylene (LDPE), polypropylene (PP), and acetylene black (a pigment and the base of dry-cell batteries). Other output of the naphtha cracker, as yet unutilized domestically, include butadiene, benzene, toluene, and xylene. Figure 7 is a simplified diagram of these operations. Ownership of the plants are as follows: 4/

(1) Petrochemical Corporation of Singapore (Private) Ltd. (PCS)
Joint venture between the Government of Singapore, Japan-Singapore Petrochemicals Co. Ltd., and The Development Bank of Singapore Ltd. It produces the primary petrochemicals and has 500 employees.

1/ The Economist, Mar. 16, 1985, p. 78.
2/ U.S. Department of Commerce, Business America, Apr. 1, 1985, p. 8.
3/ U.S. Department of State, communications from Singapore Embassy, February and March 1985.
4/ Ibid.

Figure 7.--Singapore Petrochemical Complex



1/ LPG: Liquefied petroleum gas (mostly propane)
HDPE: High-density polyethylene
LDPE: Low-density polyethylene
EO: Ethylene oxide
EG: Ethylene glycol
PP: Polypropylene

(2) Phillips Petroleum Singapore Chemicals (Private) Ltd. (PPSC)
Joint venture: Phillips Petroleum Co. (60 percent), Government of Singapore (30 percent), and Sumitomo Chemical Co. (10 percent). It produces high-density polyethylene.

(3) Ethylene Glycols (Singapore) Private Ltd. (EGS)
Joint venture of Mitsubishi and other Japanese companies, the Government of Singapore, and Shell Chemical Co. It produces ethylene oxide and glycols, oxygen, and nitrogen, and has 100 employees.

(4) The Polyolefin Co. (Singapore) Pte. Ltd. (TPC)
Joint venture of the Singapore Government (25 percent), Development Bank of Singapore (5 percent) and a consortium of Sumitomo Chemical Co. Ltd. (55 percent) and four other Japanese companies (15 percent). It produces low-density polyethylene and polypropylene, and has 260 employees.

(5) Denka Singapore Private Ltd
Joint venture of a Japanese company, Denki Kagaku Kogyo K.K., (80 percent) and a holding company of the Singapore Government (20 percent). It produces acetylene black, and has 30 employees.

With the new oil refineries and petrochemical plants coming onstream in the Middle East and considering those planned for Indonesia, Singapore's petroleum and petrochemical industries will be feeling increased competitive pressure. 1/

The remainder of Singapore's chemical industry consists of more than 100 companies--some U.S.-owned--with 1983 sales of about $600 million, up from $434 million in 1980, or about 3.4 percent of manufacturing output. Almost two-thirds of Singapore's chemical sales in 1983 were exports mostly to markets in East and Southeast Asia. In terms of value, the medicinal chemicals and pharmaceuticals sector was by far the most important, followed by plastics materials and synthetic resins, organic and inorganic chemical intermediates, and a host of other products, including surface coatings, soaps and detergents, cleaning compounds, adhesives, water-treatment chemicals, dyes, inks, pigments, ethyl alcohol, lubricating oil additives, electronic chemicals, fatty acids, plastics additives, leather-finishing chemicals, pesticides, and electroplating chemicals. (Singapore does not produce synthetic fibers, fertilizers, or cosmetics.)

Government involvement

The Government's development policy throughout the past decade has emphasized industrialization. Singapore's separation from Malaysia precluded realization of a large national market and resulted in a shift of emphasis

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1/ Ibid.

from import substitution to export manufacturing. According to the U.S. Department of State, the Government of Singapore has introduced new and remarkably successful financial incentives for export-oriented industry and provided efficient infrastructure for manufacturing. Labor legislation enacted in 1968 eliminated costly fringe benefits, ended labor unrest, provided for wage stability, and gave employers more flexibility in hiring and firing. 1/

Several institutions played a key role in carrying out Singapore's industrialization policy. The Development Bank of Singapore was responsible for industrial financing, while the Jurong Town Corp. was charged with developing industrial estates. The latter's major achievement is the Jurong Industrial Estate, a Government-planned satellite community devoted to manufacturing, which in 1980 had more than 1,000 factories in production and many others in various stages of completion. 2/

Saudi Arabia

The Kingdom of Saudi Arabia, with an area of 830,000 square miles, is about the size of the United States east of the Mississippi. 3/ The population in 1982 was estimated at 10 million, of which more than 1.6 million were foreign workers. 4/ Saudi Arabia is largely a desert country with a hot and humid fertile area that fringes the east coast; a cooler and drier climate is found in the mountainous regions of the west and south. 5/ Saudi Arabia's natural resources include large deposits of crude petroleum, containing associated natural gas. Viable deposits of several minerals, including gold, have been found. There are also reports of uranium deposits. The GDP of Saudi Arabia increased from $115.7 billion in Saudi Fiscal Year (SFY) 1979/1980 (May 27, 1979-May 14, 1980) to $135.7 billion in SFY 1981/82 (May 4, 1981-April 22, 1982), a 17 percent increase. The per-capita GDP during this period increased from $13,400 to $15,100. 6/

The local chemical industry

In 1981, approximately 100 privately owned chemical plants were in operation in Saudi Arabia. Prior to 1985, these plants relied primarily on imported raw materials that are used to produce finished products, such as plastics, paints, and pharmaceuticals for domestic consumption. During 1981,

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1/ U.S. Department of State, Background notes-Singapore, August 1984, p. 5.
2/ U.S. Department of State, Background notes-Singapore, August 1984, p. 5.
3/ U.S. Department of State, Background notes-Saudi Arabia, February 1983, p. 1.
4/ U.S. Central Intelligence Agency, The World Factbook-1982, April 1982, p. 204.
5/ Economic Handbook of the World: 1981, New York, 1981, p. 380.
6/ U.S. Department of Commerce, Foreign Economic Trends and their implications for the United States, "Saudi Arabia," FET: 82-005, January 1982, p. 2.

20 plastics-producing factories consumed 80,000 tons of imported raw materials that were used in the manufacture of polyvinyl chloride (PVC). One of these factories, a producer of PVC pipe, produced 22,000 tons of pipe and fittings for domestic consumption in 1978. Saudi-made plastics goods include household items, bags, containers, eggtrays, toys, jugs, barrels, boxes, shoes, pipes and sheets, fittings, insulating foam, foam rubber, adhesives, fiberglass products, furniture, windows and doors, prefabricated buildings, and upholstery. In addition, three rubber products plants produce 1,100 tons annually of sandals, bags, and pipe rings. There are 4 tire retreading factories with a total annual capacity of 74,000 units. 1/

Both of the methanol plants, with a combined capacity of 1.25 million metric tons per year, and located at Jubail, have been onstream since 1984. The major part of production will be directed to international markets.

During 1985, five other petrochemical projects are scheduled to come on stream. These plants will produce up to 1.6 million metric tons a year of ethylene, 520,000 tons a year of ethylene glycol, and 670,000 tons a year of low-density and linear-low-density polyethylene. 2/ The Saudi Basic Industries Corporation (SABIC) is the state-owned corporation responsible for launching and implementing these petrochemical projects.

Government involvement

SABIC was incorporated in 1976 and is responsible for establishing capital-intensive basic industry projects (other than in the petroleum industry). In the mid-1970's, SABIC launched a world-scale hydrocarbon-based industrialization plan in an effort to make the nation less dependent on crude petroleum as a source of revenue. 3/ SABIC placed the greatest emphasis on the development of a world-scale petrochemical industry based on natural gas--the production of which is often associated with and dependent on the production of crude oil and had previously been flared at the well-head. 4/

The Saudi Arabian Fertilizer Co. (SAFCO), an ammonia and urea fertilizer producer, was the first major nonpetroleum industrial company in Saudi Arabia. 5/ The plant was completed in 1969, and urea and ammonia production began in 1970. Since 1970, SAFCO's annual production of urea and ammonia increased as follows (in 1,000 metric tons):

1/ U.S. Department of Commerce, "Market Survey: Saudi Arabia's Petroleum, Gas, Petrochemical, and Chemical Equipment and Products Market," International Marketing Events, January 1982, p. 15.

2/ U.S. Department of State, Saudi Arabia's Emerging Petrochemical Industry, airgram, Reference No. A-011, Oct. 31, 1982, p. 5.

3/ U.S. Department of State, "Saudi Arabia's Emerging Petrochemical Industry--Implications for the West," airgram, Reference No. A-011, Oct. 31, 1982, p. 2.

4/ Ibid, pp. 2-3.

5/ U.S. Department of Commerce, International Marketing Events, January 1982, p. 14.

Year 1/	Urea and ammonia production
1970	17
1972	94
1974	197
1978	260
1979	299
1980 2/	330
1981 3/	329
1982	330

1/ Production from 1970 to 1979 derived from Kingdom of Saudi Arabia Ministry of Planning, Third Development Plan: 1980-1985 A.D., Riyadh, June 19, 1980, p. 221.
2/ Production for 1980 derived from Chimie Actualities, Jan. 29, 1982, p. 18.
3/ Production for 1981 and 1982 derived from Nitrogen, April 1983, p. 11.

The Saudi Industrial Development Fund (SIDF) was established in 1974 to promote private sector participation in Saudi industry. This Government agency provides interest-free loans for industrial projects with more than 25 percent Saudi participation. 1/ These loans may cover up to 50 percent of project costs.

Trade practices

The Saudi Government generally does not emphasize import restrictions or protective tariffs for petrochemicals, and hopes to encourage the development of a strong private sector. Import duties are 3 percent ad valorem for most resins and plastics raw materials. Duties are exempt for chemical raw materials, industrial pumps, and most other petroleum, gas, and petrochemical machinery. 2/ The Government aids local industry through "Buy Saudi" programs. As part of this program, the Commerce Ministry requires foreign contractors to purchase locally produced goods before turning to imports. 3/

The Saudi strategy to promote petrochemical exports has been to concentrate on joint ventures between SABIC and foreign firms with recognized expertise and experience in petrochemical production and marketing. Foreign firm participation was accomplished through generous financing and crude petroleum entitlement incentives; reportedly for each $1 million of real investment the foreign firm received the right to purchase 500 barrels of crude petroleum a day. These purchase rights should become more valuable if crude petroleum again becomes less plentiful.

1/ The Europa Yearbook 1982: A World Survey, London, vol. II, 1982, p. 1332.
2/ U.S. Department of Commerce, International Marketing Events, p. 19.
3/ U.S. Department of commerce, "Saudi Arabia: Market Expands Despite Reduced Oil Production," Business America, Aug. 9, 1982, p. 31.

Energy and feedstock supplies

As of January 1, 1985, Saudi Arabia had 169 billion barrels of estimated proved reserves of crude petroleum, or about 24 percent of the world's total. 1/ Saudi Arabia also has proved reserves of 5.4 billion barrels in the neutral zone, which is shared equally with Kuwait. Saudi Arabia has effective crude petroleum production capacity of 10 million barrels per day, 2/ and the crude petroleum refineries have a combined capacity to process 840,000 barrels per day. Construction of additional refining capacity is planned, but in April 1985 contracts were cancelled for two refineries that would have processed 340,000 barrels per day beginning in 1987. 3/

Saudi Arabia's estimated proved reserves of natural gas were 169 trillion cubic feet, as of January 1, 1985. 1/ Most of Saudi's natural gas is associated with crude petroleum. Between 500 million and 600 million cubic feet of natural gas is usually produced with each 1 million barrels of crude petroleum. 4/

Saudi Arabia has no known reserves of coal and only negligible known reserves of uranium ore. Like most other nations of the world, however, Saudi Arabia is considering the use of nuclear power as an alternative source of energy in the future. Another alternative energy source being considered by Saudi Arabia is solar energy, which because of its wide availability throughout the nation, could be used to provide electricity to remote villages.

Saudi Arabia has completed a vast natural gas gathering system that can collect about 3 billion cubic feet per day of associated natural gas. 5/ The methane and ethane derived from the collected natural gas is to be used primarily as fuel and petrochemical feedstock. 6/ A 730-mile cross-country natural gas liquids (NGL's) pipeline from the petroleum fields in the Eastern Province where the NGL's are excluded from the associated natural gas to Yambu on the west coast has been completed. This pipeline, which is 26 to 30 inches in diameter, can provide 270,000 barrels per day of NGL for use in the new petrochemical complexes at Yambu. 7/

According to SABIC, the projected market distribution for petrochemical production from plants expected onstream during 1985 could be 10 percent for local consumption, 20 percent for the United States, 22 percent for Europe, 20 percent for Japan, and 28 percent for the rest of the world. 8/ The Saudi

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1/ "Worldwide Report," Oil and Gas Journal, Dec. 31, 1984.
2/ U.S. Central Intelligence Agency, The World Factbook-1982, p. 20.
3/ Hydrocarbon Processing, April 1985, p. 11.
4/ U.S. Department of Commerce, International Marketing Events, p. 4.
5/ "Vast Saudi Gas-Gathering System Move Into Final Phase," Oil and Gas Journal, Apr. 12, 1982, p. 76.
6/ "First Phase of Vast Gas System Near Completion," Financial Times, Apr. 26, 1982, p. III.
7/ U.S. Department of Commerce, International Marketing Events, p. 8.
8/ Mr. Abdulaziz al-Zamil, Middle East Economic Survey, Feb. 8, 1982, p. 4.

joint-venture agreements are structured so that the foreign partner is involved in the marketing of the petrochemicals; the foreign partner generally supplies the technology and management as well as the marketing expertise.

The main exports from Saudi Arabia will be linear low-density polyethylene (LLDPE), methanol, ethylene glycol, ethylene dichloride, styrene and ethanol. The SABIC marketing director, estimates that domestic consumption of LLDPE could reach 78,000 metric tons per year (mtpy) by 1990. With an expected domestic capacity of 590,000 mtpy, this means some 512,000 mtpy of LLDPE would be available for export by 1990. 1/ Saudi Arabia is also a significant producer of methanol with a total annual capacity of 1.25 million mtpy. Domestic demand is negligible and could remain so until additional methyl-tertiary-butyl ether (MTBE) and acetic acid plants are built in a second-phase expansion plan. When these plants are operating they will require about 230,000 mtpy of methanol, or 20 percent of installed capacity.

Saudi Arabia plans to export 600,000 metric tons in 1987 and 1 million mtpy by 1990. 2/

Current domestic demand for ethylene glycol and ethanol is not large and plant production rates will depend on joint-venture partners' skills in marketing these products. The Saudi ethylene glycol capacity is 500,000 mtpy; for ethanol, 281,000 mtpy. 3/

Ethylene dichloride (EDC) production (456,000 mtpy capacity) is scheduled to be onstream by the fourth quarter of 1986. Initially, most of it will be available for export. 4/ PVC production is scheduled to be onstream by the fourth quarter of 1986 and if Saudi PVC resin demand runs to forecast then about 80 percent of EDC production, available as vinyl chloride monomer feedstock, could be absorbed locally. 5/

Styrene monomer from the 295,000-mtpy Sabic-Pecten plant is scheduled onstream by the fourth quarter of 1985. Most of the product will be available for export. Eventually some of the product will be used as feedstock for a planned 70,000 -mtpy-polystyrene resin plant. A styrene-butadiene-rubber plant is also a possibility, and if built would further increase the domestic consumption of styrene. 6/

Assuming that 20 percent of Saudi petrochemical exports are sold in the United States, this would account for 2 to 3 percent of the U.S. market. Many of the joint venture partners involved in Saudi Arabian petrochemical production are major U.S. firms. These firms have supplied equipment, technology, management, and U.S.-based training. If the projects prove as

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1/ "Saudi Chemicals: What Kind of Menace?," Chemical Business, September 1984, p. 12.
2/ Ibid.
3/ Ibid, p. 15.
4/ Ibid.
5/ Ibid.
6/ Ibid.

profitable as expected, the American partners will earn a substantial return on their investment. 1/

Some of these U.S. firms are preparing to use Saudi petrochemicals as inputs to domestically produced specialty chemicals and could profit from their lower cost. However, U.S. petrochemical producers will be competing with Saudi output in an industry already marked by overcapacity. Some of the more pressed U.S. producers reportedly may petition the U.S. Government for measures to restrict imports, such as quantitative restrictions or tariff increases. They have pursued congressional legislative remedies against imports from countries where feedstock prices are below market value. The natural resource subsidy proposal that emerged from these efforts in 1984 was only narrowly defeated in the 98th Congress; the issue remains a subject of debate. 2/

The following tabulation shows the value of U.S. chemical trade with Saudi Arabia since 1980 (in millions of dollars): 3/

Year	U.S. imports	U.S. exports
1980	0.001	179
1981	.003	237
1982	.018	256
1983	.140	228
1984	.005	225

As the tabulation shows, U.S. chemical imports from Saudi Arabia have not been significant in the past. The value of Saudi's chemical imports from the United States has remained above $200 million a year since 1981.

The following tabulation shows the value of merchandise trade between the two nations for selected years (in millions of dollars):

Year	U.S. imports	U.S. exports
1972	194	314
1977	6,347	3,575
1980	12,509	5,769
1981	14,391	7,327
1982	7,443	9,026
1983	3,627	7,903
1984	4,009	5,564

Source: Official statistics of the U.S. Department of Commerce.

1/ U.S. Department of State, Saudi Arabia's Emerging Petrochemical Industry--Implication for the West, airgram, Reference No. A-011, Oct. 31, 1982, p. 13.

2/ U.S. International Trade Commission, Potential Effects of Foreign Governments' Policies of Pricing Natural Resources, USITC Publication 1696, May 1985, pp. ix and x.

3/ Trade data compiled from official statistics of the U.S. Department of Commerce.

U.S. imports from Saudi Arabia, mainly crude petroleum, increased from $194 million in 1972 to a high of $14.4 billion in 1981. Since then, imports have decreased irregularly to $4.0 billion in 1984. U.S. exports to Saudi Arabia peaked at over $9.0 billion in 1982 and decreased to $5.6 billion in 1984.

Other

Hong Kong

The chemical industry represents a minute share of the territory's manufacturing sector. Major products are pharmaceuticals, synthetic rubber and plastics, paints and varnishes, and industrial chemicals and products. Value added was about $110 million in 1982. Imports, on the other hand, amounting to several billion dollars per year in recent years and coming mainly from Japan, China, and Taiwan, were as follows (in millions of dollars): 1/

Source	1982	1984
Synthetic fibers, including yarn and fabrics made therefrom	1,727	2,431
Organic chemicals	178	249
Inorganic chemicals	168	196
Plastics materials	438	635
Synthetic rubber	6	8
Medicinals and pharmaceuticals	227	234
Cosmetics, perfumery	65	74
Synthetic detergents	45	52
Essential oils, perfumes and flavor chemicals	27	40
Paints, pigments, and related products	65	74
Urea	1	18
Miscellaneous chemicals and products	176	248
Dyes	6	9
Total	3,129	4,268

Direct foreign investment in Hong Kong's manufacturing industries as of September 1984 was 54 percent from the United States and 21 percent from Japan; more than one-third was in electronics and 7 percent was in chemicals. 2/

India

A $1.8 billion petrochemical complex in Maharashtra State is scheduled for completion in 1989 and will help India double its production of petrochemicals. This project is the first in India to use natural gas feedstock.

1/ U.S. Department of State, March 1985.
2/ Hong Kong Survey, The Economist, May 11, 1985, 25 pages.

Financing includes a $300 million World Bank loan, and Government and private funds. Major products will be ethylene, polyethylene, polypropylene, ethylene oxide and glycol, and acetylene black. 1/ Another complex is being built, at a cost of about $600 million, in Uttar Pradesh, to produce ammonia and urea for fertilizer use. Completion is scheduled for 1988. The complex is owned by Bahrainian and Uttar Pradesh (Government) interests. 2/

India's chemical industry was well established in the 1970's, particularly in all of the leading synthetic fibers (nylon, acrylic, polyester), synthetic rubber, and several of the leading plastics (polyethylene, polypropylene, polystyrene, polyvinyl chloride), as well as their chemical raw materials and intermediates. 3/ Fertilizers, in addition to being a major import, were produced in 13 publicly owned plants in 1983-84, and at least 5 additional ammonia/urea plants were being constructed or were in the planning stage. 4/ 5/ Fertilizer production in FY 1984 was 4.5 million metric tons. Other petrochemical projects under construction or in the planning stage include plants for methanol, formaldehyde, maleic anhydride, phthalic anhydride, benzene, toluene, xylenes, caprolactam, ethylene glycol, nylon, EPDM synthetic rubber (based on ethylene and propylene), phenol, acetone, polypropylene, dimethyl terephthalate, oxo alcohols, and carbon black. 5/

Indonesia

Long established in the production of crude petroleum and natural gas, and with a large population now exceeding 150 million, Indonesia in 1971 set a national goal of self-sufficiency in fertilizer production, part of a broader goal of self-sufficiency in food grain production. At that time Indonesia had only one small ammonia/urea plant and imported nearly all of its fertilizer. Since that time, four large ammonia/urea plants went on stream during 1974-78. In the 1980's, faced with declining demand on the international market for liquefied natural gas, Indonesia began planning to use its large gas reserves for domestic fuel and as feedstock for additional production of petrochemicals, including additional ammonia/urea and methanol plants. A naphtha-based petrochemical complex, was also planned that would have produced terephthalic acid and other intermediates for synthetic fibers from facilities that would have cost $1.3 billion. With declining national revenues, however, this was scaled down and sections postponed, so that currently only the terephthalic acid plant is under construction. Other projected petrochemical ventures have reportedly also been postponed. 6/

1/ Petrochemical News, Apr. 1, 1985, p. 1; also European Chemical News, Aug. 13, 1984, p. 26.

2/ Hydrocarbon Processing, April 1985, p. 42.

3/ Chemical Week, Sept. 19, 1979, pp. 36-38.

4/ U.S. Department of Commerce, Foreign Economic Trends, August 1984.

5/ Oil and Gas Journal, Oct. 29, 1984, p. 100.

6/ U.S. Department of Commerce, Foreign Economic Trends, August 1982; European Chemical News, April 1984; Oil and Gas Journal, Aug. 6, 1984, p. 32, and Oct. 29, 1984, p. 100; Chemical Week, Nov. 14, 1984, p. 29; and The Economist, Oct. 6, 1984, p. 80.

Jordan

Jordan produced 4.7 million metric tons of phosphate rock in 1983 and was the world's No. 3 exporter of this mineral. Since 1983, some of the phosphate rock has been converted to diammonium phosphate (DAP) in the new, $40-million plant of the Jordan Fertilizer Industrial Co. Nearly all of the 365,000 metric tons of DAP produced in 1983 was exported to China, India, Pakistan, Italy, and other countries. 1/ The Arab Potash Company's $475-million Dead Sea project, started in 1982, produced 280,000 metric tons of potash in 1983 and projected to produce 500,000 tons in 1984. This was exported to Iraq, China, India, Japan, Indonesia, and other countries. 1/

Republic of Korea

Korea's negative balance of trade in all commodities has improved in recent years, but has widened in chemicals, as shown in the following tabulation (in millions of dollars): 2/

Year	Imports	Exports	Trade balance
1981----	2,109	682	-1,427
1983----	2,279	747	-1,532
1984----	2,762	918	-1,844

The production index for industrial chemicals in 1984 was 26 percent higher than in 1980. The corresponding increase for other chemical products was 61 percent; for plastic products, 45 percent; for rubber products, 38 percent; and for all manufacturing, 61 percent.

Production of important chemical products has been as follows (in thousands of metric tons): 3/

Chemicals	1981	1984
Complex fertilizers----------	1,211	1,861
Urea fertilizers----------	1,070	858
Ammonia----------	565	908
Ethylene----------	374	526
Polyethylene----------	200	317
Polyester fibers----------	193	265
Insecticides----------	54	110
Synthetic detergents----------	62	57

In early 1985, South Korean Trade and Industry Ministry officials said that construction of several petrochemical plants will begin this year and be

1/ U.S. Department of Commerce, Foreign Economic Trends, August 1984, and Business America, Sept. 17, 1984.
2/ Chemical and Engineering News, June 10, 1985, p. 65.
3/ Chemical and Engineering News, June 10, 1985, p. 65

completed during 1986-89. About 40 percent of the $749 million construction costs reportedly will come from foreign investors. Projected products and plant capacities are as follows (in metric tons per year): 1/

Product	Capacity
Terephthalic acid	160,000
Polyethylene	80,000
Ethylene (ex naphtha)	250,000
Polyethylene, high density	80,000
Polypropylene	77,000

Until the early 1980's, Korea effectively discouraged most foreign investment. As a result, the country fell behind some other developing nations in attracting foreign investment and technology. As of mid-1985 it had less than one-third the foreign investment Hong Kong had in manufacturing alone. Although the promotional effort reportedly still lags, the thrust of Government policy appears to be to open up the economy gradually to foreign participation. 2/

Kuwait

Kuwait is unique among the energy-rich developing countries in that its substantial chemical investment has been outside its own borders. It purchased a 25 percent interest in a West German chemical company that ranks among the top five such companies worldwide, and it has invested in a petrochemical complex in Bahrain and four phosphate fertilizer plants in Tunisia. 3/ Kuwait will move into downstream petrochemical production with the construction of plants to produce polypropylene and polystyrene--about a $120 million investment. Most of the polypropylene will be for local consumption, but perhaps 80 percent of the polystyrene will be exported. Scheduled completion is late in 1987. 4/ Other petrochemicals scheduled for production in the near future are ethylene glycol, paraxylene, orthoxylene, ammonia, and benzene. 5/

Malaysia

Malaysia's chemical industry is small and limited to the production of paints and varnishes, fertilizers, drugs, herbicides, and a limited number of base chemicals, mostly produced from imported intermediates. From its

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1/ PetroChemical News, Feb. 25, 1985, p. 1.

2/ "Korea in 1985--Going for Gold: A Three-Year Business Outlook," Business Week, July 1, 1985, special section following p. 83.

3/ U.S. Department of Commerce, Foreign Economic Trends and Their Implications for the United States (FET), June 1984.

4/ "Kuwait Ventures into Downstream Petrochemicals," Chemical Week, Apr. 17, 1985, p. 36, and Hydrocarbon Processing, June 1985, p. 29.

5/ Oil and Gas Journal, Oct, 29, 1984, p. 101.

production of natural gas, a large methanol plant began operations in 1984 and a fertilizer plant producing urea and ammonia will come onstream in 1985. (A foreign-owned ammonia plant has been in operation about 15 years.) Because Malaysia is a net exporter of crude petroleum and natural gas, the Government is considering the construction of a petrochemical complex to upgrade these products for export. Sales by Malaysia's chemical industry in recent years, were as follows (in millions of dollars): 1/

Item	1981	1983
Herbicides	28.2	33.5
Fertilizers	95.0	62.2
Industrial chemicals	35.9	38.9
Miscellaneous chemicals	5.7	7.4
Paints	62.1	74.9
Lacquer, varnish, and shellac	3.1	3.0
Wood preservatives	4.5	4.6
Soap	21.6	20.3
Soap powder	38.5	39.4
Medicinals and pharmaceuticals	21.3	28.9
Cosmetics and toilet preparations	12.3	11.5
Mosquito coils	8.0	10.4
Total	336.2	335.0

Imports of chemicals and related products in 1981 were $910 million; exports were $83 million.

Mexico

In spite of increasing production of nearly all chemicals, Mexico's chemical trade deficit, which had narrowed in 1982 and 1983, widened substantially in 1984; trade in primary petrochemicals is shown in the following tabulation (in millions of dollars): 2/

Year	Imports	Exports	Trade balance
1978	165	65	-100
1979	320	105	-215
1980	525	130	-395
1981	525	150	-375
1982	400	140	-260
1983	340	125	-215
1984	430	130	-300

1/ U.S. Department of State, March 1985.
2/ Chemical and Engineering News, June 10, 1985, p. 62, quoting Petroleos Mexicanos (PEMEX).

Production and imports of primary petrochemicals, by PEMEX, are shown in the following tabulation (in thousands of metric tons in 1984):

"Primary petrochemicals" 1/	Production	Imports
Acetaldehyde	147	70
Acrylonitrile	49	34
Ammonia	2,156	0
Benzene	156	0
Butadiene	20	67
Cumene	33	-
Cyclohexane	30	26
Dodecylbenzene	51	49
Ethane (feedstock)	1,574	0
Ethylbenzene	31	16
Ethylene	643	0
Ethylene dichloride	220	57
Ethylene oxide	97	11
Hexane (feedstock)	95	0
Hydrochloric acid	77	-
Isopropyl alcohol	14	44
Methanol	197	-
Perchlorethylene	-	15
Polyethylene (high density)	76	19
Polyethylene (low density)	134	63
Propylene	208	26
Propylene tetramer	35	12
Styrene	30	93
Sulfur, recovered	461	-
Toluene	216	37
Vinyl chloride	132	109
Xylenes	268	119

1/ Production and imports of products designated by PEMEX as "primary" petrochemicals that only PEMEX can produce or import. However, only ammonia, benzene, butadiene, ethylene, methanol, propylene, toluene, and the xylenes (and possibly the recovered sulfur) can be regarded as "primary" in the context of this study. Data are from Chemical and Engineering News, June 10, 1985, p. 62.

Mexico is one of the countries that was cited in earlier sections as having noncompetitive industries because these were developed in line with import-substitution guidelines. The secondary chemical industry (i.e., non-PEMEX) is one such industry. An executive of the largest secondary chemical (and synthetic fiber) company, with sales of $350 million in 1983 (including $80 million in exports), 40 percent owned by a U.S. chemical company, commented on reports that its domestic products are "grossly overpriced" and are not competitive in international trade, as follows: the Mexican plant is completely different from its counterpart on the U.S. gulf

coast. Its capital investment includes a dam to generate power, housing for workers, rail lines, and an entire marine shipping terminal. It is required to buy overpriced, nonstandard raw materials from PEMEX. 1/ Foreign direct investment represents only 4 percent of total investment in the Mexican economy, with U.S. firms accounting for roughly 65 percent of all foreign investment. In theory, Mexico welcomes foreign direct investment, subject to its own rules and discretionary criteria. According to guidelines issued by the Government in 1984, chemicals is one of the five sectors targeted for increased foreign investment. 2/

Nigeria

With abundant natural gas, much of which is now being flared, Nigeria has long planned to build a large $2 billion petrochemical complex that would be completed by 1990. 3/ More recently, because of the country's worsened financial position and the saturation of the world petrochemical market, other options have been considered. One would be to limit the wholly government-owned portion to ethylene and bring in joint-venture partners from the United States, Europe, and Japan for downstream products. It is reportedly certain that the project will be split into two parts, one to open possibly around 1990 and the other later in the decade. In one scenario, the first stage would produce the following products, (capacities in thousands of metric tons per year): 4/

Product	Capacity
Ethylene	325
Polyethylene	270
Ethylene oxide/glycol	35
Polyvinyl chloride	70
Propylene	70
Polypropylene	70

Stage 2 would include the following products (capacities in thousands of metric tons per year):

1/ "Strong Medicine--To Increase Exports, Mexico Intends to Let Industry Raise Imports. Aim Is to Cut Factory Costs, Push Protected Suppliers To Grow More Efficient," The Wall Street Journal, July 9, 1985, pp. 1 and 20; "How Celanese Mexicana Has Beaten the Odds," Chemical Week, May 16, 1984, p. 47.

2/ U.S. Department of Commerce, Business America, Mar. 4, 1985, p. 38.

3/ "Nigeria Gives Go-Ahead for $2bn Petrochemical Complex," European Chemical News; Jan. 2, 1984, p. 23, and Hydrocarbon Processing, September 1984, p. 37.

4/ "Step by Step Plan for Port Harcourt Complex," European Chemical News, Mar. 11, 1985, p. 21.

Product	Capacity
Chlorine/caustic	100
Vinyl chloride	145
Polyvinyl chloride	70
2-ethyl hexanol	26
Phthalic anhydride	15
Plasticizers	30

With a population already exceeding 90 million, Nigeria expects that most of the output will be consumed within its borders.

Qatar

Petrochemicals are produced from Qatar's associated and nonassociated natural gas. Recent production, has been as follows (in thousands of metric tons):

Product	1981	1983
Ethylene	133	164
Polyethylene	111	144
Sulfur	9	19
Synthetic detergents	-	1,012
Ammonia	446	568
Urea	575	685

Most of this production is exported to Japan, India, and other Asian countries. Exports to the United States have been minimal and are expected to remain so. 1/ The Qatar Fertilizer Co., in which European interests hold a minority position, produced more than 1 million metric tons of urea and ammonia in 1981. Most of the output was exported to India, East Asian countries, China, Italy, and North Africa. Plants to produce ethylene and polyethylene came onstream in 1981. 2/

Romania

Growth in output of chemicals was 6.8 percent in 1980, 3.9 percent in 1981, 1.4 percent in 1982, and 5.3 percent in 1983. This slightly surpassed the growth of all industry. Production of key chemical groups, was as follows (in thousands of metric tons in 1980 and 1983): 3/

1/ U.S. Department of State, March 1985.
2/ U.S. Department of Commerce, Foreign Economic Trends, October 1982.
3/ Chemical and Engineering News, June 10, 1985, p. 64.

Chemical	1980	1983
Mineral fertilizers (as P_2O_5 and K_2O)	2,451	2,913
Ammonia	2,247	2,913
Plastics	579	633
Synthetic rubber	150	147
Pesticides (active substance)	40	48

Syria

Syria produces ammonia, urea, and triple superphosphate fertilizers. In 1983 it exported $21 million of phosphate products mostly to Europe and the U.S.S.R. Imports of chemicals, mostly from other Middle East countries and Europe, were about $358 million, or 17 percent of total imports. 1/ Plants to produce ethylene and polyethylene are scheduled. 2/

Thailand

Thailand lacks crude petroleum reserves but has moderately large natural gas reserves that are being developed by three U.S. companies. It was decided in 1980 that the best use of the gas would be to use it as a raw material in petrochemical complexes for fertilizers and plastics materials. Originally it was planned that private interests would finance the plastics project, but disputes on the price of the natural gas and the possibility that the project will be less profitable than previously believed have led to some delays. The Government therefore plans to take a 51 percent interest in the ethylene (and propylene) cracker, which will be the heart of the $860 million project. Downstream products will be polyethylene, polypropylene, vinyl chloride, and ethylene glycol. The fertilizer complex will produce ammonia, urea, sulfuric and phosphoric acids, ammonium phosphates, and other fertilizers, and should be completed near the end of 1987. The National Fertilizer Corporation, which will own the project, is held 45 percent by the Government, 45 percent by private companies in the fertilizer business, and 10 percent by commercial banks. 3/

Trinidad and Tobago

Four ammonia plants, with a capacity of almost 1.5 million tons per year, are in operation and are operated by two U.S. companies and the Trinidad and Tobago Government. One of these operations is being expanded, and in 1984, at least three European industrial groups sought Government permission to build

1/ U.S. Department of Commerce, Foreign Economic Trends, June 1984.
2/ Oil and Gas Journal, Oct. 29, 1984, p. 102.
3/ European Chemical News, July 9, 1984, p. 31, and Aug. 20, 1984, p. 30; U.S. Department of Commerce, Overseas Business Reports, June 1984, and Foreign Economic Trends, Apr. 1983; The Economist, Oct. 6, 1984, p. 80; and Oil and Gas Journal, Oct. 29, 1984, p. 102.

additional capacity. According to Government sources, the country is already the world's second largest exporter of ammonia, after the U.S.S.R., and is likely to become the largest after the new plants come onstream. 1/

A Government-owned methanol plant--based on natural gas, as is ammonia--was being started up in 1984. In 1985, the largest English chemical company succeeded om winning approval to construct a second large methanol plant, this one a $160 million joint-venture enterprise owned 30 percent by the English company and 30 percent by the Trinidad Government. The Commonwealth Development Fund and the International Finance Corporation will make up the balance. The plant is planned to be onstream by 1988. 2/

Turkey

After 136 years of exporting chromite, Turkey has opened its first chrome chemicals industrial complex. The $40 million complex produces sodium dichromate, sodium sulfate, and chromium sulfate. Three-fourths of the production is targeted for export. 3/

Turkey has major facilities for synthetic fibers, expanded recently by plants in developed countries that were bought by the Turks, dismantled, shipped to Turkey, and reassembled. Some of the output of synthetic fibers is being exported to other European countries. 4/

A major fertilizer project, financed 40 percent by Turkish investors and 60 percent by Arab interests, and scheduled for completion in 1988, will produce ammonium phosphates and nitrate. Ammonia, a raw material, will be imported from Kuwait, and phosphoric acid, another raw material, from Tunisia. Cost of the complex is estimated at $200 million, and fertilizer production is projected at approximately 3,000 metric tons per day. 5/

United Arab Emirates

United Arab Emirates is a confederation of seven sheikdoms, four of which--Abu Dhabi, Dubai, Ras al Khaimah, and Sharjab--have petroleum and natural gas reserves. The chemicals affiliate of the state-owned Abu Dhabi National Oil Co. (ADNOC) was established in 1982 with investments of about $80 million. In 1983 it operated at about 70 percent capacity and produced about 38,000 metric tons of chlorine, caustic soda, hydrochloric acid, and other industrial chemicals. Another affiliate produced sulfur. Other firms produced soaps and detergents, fertilizers, paints, cosmetics, and cleaning compounds. Local companies that consume these chemicals include makers of

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1/ "Three European Groups in Trinidad Ammonia Plans," European Chemical News, Mar, 25, 1985, p. 18.

2/ European Chemical News, Aug. 6, 1984, p. 18, and May 27, 1985, p. 15, and Sept. 9, 1985, p. 34.

3/ Chemical Week, October 1984.

4/ European Chemical News, May 27, 1985, p. 4.

5/ European Chemical News, May 13, 1985, p. 26.

plastic pipe and reinforced and other types of fabricated plastic products. Exports are small and go mainly to other Middle East countries. 1/

1/ U.S. Department of State, March 1985.