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RENEWING COMPARATIVE ADVANTAGE: MALAYSIA'S EXPERIENCE WITH RUBBER AND OIL PALM

by

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I

THE TERMS OF TRADE PROBLEM

Primary commodity production is an important activity in all countries, but in the developing nations it is especially significant because of the vital role that the commodities play in exports. The export structure of developing nations is usually insufficiently diversified and often comprised of products in which world trade is not expanding at a rapid rate. Prosperous during the early years of the century, tropical trade has since entered a long depression in which the products that developing nations customarily sell are no longer the ones for which the world has an urgent need. This has been especially true for agricultural commodities and other primary products which are the traditional exports of developing areas. Tropical trade has simply not grown as fast as world trade in agricultural products in general.

The consequences of a continual specialization in agricultural products are quite plain. Since the level of a nation's exports determines the level of its imports, adverse shifts in terms of trade constrain the extent to which the two can be exchanged. New nations require growth rates which expand just as fast if not faster than industrial growth in developed nations; rapid growth requires accelerated imports and therefore, accelerated exports; but an export structure dominated by agricultural products with sluggish export prospects constrains the capacity to import. Trends in world production and exports from 1948 to 1962 are illustrated in Figure A. Clearly there has been a slower rate of growth for the volume of trade in primary products than for manufactured goods.

Development had expanded rapidly in tropical areas during the last quarter of the 19th century in response to the industrial growth in Western Europe and North America. Tropical trade more than tripled in volume between 1883 and 1918; primary producing countries such as those in South Asia prospered from this trend. Then followed a long period which was characterized by the tendency of supplies of primary products to outrun demand. During the 1920's countries which were mainly exporters of primary products began to experience a deterioration in the terms of trade in relation to countries which were manufacturers. Moreover, exporters of primary products could not maintain resilience to depression. During the 1930's there was a catastrophic fall

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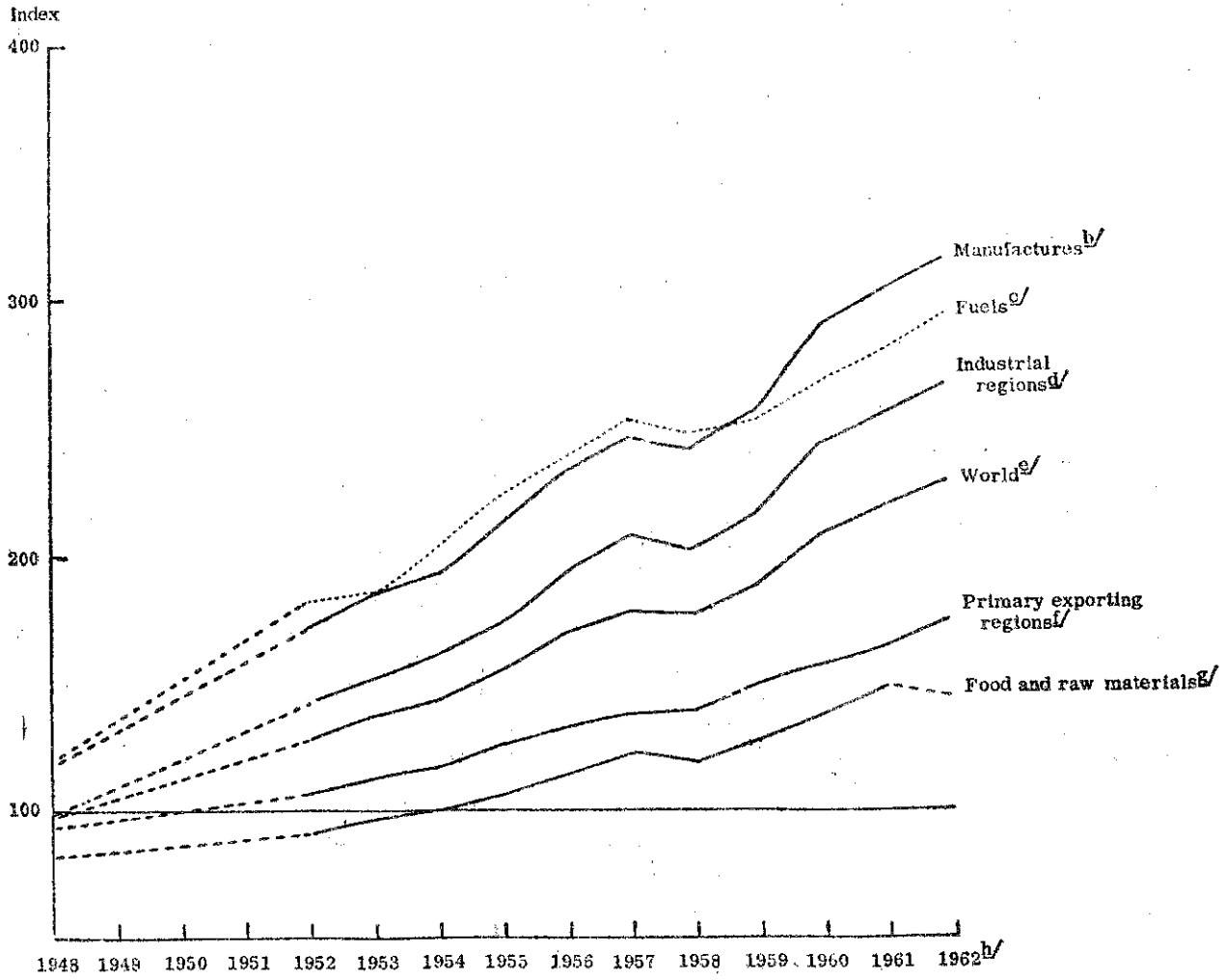
FIGURE A.

Trends in the Quantum of Exports, by Major Region and Major Commodity Group, 1948-1962[a]

(Indices, 1938 = 100)



Source: Bureau of General Economic Research and Policies of the United Nations Secretariat, based on United Nations, *Statistical Yearbook, Monthly Bulletin of Statistics* and *Commodity Survey, 1962.*

[a] Between 1938 and 1951 exports are valued at 1948 prices; between 1951 and 1958, at 1953 prices, and between 1958 and 1962, at 1958 prices; the series are spliced at 1951 and 1958.

[b] SITC sections 5 to 9.

[c] SITC section 3.

[d] North America, western Europe and Japan.

[e] Excluding the centrally planned regions.

[f] Latin America, Africa, western Asia (excluding Turkey), southern and south-eastern Asia and Oceania.

[g] SITC sections 0, 1, 2 and 4.

[h] Preliminary, based on partial returns.

Source: United Nations, World Economic Survey, N.Y., 1962, p. 11.

in primary product prices; the swings against the barter terms of trade were intensified with world depression. This era saw the beginnings of commodity control schemes. World War II cut off sources of supply and created deficiencies at one end and surpluses at the other. With these experiences with commodities from South Asia in particular, industrial nations scrambled to stockpile raw materials with the onset of the Korean War. Following this, those commodities which had realized the highest prices fell heavily. A new phase entered of downward price movements, exaggerated by the recession in 1957, and continuing in its decline until the 1970's (141, 85).

The reasons for this failure in tropical trade educe little argument. Tropical agricultural exports are confronted by income inelasticities of demand in the importing markets. Also, the export prospects of many agricultural raw materials have been affected by new technological developments. Synthetic substitutes have displaced many primary commodities. Vast overproduction plagued many tropical exporters. While nations have undertaken diversification programs and attempted to adjust their exports to the changing needs of world demand, the structural bottlenecks are often such that it has required considerable time to undergo transformation.

The exporting nations of South and Southeast Asia are particularly vulnerable to terms-of-trade problems, for exports have represented a sizable share of each of their gross domestic products. The percentage of gross domestic product to exports has ranged from under twenty to over fifty percent, and in all these countries, export earnings are derived from a limited number of primary products. Especially vulnerable are certain smaller nations which have historically attached great importance to exports. Their exports, Kuznets found, "in relation to total activity, are likely to be greater ... than in equally undeveloped but larger countries" (82, p. 17).

Malaysia is a classic case in point. Rubber and tin were originally high in demand by the industrial nations. Expansion of these two export industries under colonial rule founded an economy with an extremely high export orientation relative to its geographic size and stimulated the growth of the economy as a whole (155). The relative significance of this trade to Malaysia may be seen in the following table, which is an annual average of values of exports and imports, and their relation to per capita income, 1957-59 (125a, p. 585):

	Total Value		Value per head		% of Nat'l. Income	
	(Million Indian Rs.)		(Rupees)			
Country	Exports	Imports	Exports	Imports	Exports	Imports
Pakistan	1,515	1,888	17	22	7	8
India	6,203	9,445	15	23	5	8
Indonesia	4,120	2,818	47	32	20	14
Burma	1,025	1,419	46	52	23	25
Philippines	2,306	2,681	90	105	11	12
Thailand	1,638	1,919	69	80	18	21
Ceylon	1,715	1,842	176	189	33	36
Malaya (Fed.)	6,106	6,545	757	811	53	43

From the above it can be concluded that Malaysia has the highest amount of foreign trade relative to national income. Moreover, it enjoys the highest per capita income. The poorest countries, i.e., India and Pakistan, had the lowest amount of foreign trade in relation to national income.

This export specialization served Malaysia well until the advent of synthetics affected the demand for its natural rubber. Then it became evident that Malaysia's most important export offered little competition to low priced synthetics. Even though the nation has undergone a diversification program in recent years, so large has rubber figured in the economy that this structural impediment could not be immediately overcome. In 1950, the primary sector accounted for 55 percent of national product; and rubber alone accounted for 28 percent. Therefore, Malaysia had to retain this once profitable industry and improve its market prospects in addition to undertaking an import substituting industrialization program. Specialization in rubber production continued and an ambitious modernization program was undertaken to make the product more competitive with synthetics.

Where diversification out of rubber has taken place, the oil palm has been the most appealing alternative. In recent years, palm oil has been high in demand in Europe and the United States where this vegetable oil competes favorably with domestic vegetable oils. Malaysia, has thus managed to use export specialization as an "engine of growth" originally with rubber, and now with the oil palm as a prominent contender.

A decade ago, most authorities writing on trade would probably have agreed that the case of Malaysian exports typified the problems confronting the developing nations. Today, this may not be. Changing prices for some primary commodities, especially petroleum, have begun to alter the pattern of demand in industrial nations for other primary commodities. The synthetic rubber industry has certainly been affected since oil is a major input; this in turn has altered the market for natural rubber. And too, agricultural products have undergone changes in their prospects as well. While the demand for primary food products confronts income inelasticities, their individual markets are far more complicated; this is particularly true for fats and oils.

It is worthwhile examining how well a nation which has continued to specialize in expanding agricultural products has fared in the light of recent world trade conditions. While trade in primary product exports did serve as an "engine of growth" for Malaysia in an earlier era, the fact that this strategy continues to the present day is sufficient grounds for examining the country's success or failure in agricultural exports. We will begin with a discussion of the problem which confronted Malaysia at the onset of its independence; here, the outlook for its exports was particularly bleak. We will examine in Chapter 2 the efforts which Malaysia undertook to counteract the decline in its rubber production; due to the circumstances of its large size, the rubber industry could not be rapidly diversified into other activities. Chapter 3 examines Malaysia's success in modernizing the industry, and Chapter 4 discusses the efforts to reduce production costs. Chapter 5 discusses the current demand for rubber and the implications for the future demand for natural rubber in the light of high prices for petroleum. Chapter 6 discusses Malaysia's diversification into oil palm, and Chapter 7 examines

the extent to which industrial nations have increased their demand for vegetable oils, and how palm oil figures into this. Finally, Chapter 8 explores the relevance of the Malaysian case and what may lie ahead for other developing nations wishing to upgrade their export sector.

II

EXPORT SPECIALIZATION IN MALAYSIA

Commodity Concentration

Historically, Malaysia has adhered to the theory of comparative advantage. The foundation of the nation's economy has been constructed on the exports of rubber and tin. In combination their export value has represented over 80 percent of export proceeds. While tin has its special history, we shall be primarily concerned with rubber and its role in the agricultural sector. There are other primary industries but rubber has played the dominant role in agriculture and it is in agriculture that the majority of the population finds a livelihood. The importance of rubber has set Malaysia apart from its neighbors, for rubber has claimed over 60 percent of the total cropped acreage and contributes to over 40 percent of gross export earnings. This accounts for the extreme openness of the nation's economy; the market relationships with the rest of the world have been more important than those within the nation itself. The agricultural sector has been more adjusted towards supplying food and raw materials to the metropolitan nations than it has been engaged in inter-sectoral relationships with the non-agricultural sector. Until recently, rice, a basic foodstuff for the population, had been imported; self sufficiency in food production was not considered important.

The origins of Malaysia's rubber industry date from the 1890's when estates began to intercrop rubber with coffee or coconuts. World demand for natural rubber for tires increased with the advent of the automobile. By 1900 every coffee estate had been interplanted with rubber. Soils and topography played little part in fostering or hindering its expansion; rubber grew in a wide variety of soils and the tropical conditions of Malaysia made the crop ideally suitable. The development of the plantation industry relied upon immigrant labor from China and south India, merchant houses in Singapore and London provided ample share capital. By 1910 the basic shape of a plantation industry was firmly in place. All previous export crops were phased out and rubber became the sole basis for an export oriented agriculture and mainstay of the Malayan economy. The turn of the century also saw the introduction of another tree crop, the oil palm, which at first was used only as a decorative planting (2, pp. 106-148).

The colonial government identified the development of the rubber industry as the central agricultural issue. Complementing the plantation industries were the gradual participation of smallholders. "Growing rubber and processing it for overseas shipment was a comparatively simple process well within the capacity of the smallholder" (173, p. 25). Between 1920 and 1930 smallholder production increased at a rapid pace and provided a classic example of the development of peasant agriculture for export by emulation of plantation enterprise. Smallholders were given growing recognition as an integral part of the industry's overall complex. At the beginning of World War II, three-fifths of Malaya's total cultivated area was under rubber production, and smallholder production represented 40 percent of the total production. Except for interruptions by World War II, acreage changed very little between

1940 and 1957, and was as follows, in thousand acres (103):

	1940	1949	1957
Rice: Planted Acres	820	908	897
Rubber:			
Estate acreage	2,082	1,970	2,020
Smallholder acreage	1,329	1,394	1,500
Oil Palm: Acreage	78	88	116
Coconut:			
Estate Acreage	114	94	
Smallholder Acreage	486	404	

Export Instability

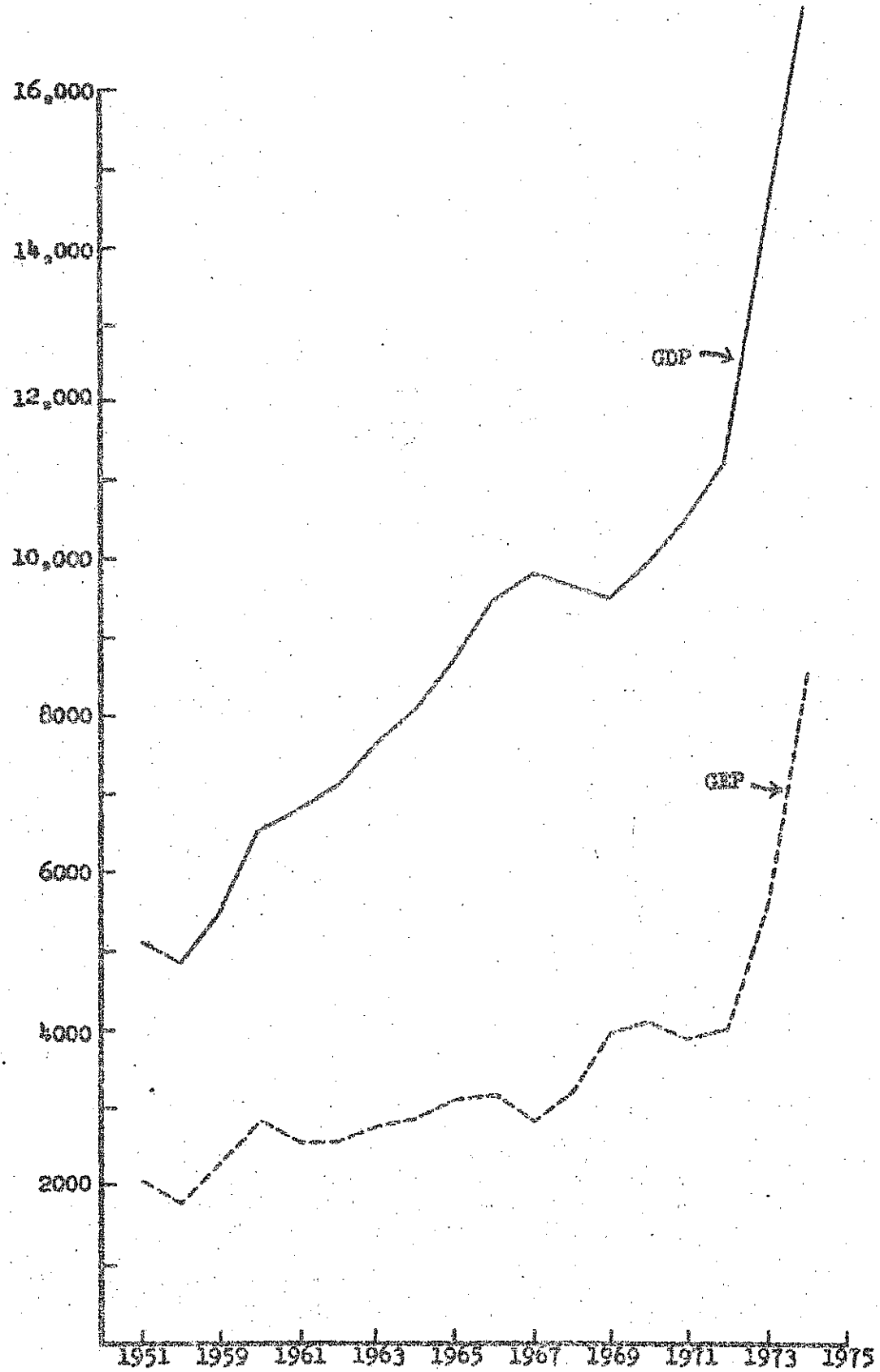
Associated with such a high degree of commodity concentration, Malaysia also has had a high degree of export instability. The percentage ratio of gross export proceeds and gross national product of fourteen representative countries is as follows (87, p. 48):

Country	GEP/GDP Ratio (%)	Country	GEP/GDP (%)
W. Malaysia	40	Pakistan	6
Philippines	27	Korea (South)	5
Ceylon	26	India	4
Nationalist China	19	New Zealand	33
Burma	17	United Kingdom	14
Thailand	16	Australia	14
Japan	10	United States	4

Of the ten Southeast Asian countries listed above West Malaysia stands out as having the highest degree of export orientation. Export trade is of greater importance to Malaysia than any of the other thirteen countries. The population of Thailand is four times that of West Malaysia, but its export trade is only half as important. The population of Pakistan is thirteen times that of West Malaysia, but in exports, West Malaysia's ratio is over six times as large. The extent of this ultra-trade bias emphasizes the degree of its dependence on foreign markets and foreign economic forces. The greater the foreign marginal propensities to import, the greater are the economic transmissions back to Malaysia. Thus with a high GEP/GDP ratio and with positive marginal propensities to import such products as rubber and tin, the nation is open to the economic changes in the countries which are her major importers. Figure 1 illustrates that Gross Export Product and Gross Domestic Product fluctuate together. For the period 1948-58, the United States GEP/GDP ratio fluctuated only between 2.9 percent and 4.4 percent, but for Malaysia, it fluctuated between 45 percent and 60 percent (87, pp. 46-64).

Sharp changes in the revenues from the Gross Export Product can bring about corresponding violent changes in the demand for home and imported

FIGURE 1. RELATION OF GEP TO GDP, MALAYSIA, 1951-75



Source: United Nations, Yearbook of National Account Statistics New York. various issues.

goods. If GEP is increased, then all sectors are affected.

Export instability varies from commodity to commodity. Both rubber and tin are extremely volatile and this compounds the complications of an open economy dependent on the business cycle of its importers. The following table indicates that of the five major commodities which Malaysia exports, iron ore is the most unstable and palm oil displays the least fluctuations. Natural rubber is the second most unstable commodity for the period 1947-67, and represents the largest percentage share of total exports. Listed as follows is the percentage share in total exports of the nations major commodities along with the coefficient of instability and its rank (5, p. 5):

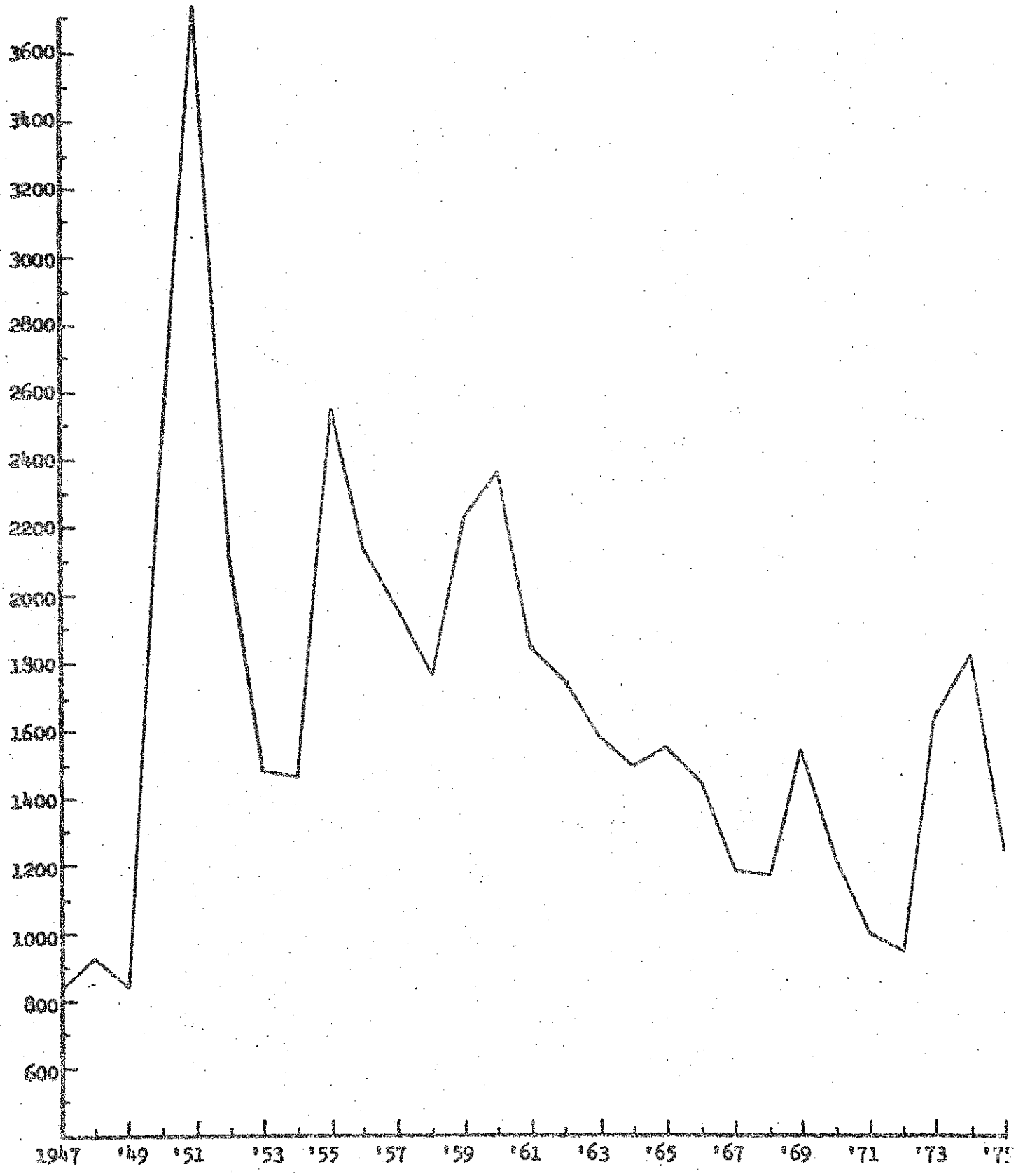
Commodity	% of Total Exports	1947-67	Rank
Natural Rubber	45.6	42.1	3
Tin	25.9	28.6	6
Iron Ore	5.2	73.5	2
Palm Oil	3.3	17.7	8
Timber	3.2	28.8	7
Pineapple	1.3		5
Cocomut Oil	0.6	38.0	4
Palm Kernel	0.3	38.6	1
Copra	0.2	143.2	
All Exports	100.0	29.1	

The cause of instability in commodities has been attributed to low elasticities of demand and supply. MacBean states that "low price elasticities combined with uncontrolled variability in demand, supply, or both provide an entirely credible explanation for sharp instability in both prices and proceeds of primary products" (97, p. 25). The price elasticities of demand for both rubber and tin are low and for some importing countries, they approach zero. For the United States they are -.0356 and .5156 for rubber and tin respectively. For the United Kingdom, they are lower, or -.0051 and -.3716. For the world, they are .0167 and .1998 for rubber and tin. These low elasticities are due to the fact that their contribution to the costs of the final product is very low (88, pp. 34-35). Inelasticities of supply complete the other side of the picture. Wharton has estimated that the supply response for rubber is extremely price inelastic. He found estate rubber to be almost perfectly inelastic. The lengthy gestation period makes the long run supply extremely inelastic, ranging from .03 to .12. The supply response of smallholders is also inelastic, although their short run adjustments are less rigid than estates (149, p. 147). The price elasticities of supply for tin are also low and have been estimated to range from -.04 to -.17, or lower than for rubber (150, p. 147).

When inelastic supply and inelastic demand are combined, a higher degree of price instability is inevitable. Specialization in primary products together with their greater proportion of total exports for developing countries, only contributes to an even greater internal instability; absence of diversification exposes the economy to extreme price fluctuations.

FIGURE 2. RSSI MALAYSIAN NATURAL RUBBER PRICES, 1947-75

(per metric ton in Singapore dollars)



Source: International Rubber Study Group, Rubber Statistical Bulletin, various issues.

The pattern of price fluctuations for rubber is shown in Figure 2. During the boom years, revenues from rubber exports have done the country well. This phenomenon enabled the economy to expand through a series of high price swings which occurred in 1950-51, 1955-56, and 1957-58. The Korean War completely changed the financial position of the Government of Malaya. The sudden increase in the demand for natural rubber caused gross export revenues to increase over 187 percent over the preceding period. The M$ 214 million export duty collected in 1951 represented an eightfold increase over the amount collected in 1949. As a result primarily of a higher level of trade and secondarily of the increased tax rates on rubber exports, government revenues rose faster than expenditures so that sizable budget surpluses were achieved over the two year period. The administration had learned that a sliding scale levy on exports of primary products seemed to offer promise as a means of cushioning the domestic economy against the full impact of an export boom, and of building up reserves to sustain development activity during periods when foreign exchange receipts were depressed (119, pp. 27-28).

Similar but milder "pushes" to the economy occurred in 1955-56, and 1957-58. The average 1955-56 GDP was higher than that of 1952-54, by 13 percent. Corresponding GEP increased by 30 percent. Prosperity in Western Europe and North America was reflected in the important rise in the prices of rubber, petroleum and metals. The terms of trade were such that only those countries which produced the aforementioned commodities benefited from the 1955 boom. Malaya was again in a favored position, but the terms of trade for many of the other developing nations continued to deteriorate.

The third bug push, 1959-60, occurred through the increased demand for raw material exports. Once more, the bouyant export sector was due entirely to rubber and tin prices.

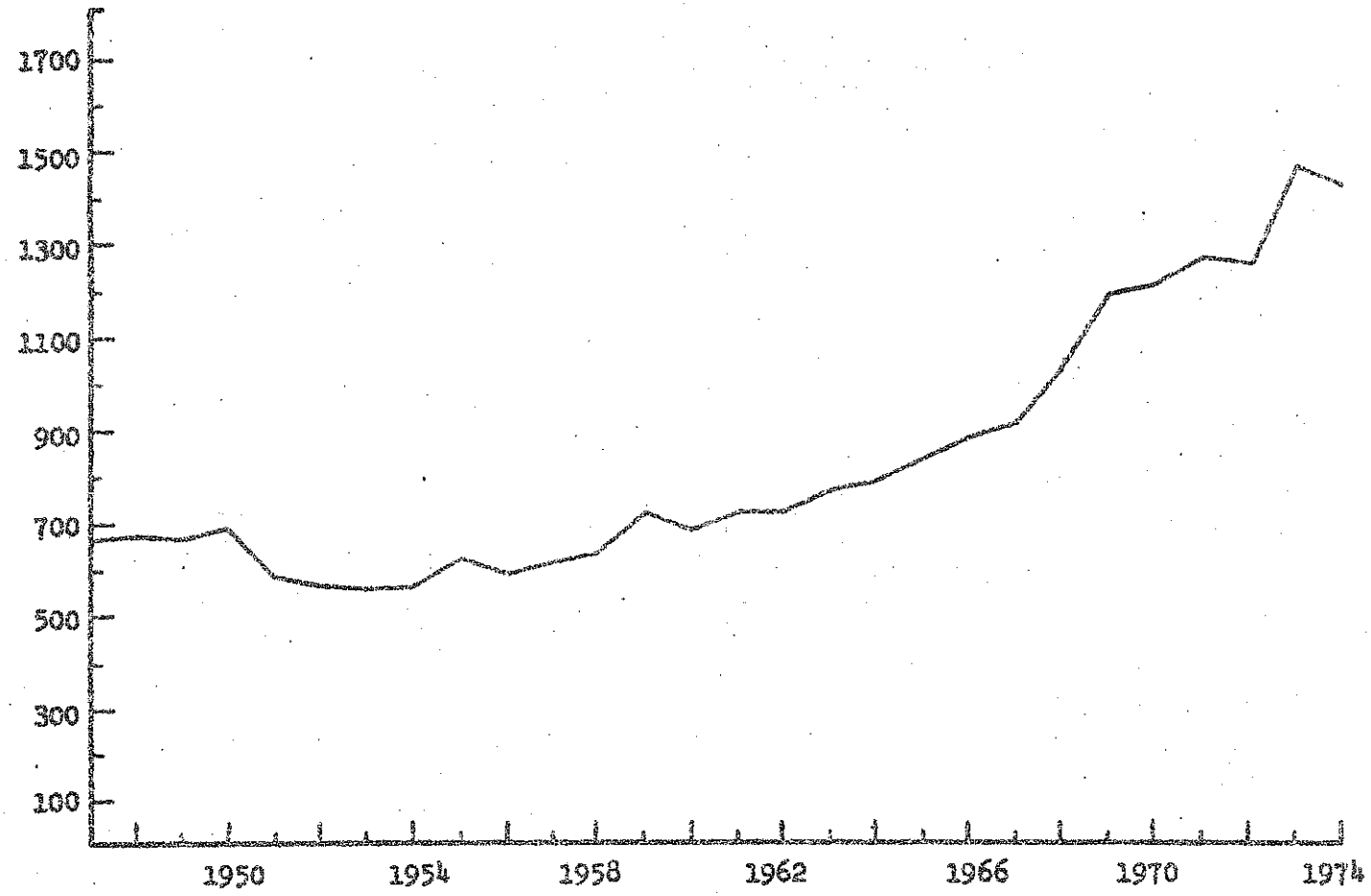
The price fluctuations in Figure 2 do not reveal the slow decline in the quantity of rubber demanded. During each of these periods changes in export proceeds of rubber were due more to changes in the price factor rather than the quantity factor. Figure 3 indicates that net exports of natural rubber did not fluctuate as much as price for the acute boom year of 1951; there was no visible sign of any change in total quantity exported. It is not until 1960 that net exports begin to increase and that is due to the results of the rubber replanting schemes.

Synthetics

The most striking feature in the rubber world in the post war years has been the competition and domination by synthetics. With the source of supply cut off by the Japanese during World War II, the United States and Western Europe turned to synthetic rubber production. To assure self-sufficiency in rubber, efforts to reproduce synthetic substitutes hastened the arrival of a whole new rubber technology. Research and development and initially high start up costs were supported by special Congressional legislation, the Rubber Act of 1948. Subsequent technical improvements lowered the production costs and began to close the competitive gap. Synthetic rubber of that period can be divided into co-polymerized styrene and butadiene or SBR, a general

FIGURE 3. MALAYSIA: NET EXPORTS OF NATURAL RUBBER, 1947-75

(thousand tons)



Source: Malaysia, Monthly Statistical Bulletin, various issues.

purpose synthetic thought to be a chemical duplicate for natural. There were two other types suitable for specific end uses, Butyle and Neoprene. Scientific technology gradually improved the quality of synthetic rubber. The discovery of cold polymerization process improved abrasion and aging resistance; the oil extension technique lowered production costs; and the discovery of micro-particle carbon blacks aided heat dissipation. Finally, the discovery of the stereo-regular polymers enabled synthetic rubber to make even more significant inroads over natural; and this new synthetic opened up new markets based on technical capabilities previously unavailable to either types (115).

By the late 1950's, "it became an accepted rule of thumb that natural rubber on the one hand and the various synthetics on the other split 60 percent of the market on the basis of technical considerations. The remaining 40 percent was cost competitive" (117, p. 45). The pattern of industrial consumption of natural and synthetics for natural has occurred at a spectacular rate; but technology alone has not been a deciding factor.

Figure 5 illustrates the question of price. Malaysian RSS 1 is very unstable in comparison with any of the synthetics. SBR has remained consistently lower in price than RSS 1, and even though neoprene and butane are higher in price, the irratic price movements of natural make synthetics desirable even during the periods where the latter is higher in price. The distinct disadvantage of price uncertainty for natural has encouraged a switch to synthetics even if the price has been higher.

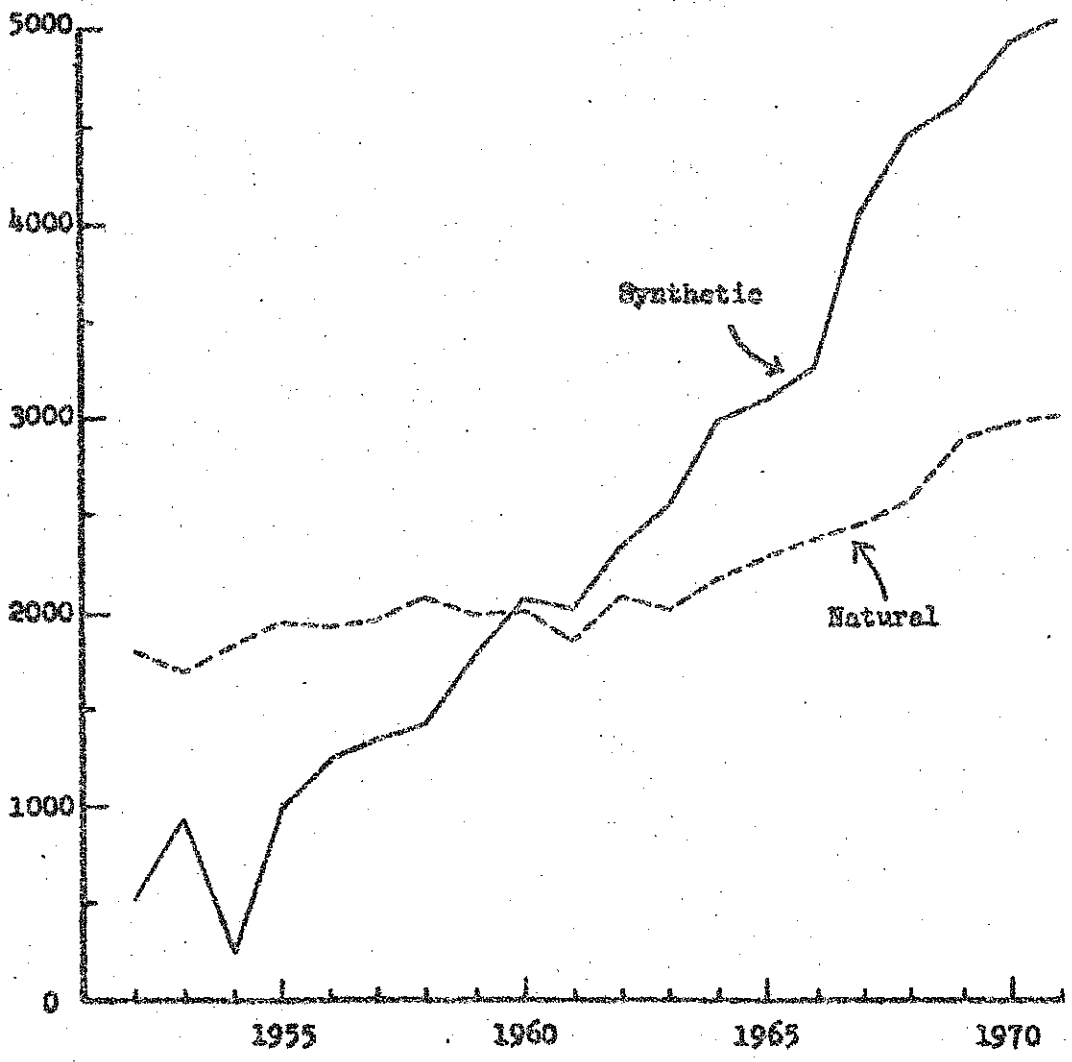
In addition to price, other disadvantages such as poor bailage, physical impurities, and high labor costs encouraged manufacturers to switch to synthetics. The labor input comprises a large proportion of natural rubber production costs. Any reduction could only be achieved through increased yields thereby lowering unit costs. However labor costs cannot be reduced below a certain level; natural rubber production requires the individual trees to be hand tapped and latex collected over a hundred times a year. Limitations in labor cost reduction are therefore severely constrained.

In the synthetic rubber industry, the highest cost element is not labor but rather the costs of petroleum and petroleum chemical intermediaries. Following World War II, the supply of fossil fuels increased faster than demand. Discovery of North African oil in addition to supplies from the Middle East, and European natural gas, provided a viable economic base for the development of a large European petro-chemical industry. Raw material supply conditions were highly favorable to the rapid development and expansion of a synthetic rubber complex.

Within the total picture, synthetics have come to play the dominant role. There has been an absolute drop in natural rubber absorption in the United States. Before World War II, the natural rubber producers in Southeast Asia were largely dependent on American demand which accounted for half the world total demand. Since World War II, United States consumption of natural rubber has dropped steadily to a point where it accounts for one fifth of world demand. Similar trend patterns took place in the industrial nations of Europe.

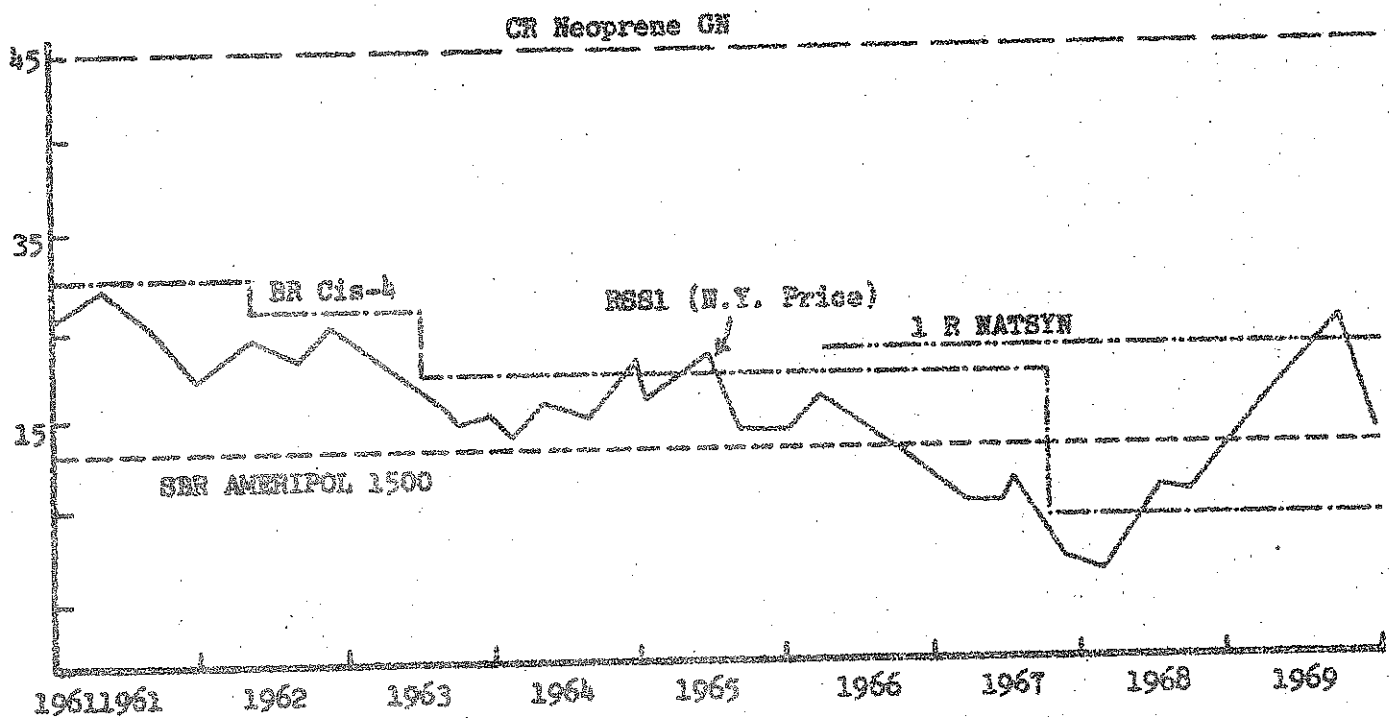
FIGURE 4. WORLD RUBBER PRODUCTION, SYNTHETIC AND NATURAL, 1952-71

(thousand tons)



Source: U.K., Commonwealth Secretariat, Plantation Crops, Series 1952-73.

FIGURE 5. N.Y. PRICES OF RSS1 AND U.S. FACTORY PRICES OF IMPORTANT SYNTHETIC RUBBERS, 1961-69



Source: C. Barlow, "Prospects for Natural Rubber," Economic Record, Vol. 46, No. 116 (1970), p. 493.

Outdated Domestic Policies

Lingering and outdated policies maintained by the Malayan Government contributed to the inability of natural rubber to compete effectively with synthetics. During the 1920's and 1930's the rubber industry encountered a series of setbacks due to over production and aggravated by the world wide economic depression. Following the rubber boom preceding World War I, when prices registered a record high of $5.50 per pound, planters experienced a steady price decline which reached a low of 33 cents per pound between 1921-22. The Stevenson Scheme was a commodity control effort designed to restrict production in Ceylon and Malaya. Since both countries accounted for over 70 percent of the world's total rubber exports, the objective of the Scheme was to raise prices above the slump level by curtailing production. The Scheme remained in force from 1922-28 and the effect was to raise average prices back to around 50 cent per pound. The other major rubber producer, the Netherlands East Indies was not a party to the Scheme and because of this they were able to take advantage of the rise of rubber prices by expanding their output and increasing their share in the world market from 25 percent to 40 percent. The windfall was not for long; the market for rubber completely collapsed in 1930. Another commodity control effort, the International Rubber Regulation Committee was initiated, this time with the Netherlands East Indies as participants. Export quotas were assigned to each country for each year. The Malayan Government did much to discourage the alienation of new land for rubber. By the 1950's the total area under rubber had not increased to any extent since 1940 (131, pp. 199-206). As Malaya approached its independence, many agreed with Bauer that the dated rubber restriction policies were a "notable example of the self-perpetuation of measures when the circumstances which gave rise to them have long passed" (150, p. 301).

While the rubber industry had served as a useful accelerator for growth in an earlier period, it was no longer economically viable for the Malaysian economy to be dependent upon it. Sharp price fluctuations impeded the development process and contributed to export instability. The advent of synthetics displaced the demand for natural rubber. Finally, the commodity control efforts and restrictions on alienation of new land for smallholder production were inappropriate tactics at a time when natural rubber's prices could not compete with lower priced synthetics.

III

THE STRATEGY OF AGRICULTURAL DEVELOPMENT IN POSTWAR MALAYSIA

Malaysia is something of an exception to the other colonized states in Asia. Its present structure has been the result of expanding Western industrial economies of the last century. Attached to this has been a strong interrelationship between economic development and immigration. Both operated very much together. Immigrants were first attracted to the rapidly expanding export industries. Until the turn of the century, tin mining was largely the reserve of small scale Chinese firms. Efforts at planting were limited until the strong demand for rubber surpassed tin as the mainstay of the economy. The expansion of rubber was accompanied by another influx of immigrant labour--Tamils from south India. The "new Malaya" was used to distinguish the densely populated and economically advanced strip specialized in export production; in contrast, the "old Malay" was overwhelmingly Malay and engaged in subsistance agriculture. While the rural Malays provided for their own needs, Chinese and Indian consumption was satisfied by imports. "Thus Malaysia was not bogged down by an overpopulated outworn food-producing agriculture; indeed Malaya in all probability has not had a majority of its working force engaged in food production since about 1850." (49, p. 208). One of the recurrent themes in Malayia's economic growth is the way in which the various ethnic categories have acted upon each other to shape the direction of development. The interaction of race has been much more pronounced and has had considerable influence on the economy.

The rubber economy of Malaysia is distinguished by a division between estates and smallholders. In no other country in the tropics does an estate industry figure so large in the economy. The restrictions imposed on estates in Sri Lanka and Indonesia are not found in Malaysia; but the estate sector is by no means homogeneous. There is no clear uniformity in terms of statistical definition. Usually, "any holding planted with rubber exceeding 100 acres and managed as a single unit has been regarded as an estate in Malaya" (49, p. 227). European interests have strongly dominated the estate sector but over the years their proportion has declined; nevertheless the European share of acreage production has remained at 70 percent. In 1953, about 23 percent of the total acreage under rubber was owned by Chinese and 7 percent by Indians. The area, production, and yield per tapped acre in 1954 are given below (106):

	European Estates	Asian Estates	Smallholders
Planted Area	1,411,468	659,239	1,500,000
Immature Area	373,400	47,732	
Production	344,851		240,230
Yield per tapped acre	510	410	

Smallholders have occupied a position almost as important as estates. Few other countries have had such a large proportion of smallholdings engaged in the production of an export crop. Smallholder cash crop production is

in effect virtually synonymous with smallholder rubber. In 1954, about 42 percent of the total rubber acreage in Malaya was on smallholdings which produced 44% of the total output of rubber. By definition a rubber smallholding can vary from one to 99 acres. Generally smallholders fall into two distinct categories. There are medium-sized holdings averaging 44 acres and peasant holdings averaging three and a half acres. Medium holdings or those from 25-99 acres resemble estates in that they are tapped by contract labor, while peasant holdings operate as a family firm. Trees on medium holdings are planted in an orderly manner as on estates, while peasant holdings or those with less than 25 acres are planted in a haphazard fashion. "Of the total smallholding acreage of 1,697,800 acres in 1953, 81 percent came under the peasant holding category" (131, p. 144). Peasant holdings were usually owned by Malays and averaged not much more than 3 acres. The Chinese controlled almost 66 percent of the rubber holdings in the medium-sized category with an average size of 42 acres; Malay average size was only 28 acres.

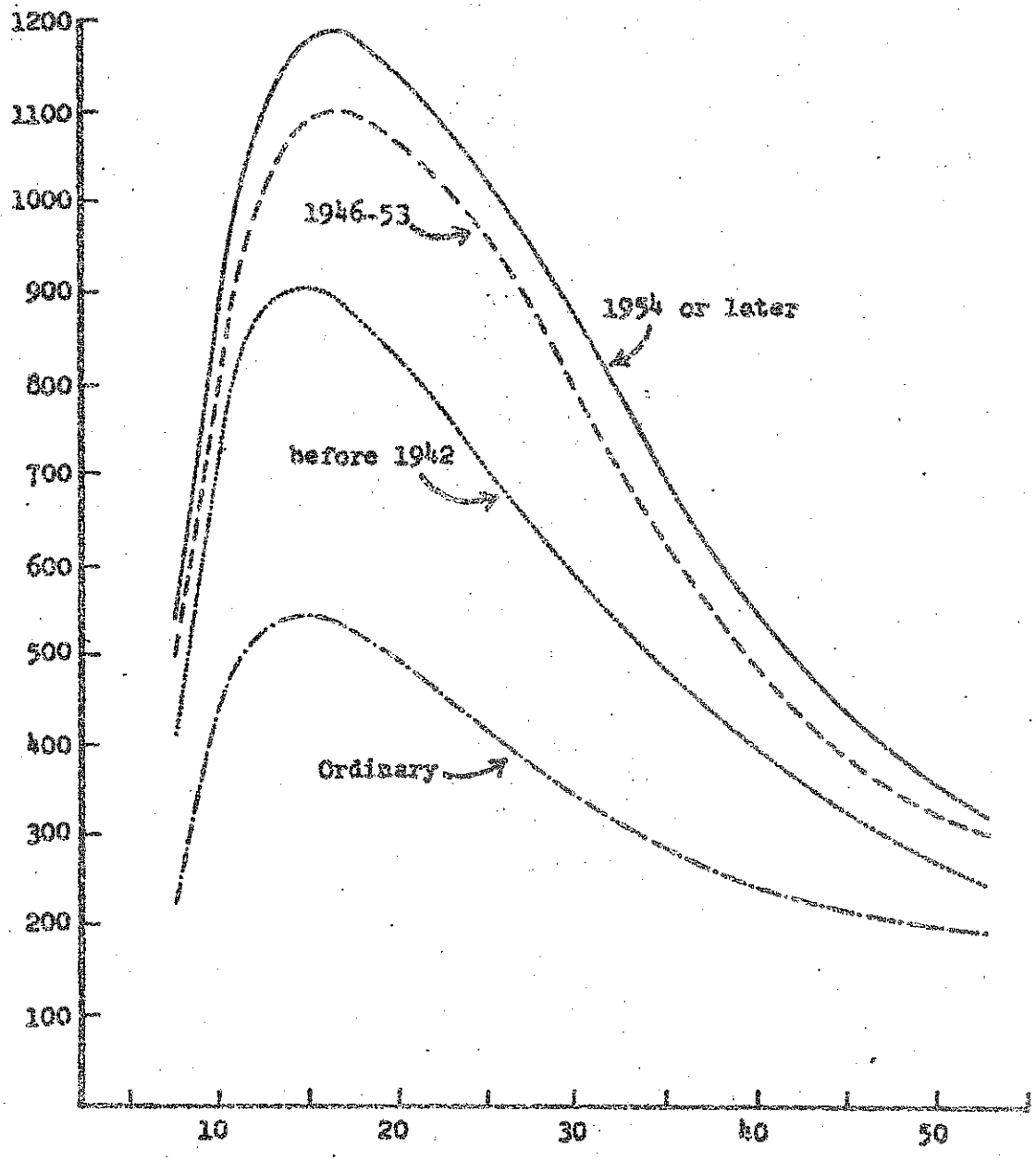
The Advice of International Missions

With rubber occupying the central position in agriculture, the solution to the problem of a declining export market was not to abandon this industry, but to make an effort to have natural rubber conform to the price of synthetic rubber and to investigate other export crops which might contribute to a stabilization of price fluctuations. To counteract the advances of synthetics, Malaysia undertook one of the most ambitious new planting and replanting schemes in tropical agriculture. This effort came about as the result of two international study missions which were highly critical of the existing situation in Malaya's rubber industry. The IBRD Report of 1955 stated that the ability of Malaya to maintain a satisfactory competitive position against synthetic rubber was "a question of over-riding importance for Malaya's economic future. In our view natural rubber can compete provided the industry, with the cooperation of the government makes a determined effort to strengthen the competitive position of Malayan rubber by replanting it with trees yielding more at lower unit costs. We consider this to be the country's highest and most urgent development priority" (66, p. 30). The Mudie Mission also issued a report in 1954 which focused exclusively on rubber production. Recognizing that the case for replanting depended on existing yields and future yields of the various age groups, the Mission warned that Malay's decline in its share of total supply of natural rubber was due to the fact that the trees were "older and less productive in comparison with those of other tropical countries as a group." The economic life of a rubber tree is on the order of 30 years. The Mudie Mission estimated that in 1953, 48 percent of all trees on rubber estates were over 35 years old and no less than 35 percent were over 33 years old. Only 36 percent of the planted acreage consisted of high yielding trees. The consequences of this age distribution were serious. As yields declined, unit costs increased, and natural rubber was slowly pricing itself out of the market (124, pp. 9, 68).

Low yields were a problem of both smallholders and estates. This is captured in Figure 6. Yields from ordinary seedlings were extremely low, while yields from improved material varied according to the year in which they were planted. While the data on smallholder yields is difficult to obtain, yields in 1952 were quite low: of the total smallholder area, the

FIGURE 6. ESTIMATE OF YEILDS OF ESTATE RUBBER AS DEPENDENT ON TYPE OF PLANTING MATERIAL AND AGE OF TREES

(pounds per acre)



Source: Malaysia, Mudie Commission Report, 1954.

average yield was a little over 300 pounds per acre. The reason for the low yields was due to the fact that nearly all smallholder acreage was planted with old unproductive trees. It is probable that as much as two thirds of the total smallholding acreage was planted with trees which were over 30 years old (124, pp. 254-257).

In the early 1950's, the oil palm, a tree crop congenial to the soils and climate of Malaya, was grown in small numbers on estates. The oil palm is unique among the major vegetable oil crops in that the oil extraction takes place at the actual site of fruit production. The processing operation is more complex than that of rubber and there are economies of scale such that production of palm oil products tends to be a more concentrated industry. At the time, almost all palm oil produced was used in the manufacture of soap and soap products. The IBRD Mission regarded it as "one of the promising means of diversification of agriculture." The mission recommended that a pilot scheme for smallholder production be undertaken (66, pp. 259-60).

Because of the long history of plantation agriculture in the nation, oil palm was suitable to this type of management even though the acreage under production was small. In 1954, there were about 100,000 acres of oil palm in production on estates. Internal complications in Indonesia, Nigeria, and Zaire retarded the expansion in those countries and served to benefit Malaya. As technical progress made it a useful vegetable oil, as well as a soap product, it began to compete with other fats and oils. Moreover, the crop begins to yield after three years of planting in contrast to the five to seven year gestation period for rubber. Since the industry requires considerable capital overhead, its cultivation was at first suitable only to estates and not smallholders (168, p. 244).

Rural Development and Replanting Schemes

The revival of the rubber economy and the introduction of the oil palm coincided with a rural development program designed to remedy the neglect of the Malay smallholders. By the close of the colonial era there had been little effort to improve smallholder agriculture. The Malays dominated the rural sector, had a lower per capita income, and at the same time, had been the politically dominant ethnic group. The economic discrepency was striking: the Malay population accounted for 44 percent of the total population but received only 22 percent of the aggregate individual income, while the Chinese accounted for 45 percent of the population and received 57 percent of the total income. This maldistribution of wealth with its racial overtones resulted in strong pressure from the rural Malays to redress the neglect of the colonial era. Increasingly the Malays began to find their voice in the Legislative Council and they grew more vigorous in their demands for development of the rural areas.

"Malay's first General Election of 1955 marked the political watershed giving rise to fundamental changes in rubber strategy" (143, p. 85). The newly elected Alliance Government singled out rubber as the largest single item in Malaya's First Five Year Plan. Whereas the colonial government had given priority to the Emergency and the resettlement of Chinese squatters

in the New Villages, the elected government placed its emphasis on rural development. Extensive replanting of smallholdings to improve rubber productivity and raise peasant incomes was the goal of the newly formed Rubber Industry Smallholders Scheme. Growers with less than 30 acres were entitled under grant to replant a third of their existing acreage plus five additional acres.

Replanting old rubber with higher yielding clones has been the principle means that yield per acre has been increased. Efforts to achieve this evolved around the programs of the Rubber Industry Replanting Board from 1952-1972 and then were surpassed, in the case of the smallholder, by the Rubber Industry Smallholders Development Authority, which has been wider in scope of operation and endeavors to modernize all aspects of the smallholder sector. Financing was done through the so called Fund A and Fund B which levied a flat rate cess of 4.5 cents per pound on exported rubber. Proceeds collected from each cess were divided between estate and smallholder in proportion to their output. Fund A provided a rebate for estates on proof of replanting with higher quality material. Revenues from Fund B provided direct assistance to smallholders for new material and labor requirements necessary for replanting. (47, p. 200).

Initially the replanting scheme provided for M$400 per acre to smallholders, but this has since been increased to M$750, and the Government of Malaysia has contributed additional proceeds to Fund B. In 1973, the replanting grant was raised to M$900, of which M$750 was derived from the cess, and the balance contributed by the government. Implementation of the replanting program has been distinguished by five schemes. The total area for each replanting scheme, in thousand acres is given below (67, p. 730).

Replanting Scheme	Replanting to Rubber
Scheme 2 (1953-59)	270,000
Scheme 3 (1960-66)	478,676
Scheme 4 (1967-70)	23,756
Scheme 5 (1971-73)	129

After 1973, the Rubber Industry Smallholders' Development Authority (RISDA) superseded the Rubber Industry Replanting Board and Funds A and B. Progress was slow; by 1955, the total area replanted with rubber amounted to slightly over 28,000 acres. Moreover, the acreage distribution favored smallholders at the upper spectrum of the 25-100 acre smallholding, and did nothing for the smallholder with less than twenty five acres. The smallest growers were unable to forgo income earned from existing holdings. It was impractical for them to accept the temporary income loss involved in replanting.

By the end of the First Five Year Plan about three-fourth's of the original replanting target had been realized, but almost entirely on the so called "medium sized" holdings. Only 30 percent of the replantings had benefited Malays since the smallest "peasant holdings" encountered financial and administrative difficulties. "In as much as participation in the Scheme came mainly from medium holdings, the operations of Fund B served to regressively redistribute real resources away from the smaller to larger producers, thereby

worsening the relative position of peasant proprietors" (143, p. 83).

While the Rubber Replanting Scheme may have served the medium sized smallholder, the government embarked on an ambitious new planting program. In 1956, the Federal Land Development Authority was organized to administer new land settlement. FLDA was created for the purpose of opening new agricultural areas and providing land for the landless, but more broadly, it was a community development program aimed at the rural population in an effort to have them play a more decisive role in their own development. FLDA was the result of a realization that the failure of small farmers to replant was due as much to shortages of land as to inadequate financial resources. Under the FLDA, large tracts of suitable virgin jungle were to be prepared by contractors for subdivision into 10 acre family holdings of which eight were planted with high yielding rubber and the remaining two with food crops. FLDA granted a maintenance stipend until the rubber matured. Repayment was to take place only when the rubber had matured (143, pp. 88-89).

The introduction of FLDA was widely received on the part of the rural population, especially the landless Malays. Continuing peasant interest in rubber settlement schemes manifested over successive general elections, further induced increasingly larger provisions for FLDA in the post election Second Five Year Plan, 1961-65, and the First Malaysia Plan, 1966-70. "Expanded rural involvement in the Malaysian political process through elections brought about a substantial mobilization of social and economic resources for rubber smallholding based on land settlement. By 1967, some 67 FLDA Schemes had come into operation involving 121,000 acres of new high yielding rubber clones (143, p. 90)."

Each national development plan increased the amount of acreage prepared for settlement. From the 10,000 acres developed between 1956-60, over the next five years, 1961-65, FLDA opened up roughly 119,000 acres of land to accommodate 40,000 settlers, The increase during the First Malaysia Plan 1966-70 was even greater with 197,000 acres of land developed. Since its conception in 1956, FLDA has developed 304,500 acres on ninety settlement schemes (88, pp. 177-79).

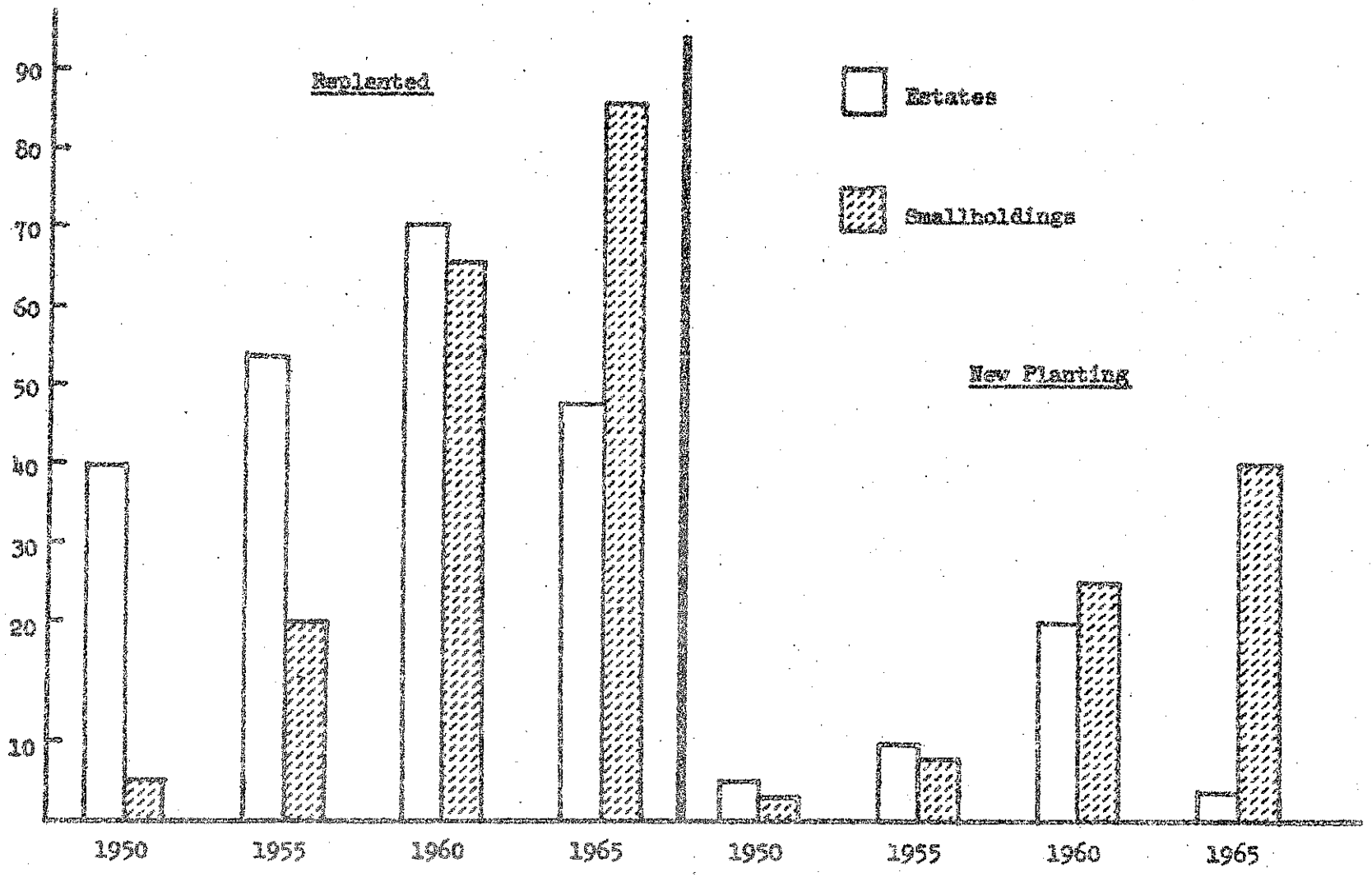
Figure 7 illustrates that the renewal of the rubber industry did much to increase productivity. Starting from the period of 1954-55, the graph illustrates a dramatic upsurge in replanting and new plantings. The effects of the various land development authorities on new smallholder acreage are especially noticeable from 1957 onward.

Research

Expanding the area under rubber production is an ineffectual strategy unless it is accompanied by a reduction in unit costs and thus in price. The Rubber Research Institute of Malaysia had always received the strongest support from the estate sector. Organized in 1926, the Institute's most noteworthy achievement has been in the introduction of high yielding clones. The first high yielding varieties were cultivated before World War II and their yield per tapped acre was around 650 pounds in comparison with 300 pounds

FIGURE 7. ACREAGE NEW PLANTED AND REPLANTED ON ESTATES AND SMALLHOLDINGS, 1947-65

(thousand acres)



Source: Malaysia, Rubber Statistics Handbook, various issues.

from unselected seedlings. After the war additional high yielding varieties were introduced which produced a yield of 1,100 pounds per acre. This last variety, selected after an extensive research program has been planted on a wide scale in Malaysia. Table 1 illustrates revenues, expenditures, and margins per acres and per pound. It is particularly important to note that margins have increased steadily with every increase in yield; expenditures as calculated by cents per pound have declined from a high of 44.8 to 31.2 cents per pound. The steadily increasing costs of tapping labour represent about 40 percent of operating costs and this input expenditure has been reduced by increasing yield per tapped acre. Estate policy has been to expand output on a declining area. Thus by 1968 estate planted acreage had declined by some 250,000 acres from 2 million acres in 1953; over this same period, estate output increased by over 40 percent.

The Change from Rubber to Oil Palm

Malaysia's national preoccupation with rubber production and the efforts at planting and replanting were based on the view that "if Malaysia could secure her foundation as a low cost producer of natural rubber her economic development would be assured" (7, p. 109). The belief that cost efficiency was the only basis on which natural rubber could compete with synthetics had been the viewpoint which prevailed due to the circumstances of size of Malaysia's rubber exports and because synthetic rubber technology would make no new advances other than those following World War II.

To be sure, price competition was vital but many now concluded that it was unrealistic to take such a simplistic view, especially when it involved competition in international markets between a primary product and a manufactured product from one of the science-based industries of the industrial economies. "The consequences of a rapid unrestricted application of modern scientific methods to the production of primary products is a very rapid increase of output and the accumulation of surplus stocks. This was the situation that faced Ghana in the late fifties, for instance, as a result of a national effort to raise the productivity and incomes of cocoa farmers" (7, p. 111). The "rubber mentality" which dominated Malaysia through a series of five year planning targets was abandoned when prices continued to be less than bouyant.

Fears that the Government pressed rubber expansion too far were initially expressed in the First Malaysia Plan 1966-70 (102, p. 112). Reflecting on the relative price trends in rubber and oil palm, policy makers were even considering uprooting the new rubber trees and replacing them with oil palm. This drastic measure was first undertaken by estates as a check against future price undertainty of rubber. Under the First Malaysia Plan, FLDA began to stress oil palm instead of rubber. Oil palm was judged to be an attractive economic alternative to rubber. The speed with which the Government and private sector switched from rubber to oil palm was extremely rapid. From 1956 to 1966, the FLDA delegated 80 percent of its acreage to rubber production; the other 20 percent was planted with oil palm. During the period of the First Malaysia Plan, the proportions were almost exactly reversed. The new emphasis on oil palm between 1963 and 1971 was as follows in thousand acres (104):

Table 1

Estimated Revenues, Expenditures and Margins
On Low and High-Yielding Estates, 1968

	Low-Yielding (251-300)		Pre-War High-Yielding (501-750)		(751-1,000)		Post-War High-Yielding (1,001 +)	
	$/acre	ct./lb.	$/acre	ct./lb.	$/acre	ct./lb.	$/acre	ct./lb
Revenues	161.9	42.6	246.6	43.5	386.7	43.3	539.2	44.2
Expenditures	170.3	44.8	226.2	39.9	311.7	34.0	380.6	31.2
Margin	-8.4	-2.2	20.4	3.6	75.0	8.4	158.6	13.0

SOURCE: Rubber Research Institute of Malaya, unpublished 'Survey on Data Estates' (Kuala Lumpur, 1968).

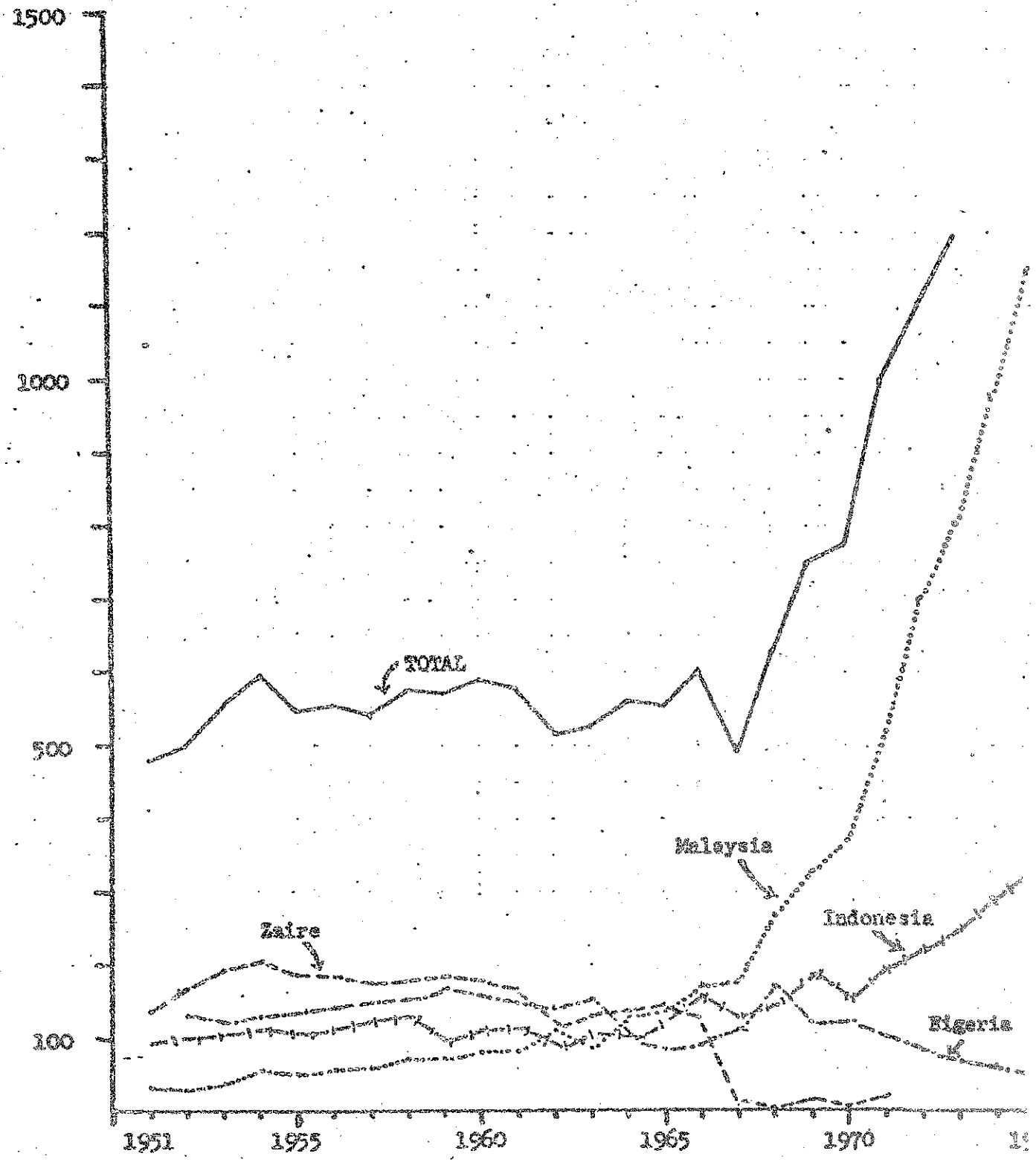
	Mature		Immature	
	Estates	FLDA	Estates	FLDA
1963	121	--	54	9
1964	129	.9	57	16
1965	144	2	63	24
1966	158	4	97	36
1967	175	9	144	50
1968	208	19	172	71
1969	248	35	190	91
1970	303	39	174	121
1971	359	57	169	131

In 1963, estates and smallholders produced a total of 123,000 tons; in 1971 this had increased to 542,145 tons. The growth rate for the period 1960 to 1970 was approximately 24 percent. This rapid increase in reflected in Malaysia's rising share in total world exports of palm oil. As shown by figure 8, during the period from 1966 to 1970 onward Malaysia had become the world's leading producer.

The bulk of palm oil production originates from estates as indicated by the table above. The capital intensive nature of the industry has tended to limit its suitability for smallholder cultivation but its demonstrated profitability and still questionable future of rubber has hastened the government to create a setting for smallholder production through the various FLDA schemes. In 1965, FLDA Schemes accounted for 2 percent of the mature acreage and about 27 percent of the immature acreage; in 1969 the respective figures were 12 percent and 30 percent.

FIGURE 8 EXPORTS OF PALM OIL, 1951-75

(thousand tons)



Source: U.K., Commonwealth Secretariat, Vegetable Oils and Oilseeds, various issues.

IV

REDUCING THE COST OF NATURAL RUBBER

Structural changes in the Malaysian rubber industry have taken place since independence and these will affect the supply and quality of the country's natural rubber. First, estate acreage has decreased over time but this has been offset by an increase in production due to higher yields per acre. Second, the decrease in estate acreage has been more than offset by an increase in smallholder acreage as a result of FLDA and various state settlement schemes. Third, new and improved methods of packaging and the processing of natural rubber according to technical specifications will have to be transferred from estates to smallholders if natural rubber is to continue to be competitive. Fourth, there will probably be government intervention to stabilize rubber prices through buffer stocks and floor prices; this will affect the quantity of rubber exported when market conditions are unfavorable.

Decline in Estate Acreage

The decline in estate acreage is evident from Figure 9. In 1960, 1.9 million estate acres produced 413,000 tons of rubber, in 1974, on a reduced 1.4 million acres, 673,000 tons were produced. Reduction in acreage has been attributed to fragmentation of estates, conversion of rubber land to oil palm, and a reduced rate of replanting. Over the past two decades, estates have been subdivided by foreign owners and sold to smallholders. Between 1957 and 1960, about 300 rubber estates involving 230,000 acres were sold to small businessmen who leased the land to tenant farmers. Under these circumstances security of tenure was uncertain and the quality of management poor (88, p. 196). Conversion of rubber land into oil palm has occurred at an increasing rate. While it is difficult to determine from the data whether it is existing rubber land or new acreage, cultivated area under oil palm has expanded from 135,000 acres in 1960 to 1.1 million acres in 1973. Because the industry is capital intensive, it is easily adaptable to estate production. The new plantings on the west coast are largely on land converted from rubber or coconut.

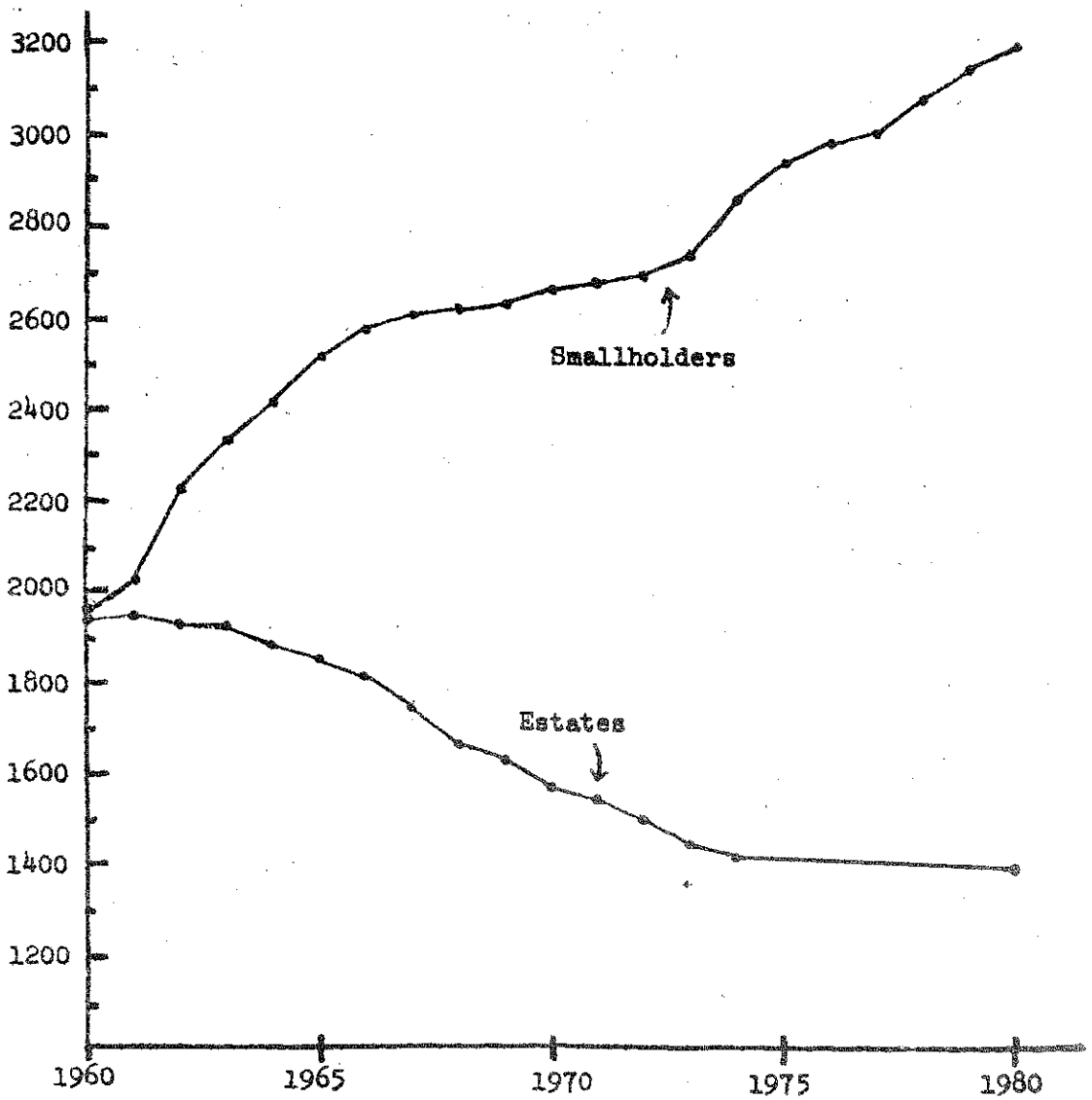
Replanting on estates has slowed down as nearly all the trees from unselected seedlings have been replaced. The yields per acre with new varieties, and replanted acreage in thousand acres, has been as follows (103):

Year	Total Acreage	Replanted Acreage	Yield/ac.
1957	367,900	199,306	667
1965	490,944	417,400	818
1974	673,341	667,541	1180

New varieties account for close to 100 percent of total planted acreage on estates, indicating a completion of the government replanting schemes. However, a second round of replantings will be necessary in the late 1970's

FIGURE 9. MALAYSIAN NATURAL RUBBER: PLANTED ACREAGE

(thousand acres)



Sources: Government of Malaysia, Monthly Statistical Bulletin; and P. O. Thomas, Planter's Bulletin No. 110, 1976.-

when the existing plantings will be due for replacement again. Available projections to 1980 indicate a slowed rate of replanting at 10,000 acres per year which implies that estates will contribute about 800,000 tons to total production by 1980 (157, p. 194).

Improvement in Yields

Reducation in production costs can be expected to decline as further developments in high yielding clones continue through the efforts of the Rubber Research Institute. Over the years, the rubber tree has been subjected to exhaustive scientific inquiry. The average yield per tapped acre on estates has risen from 450 pounds in 1951 to 1940 in 1967 to 1180 in 1972. Genetically improved trees have been the major factor contributing to increased yields. Improved methods of husbandry have been effective too but their influence is minimal in comparison.

The increased average yields do not illustrate peak yields on some estates where present record yields could be widely adopted in the future. In 1969, some estates reported yields of 1400-1500 pounds per tapped acre on existing trees. Experimentation has produced trees with yields exceeding 1800 pounds per tapped acre in the sixth year of tapping. Higher levels of production are expected to increase as acreage capable of yields from 2000-2500 pounds per tapped acre are ready to be tapped. Experimental clones now produce 3000 pounds per tapped acre over a shorter gestation period (142b, pp. 84-93). Higher yield characteristics have been in association with higher quality latex and wind resistance. To enable the industry to make the most efficient use of planting materials available at any one given time, a technique of tree surgery has been introduced to create a three part tree. This technique permits a choice of trunk and canopy to provide a high level of yield and to solve problems of leaf diseases and wind damages.

Another significant means of increasing yield is the application of stimulants to prolong the flow of latex. This would require lower frequencies of tapping than under normal conditions. Use of stimulants enables the lower yielding older clones to be as productive as the higher yielding modern clones. Of equal importance is the flexibility that Etherel stimulation provides to the industry. "For the first time, a certain measure of elasticity in production can be effected. This is particularly so among the larger production units. Less frequent tappings and shorter cuts in combination with Etheral stimulation will enable the industry to increase productivity of labor without necessarily increasing production" (115, p. 175). Etherel increases yields up to 30 percent with no damage to trees (142d, pp. 366-386).

Improving Quality

Competitive market conditions require uniform qualities of grading which are free from impurities. The packaging, grading, and processing of rubber has been improved. In 1965 the government introduced a scheme to promote Special Malaysian Rubber (SMR). Grading on the basis of impurities, ash, nitrogen, copper, and manganese content has been undertaken to improve market

presentation. Rubber sheet, crepe, or crumb is compressed into bales of 70-100 pounds and wrapped in polythene to avoid contamination under shipment. Production of this standardized brand was at first limited to estates but has since become more widespread. Production of SMR has increased from a few tons in 1965 to 250,000 tons in 1970. During the export boom beginning in 1968, SMR enjoyed an increased share of total rubber exports (142a, pp. 249-263). Although production of new presentation rubber has made remarkable growth, it still has not equalled that of conventional latex concentrate, leaving more than 70 percent of Malaysian rubber production to be marketed as conventional grades. But strict standards applied to the new process rubber have contributed to consumer confidence in the product. New process rubber sold under the SMR scheme has attained an undisputed preference over other block rubber marketed by other countries.

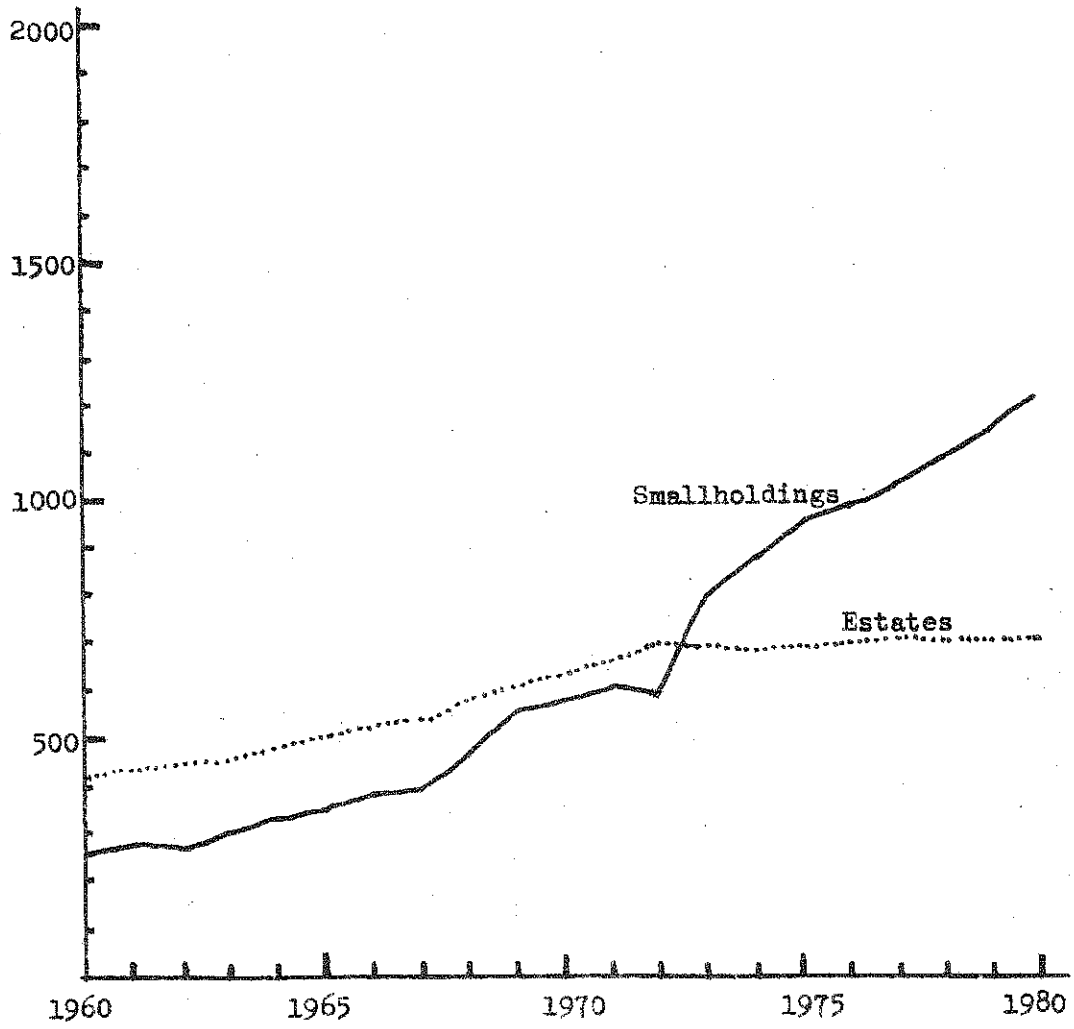
Heveacrumb, a relatively new processing technique, is a rubber crumb process to produce higher grade rubber at less expense. Here, the latex is subject to chemical cleaning, crumbling, and drying, and then the final product is baled. This enables all previous impurities such as cup lump or scrap to be included thereby offering greater economies (142c, pp. 306-312).

These technical advances have at first been to the advantage of estates and out of the reach of smallholders who may not be able to afford such sophisticated methods. And yet, as the number of estates declines and the number of smallholder schemes continue to increase, it is vital to Malaysia as an exporter of natural rubber that all new technologies be made available to the smallholders. While lack of available statistics make future smallholder production difficult to predict, the important role of the smallholder in total production is evident from Figure 10. Smallholder acreage has risen and will continue to do so to 1980. In 1960, smallholders represented 40 percent of total output; in 1974 this share increased to 54 percent and by 1980, it is anticipated that smallholders share will climb to 60 percent. Total acreage under smallholder production will be 3.1 million acres in contrast to 1.4 million on estates. The trend therefore is for rubber to be increasingly a smallholder crop. If the product is to remain competitive, it is essential that many of the new yields and processing techniques available to estates be made available to smallholders as well. For this reason, the Rubber Industries Smallholders Development Authority (RISDA) has embarked on a new replanting program. By 1974, about 1.2 million acres of smallholder rubber were replanted and 45,000 additional acres of land were opened for smallholders (110, p. 78). At the time of the first replanting program in 1952, two thirds of smallholder acreage was over 30 years old and the remainder was over 20 years old. Today virtually all original acreage has been replanted through a succession of schemes.

Draft reports for the Third Malaysia Plan (1975-1980) indicate that there are to be no additional increases in land development targets other than those set in the Second Plan; new agricultural resources are to concentrate on improvement of previously developed areas. While it is envisioned that major expansion of rubber is to be through the smallholder sector, the rate of expansion is subject to speculation. For the Third Malaysia Plan, a more vigorous replanting program by RISDA is envisaged. Production of rubber from FELDA schemes is to increase at a slower pace than in the previous five year

FIGURE 10. SMALLHOLDER AND ESTATE PRODUCTION TO 1980

(thousand tons)



Source: P. O. Thomas, "Malaysian Natural Rubber in the Seventies; A Forecast of Production Trends," Planters Bulletin No. 110, p. 104, Rubber Research Institute of Malaysia, 1970.

plans (67, p. 3).

For new SMR to appear in high volume, substantial emphasis will have to be placed on the smallholder sector. Smallholders produce more ordinary natural rubber than do estates. Accordingly, the Malaysian Rubber Development Corporation has been purchasing field coagulum and unsmoked rubber sheets from smallholders and FELDA for processing into SMR. The Malaysian Rubber Development Corporation has 14 units which will begin to process smallholder latex into SMR.

The data indicate that the modernization of the rubber industry has increased Malaysia's share of total world exports of natural rubber. Table 2 indicates that Malaysia's share has increased from 41.7 percent in 1964 to 48.9 percent in 1974. Indonesia, Sri Lanka, and Africa as a whole, have all experienced a decline in their shares of total exports. Only Thailand has increased its percentage share, and this has been modest.

Commodity Stabilization

In recent years efforts to stabilize rubber exports have led to a series of conferences which have discussed the possibility of price stabilization through buffer stocks. The principle advocate of new commodity controls has been Malaysia. Throughout the sixties the Malaysian Government intervened to prevent further decline in prices. As a balance to maintain producer incomes and absorb a drop in demand, the government intervenes when the Kuala Lumpur price drops below an established floor level. During a period of floor price support, the government purchases from dealers and brokers, stores the various grades in godowns, and then disposes of them during peak periods. At a national level the financial expenditure has been exhorbitant and requires public expenditure during periods when export revenues are low. Efforts toward multinational coordination have taken expression through the Association of Natural Rubber Processing Countries (ANRPC) comprised of Malaysia, Indonesia, Singapore, Thailand, Sri Lanka, and Vietnam. Malaysia has recently proposed a coordinated system of buffer stock of 350,000 tons or 10 percent of annual world output of natural rubber, of which 80 percent is produced by the ANRPC countries. The intent is to stabilize the price of natural rubber rather than raise it through a cartel action in view of competition from synthetics (25, pp. 188-212). Cooperation with the other ANRPC producers has not been reached since there continues to be considerable disagreement over the size of the buffer stock. It is, however, possible that proposals through the 1976 UNCTAD Conference may be fruitful (35a, p. 5).

The period 1972-74 witnessed a major change in the production costs of natural and synthetic rubber. The costs of producing natural rubber increased far less than those for synthetics which experienced a three-fold increase in feedstock costs. This new price relationship is likely to hold for many years in the future. It is likely that natural rubber producers would benefit more from a decline in prices and increased output rather than a commodity arrangement which would permit output to increase more gradually.

Table 2

Net Exports of Natural Rubber

	World	Malaysia		Indonesia		Ceylon		Africa		Thailand	
1964	2,125,000	886,950	41.7	627,365	29.5	115,290	5.4	160,750	7.5	216,585	10.1
1965	2,197,500	919,200	41.8	708,465	32.3	123,624	5.6	154,250	7.9	211,405	9.6
1966	2,242,500	965,503	43.0	697,875	30.3	124,870	5.5	170,500	7.6	202,535	9.0
1967	2,325,000	990,293	42.5	651,557	28.0	135,600	5.8	159,000	6.8	211,119	9.0
1968	2,600,000	1,114,267	42.8	770,910	29.6	144,704	5.5	166,000	6.8	252,221	9.7
1969	2,882,500	1,291,982	44.8	857,426	29.7	141,559	4.9	178,000	6.1	276,381	9.5
1970	2,785,000	1,304,083	46.8	790,161	28.3	154,051	5.5	207,000	7.4	279,163	10.0
1971	2,835,000	1,356,059	47.8	784,311	27.6	137,818	4.8	191,250	6.7	307,323	10.8
1972	2,810,000	1,331,201	47.3	733,905	26.1	138,311	4.9	190,750	6.7	324,443	11.5
1973	3,180,000	1,590,681	50.0	841,548	26.4	131,067	4.1	205,250	6.4	368,204	11.5
1974	3,130,000	1,531,000	48.9	794,742	25.3	135,070	4.3	205,500	6.5	365,188	11.6

SOURCE: Rubber Statistical Bulletin 1/76, p. 5.

V

THE WORLD DEMAND FOR RUBBER

Variables Determining Demand

There have been few, if any, accurate estimates for the future demand for natural rubber. Attempts to understand demand have historically included three important shift factors: 1) the exogenous variables, such as war; 2) changes in income within the importing nations; 3) price competition and technical relationships between natural and synthetic rubber. The first factor does not lend itself to economic projection, however it has been demonstrated that the Korean War did bring about a shift in demand and large increases in U.S. stockpiles. Similarly a release of stockpile surpluses could affect the response of current demand for imports (149, p. 135).

The second factor, changes in income, does lend itself to trend analysis and efforts have been made to correlate rubber consumption with changes in income as measured by increases in GNP or in industrial production. Elasticity coefficients or ratios of the rates of growth of rubber consumption to the rates of growth of GNP during different time periods were studied by Nehmer (1959). The evidence reveals that with the advent of the automobile, a country with high growth rates for industrial production has an even higher growth rate for rubber consumption, but as a country continues its industrialization and diversifies its industry, demand for automobiles decreases and the growth of rubber consumption in relation to industrial output decreases and the coefficient of elasticity approaches unity. The accuracy in predicting GNP is often as difficult as determining the future demand for rubber and presents a limiting factor in the high correlations (126).

Recent Developments in Synthetics

The third factor, the relationship of synthetics to natural rubber is probably the most important shift variable over the longer run. Over a range of uses synthetic and natural rubber are both complements and substitutes. Many of the purposes for which synthetics are manufactured could not be fulfilled by the technical characteristics of natural. On the other hand, natural rubber has many qualities which modern technology has not yet been able to duplicate. For this reason, the production of modern automobile tires is composed of both natural and synthetics to certain specifications obtainable only in one. If the price of either natural or synthetics rises, there may not be a substitution of one for the other, but merely a rise in the price of the tire. With further technological advances, however, synthetic rubber is gradually meeting the specifications previously maintained by natural, and substitution does occur.

The literature on natural and synthetics tends to segregate into "zones" where a) no substitution is possible between synthetic and natural; b) where natural rubber has maintained a technical superiority and synthetics offer no competition; c) where there is competition between the two (117, p. 36). Prior to 1960, technical differentiation fell into three general categories

with regard to the progress which had been made in synthetics. These general types were: 1) co-polymerized styrene or SBR, a general purpose synthetic which is the near technical substitute for natural rubber; 2) co-polymer of isobutylene or Butyle; 3) polymer of chloroprene or neoprene.

Meeting such functional requirements as abrasion resistance, heat resistance, cold resistance, elasticity or any combination requires a discrete identification of the capabilities of natural and synthetics. Neoprene is resistant to heat, oil, and certain chemicals. For this reason automobile parts, hosing, and conveyor belts utilize this particular synthetic. Butyle retains air more effectively than natural and on this basis, it is widely used in tire inner tubes. Butadiene styrene co-polymer or SBR offers greater resistance to abrasion, and since the mid-fifties, is the most important subcategory in terms of competition with synthetics. Natural rubber has maintained a technical superiority in end uses which require high elastomitor qualities. "In such products as aeroplane and heavy duty truck tires ... it is desirable to have an elastomer capable of high energy reversability; that is when it is deformed it should not dissipate the energy input as heat, but should utilize the energy to return to its initial pre-deformed shape" (117, p. 37). It has been in this category that natural rubber has maintained a technically superior use over synthetics.

The specialty synthetics of Butyl and neoprene have captured a low volume technically segregated market, but SBR competes with natural in certain areas of technical substitution, and it is this specialty synthetic which has absorbed most of natural's prior market. Production costs of SBR were further reduced through the oil extension process; petroleum is incorporated as an additive to synthetic latex. "It was a readily accepted guideline during the mid-fifties that natural rubber on the one hand and the various synthetics on the other, divided 60 percent of the market on the basis of technical considerations. The remaining 40 percent was cost competitive (114, p. 38).

In 1961 a new category of synthetic, stereo regular appeared and within this technical family, polyisoprene, polybudadiene and ethylene-polylene began to be produced. Of the three members of stereo regulars, polyisoprene has physical properties which essentially duplicate natural rubber. Polybudadiene is the technical and price threat to natural rubber in the areas where natural previously had superior physical advantages. It offers abrasion resistance and heat dissipation properties but has poor tear strength; polybutadiene is now used in combination with SBR in heavy tire treads. Polyisoprene, the chemical duplicate of natural, is increasingly used in heavy duty tires, but again its tensile strength remains inferior to natural (114, pp. 24-47).

Production of natural rubber increased from 2.3 million tons in 1964 to 3.4 million tons in 1974. Production of synthetic rubber increased from 3.5 million tons in 1964 to 7.4 million tons in 1974. Production of all rubber increased from 5.8 million tons in 1964 to 10 million tons in 1974. This 58 percent increase is due largely to the advent of synthetics whose total market share was enlarged from 40 percent in 1964 to 74 percent in 1974, or nearly double in volume.

The distribution of natural and synthetic rubber consumption in 1974, was as follows in thousand metric tons (69, 1974):

Area	Natural	Synthetic	Percent Synthetic
North America	719	2,388	76
EEC	707	1,335	65
USSR	315	---	--
Japan	312	615	66
China	220	65	23
India	133	21	14
Australia	59	64	52
Others	512	450	45
		7,260	

This distribution of synthetic and natural is skewed such that the industrial nations consume the largest portion of synthetic to total share of rubber. India has the lowest percentage share of synthetics and reflects the tendency of many developing nations to use natural in the absence of a sufficient base in petrochemical industries to produce the inputs necessary for synthetics. North America and the EEC are the largest consuming areas of synthetic rubber, and this proportion has increased steadily over the years.

How Petroleum Affects Demand

World demand for all rubber is expected to increase to 15.8 to 16.4 million tons by 1980. Increases in demand will be larger in the industrial nations depending on the activity of their GDP. Developing nations are to display an even greater demand but their percentage growth will not be equalled in a volume sufficiently large enough to approach that of the industrialized areas (37, pp. 283-293).

To determine the share accruing to synthetic and natural it is necessary to examine probable future price trends for both. Since the automobile tire industry accounts for two thirds of rubber demand in the principle consuming countries, a closer analysis of this product is necessary. The raw material inputs are extremely dependent on oil or oil based products. In the U.S., a typical passenger tire weighs about 30 pounds. Manufacturing requires 7.5 pounds of carbon black, 5 gallons of crude oil raw materials, out of which 1.5 gallons is used in the carbon black. An additional 2 gallons of oil or an energy equivalent is used to fabricate the tire, amounting to a total of 7 gallons of raw materials input (31, p. 37). Tires alone have a 70 percent synthetic input in contrast to 60 percent for all industrial rubber. In addition zinc oxide, stearic acid, and steel cord are all raw material inputs with a petroleum base. The percentage composition and estimated weight in pounds of a typical U.S. passenger tire is as follows (35, p. 4):

	lbs.	Percent
SBR	7.8	26.0
Polybutadiene	2.6	8.7
Isoprenic rubber[a/]	1.9	6.3
Butyl/chlorobutyl	1.0	3.3
Carbon black	7.4	24.7
Extender oil	3.9	13.0
Fibers	4.0	13.0
Chemicals	1.4	4.7
	30.0	100.0

a/ Polyisoprene or natural rubber

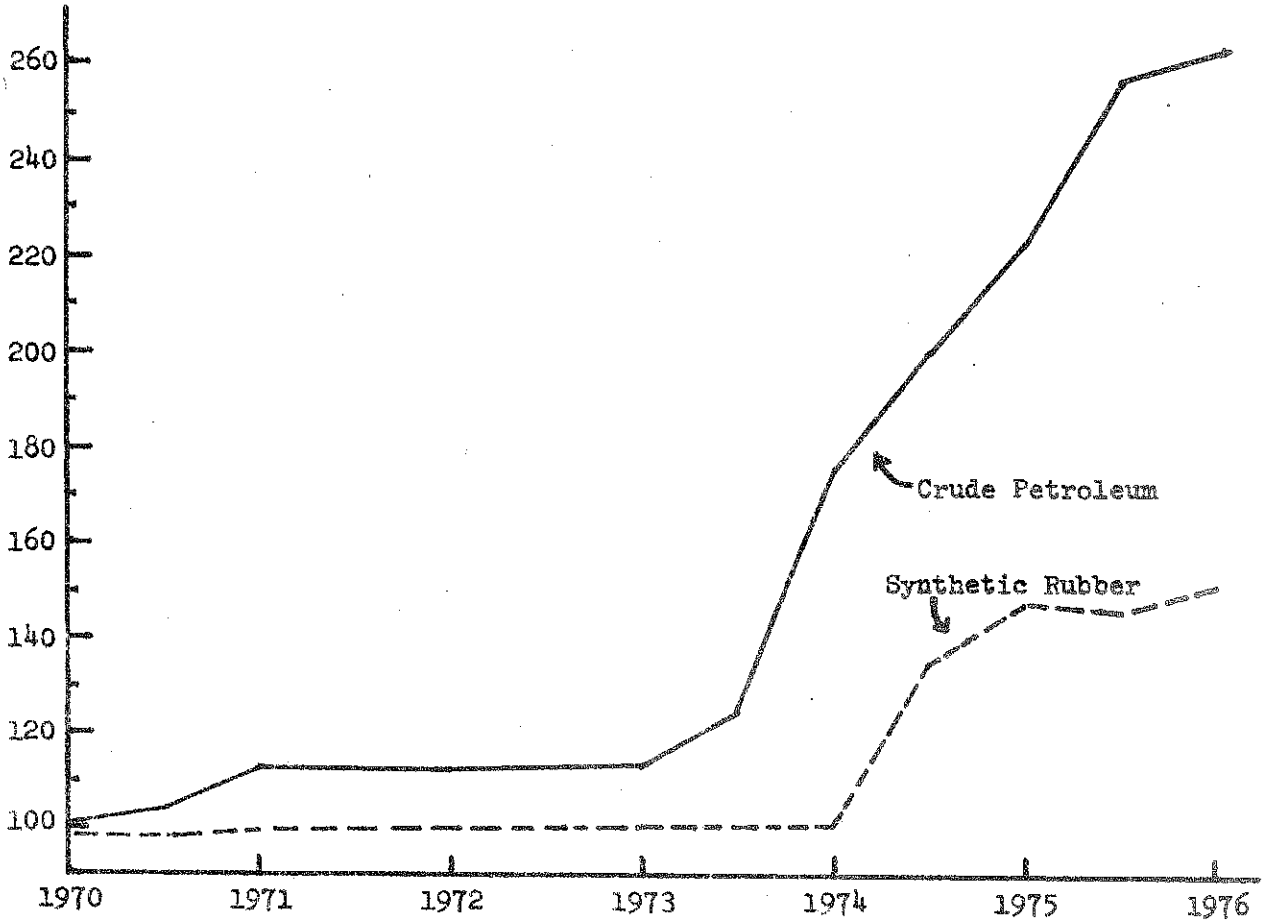
Truck tires are probably three to four times the weight and have a higher natural rubber content. The 5 gallons of petroleum input combined with the 2 gallons used in manufacturing amount to nearly one barrel of crude oil. Thus, the availability and price for raw materials used in tires is closely associated with crude petroleum. This is illustrated by Figure 11. The index of synthetic rubber prices to crude petroleum prices is closely related. The price of raw material inputs has been passed on to the rubber industry. With the increase in oil prices in 1973, many fixed price contracts for inputs related to the rubber industry were terminated and replaced by price negotiations and escalator clauses. "Feed stock and chemical suppliers to the rubber industry quickly reached, and have remained in a position where (subject to government controls) they could pass on any increased costs" (35, p. 9).

The impact of the oil crisis is affecting the production shares of natural and synthetic rubber. It is likely over the longer term that natural rubber will decrease in price to a level where it will be lower than the family of synthetic competitors, especially polyisoprene. Natural rubber will remain price competitive and it is likely that there will be substitution back to natural from synthetics. This has begun to occur as the percentage shares of synthetics in total consumption begins to decline. The percentage share of synthetic rubber to total rubber consumption for the major countries is as follows (69):

Year	U.S.	EEC	Australia	Japan	World Total
1964	75.09	51.72	49.43	44.03	59.14
1965	74.95	54.27	51.01	46.55	60.44
1966	73.33	56.14	50.91	50.68	61.92
1967	76.91	57.65	53.55	52.91	62.75
1968	76.52	58.65	54.88	57.71	63.66
1969	77.19	60.94	54.73	61.38	64.80
1970	77.42	62.58	57.25	63.67	65.37
1971	78.37	63.59	59.67	64.02	66.45
1972	78.15	64.94	55.53	65.33	67.12
1973	77.70	65.82	55.80	67.94	68.21
1974	76.36	65.36	52.05	66.34	67.44
1975	73.80	63.31	51.65	66.05	66.07

FIGURE 11. INDEX PRICE OF CRUDE PETROLEUM AND SYNTHETIC RUBBER, 1970-76

(1967 = 100)



Source: U.S. Department of Commerce, Wholesale Price Index, various issues.

The most striking feature is that synthetic rubber has ceased to gain ground. In 1973, natural rubber checked this trend, as the percentage share of synthetics in total consumption began to reverse itself. Starting first in the U.S., this trend spread to the EEC, Australia and Japan by 1974.

VI

DIVERSIFICATION: ENTER THE OIL PALM

Until recently, palm oil was a relatively insignificant crop in Malaysia. In 1960, rubber dominated Malaysia's cultivated acreage occupying 3.8 million acres; coconut was 500,000 acres; and rice, 700,000 acres. The oil palm occupied a mere 126,000 acres which left it no more distinguishable in size than tea or pineapple. Increased expansion due to the increasing world demand for fats and oils under relatively stable prices has served to hasten the expansion of oil palm (104).

Initially it had been the growth in demand for palm oil and palm kernel oil in the metropolitan regions which stimulated the expansion in Nigeria and the Belgian Congo, in Africa, and Malaya and Indonesia in Southeast Asia. For many years, the West African areas were prominent exporters. There, the palm kernel was a much more important crop and this was exported to European countries for processing into cake form to be used in soap production and margarine. Palm oil was grown in Indonesia and Malaya, and while categorized as a marine oil, it too was used in the manufacture of soap and margarine.

Until recent years Indonesia and Malaysia were relatively insignificant competitors; Nigeria dominated the market. During the 1930's, Malaya and Indonesian production grew rapidly. While World War II effectively stopped production, exports of the product were resumed in the 1950's. Political instability in Indonesia, Zaire, and Nigeria served to Malaysia's benefit. Moreover, importing nations began to switch from animal fat to vegetable fat in the composition of the diet. By the mid-sixties, Malaysia began to have the highest rate of growth of any supplier.

Under the First Malaysia Plan (1966-70), the area under oil palm increased from 264,000 acres in 1965 to 665,000 acres by 1970. Of the latter figure, about 160,000 acres came under the FLDA scheme or about one sixth of the new acreage. Expansion has been assisted by the Asian Development Bank and IBRD. These organizations have encouraged the expansion of smallholder schemes into oil palm and the rehabilitation of old rubber estates into this more appealing crop.

Increasing Area Under Oil Palm

There are certain geographic constraints on oil palm production which have tended to limit its location to the west coast of Malaysia where better transport facilities speed up the harvesting of the fruit. "Harvesting is carried out with the object of obtaining the maximum quantity palm oil of a quality, as judged by the free fatty acid content, acceptable to the purchaser" (60, p. 435). The timing is critical: under-ripe fruit is lower in oil content than ripe fruit; over-ripe fruit contains oil with a higher free fatty acid content. To maintain a quality oil with a less than 5 percent free fatty acid content, the harvested fruit must be processed within 24

hours. Oil with less than 5 percent free fatty acid content "commands a premium of 1 percent of the prevailing price for every 1 percent reduction of free fatty acid below 5 percent"(170, p. 440). Factors altering the quality of the oil are of economic importance and need to be considered when evaluating a harvesting system. Any delay in the harvesting causes a decline in the quality of the oil. Economies of scale necessitate expensive transport facilities whereby the fruit bunches are loaded into trucks or rail cars, and then to the factories. The density of roads and light railways on oil palm estates is thus very high, for every effort is made to keep the distance over which fruit has to be handled to a minimum (49, p. 242).

Extraction of the oil from the fruit bunches is carried out in four stages: sterilization, bunch stripping, oil extraction, and oil purification. Harvesting accounts for only 20 percent of the total cost; therefore, the labor expenditures are considerably less than rubber. Earlier in the century, oil palm estates used more rudimentary processing technologies and the average acreage which the technology could support was somewhat low. During the 1920's, the average estate size was about 2,000 acres, but in later years the production of higher quality oil necessitated estate acreage ranging from 10,000 to 20,000. Smaller estates can operate efficiently so long as the processing facilities can be shared by contiguous holdings. The size group of various nationalities maintaining acreage in 1971 is as follows in thousand acres (104):

Size Group	Malaysian	Singaporean	British	Total
1-99	2,960	364	239	3,779
100-499	20,826	1,686	5,160	28,032
500-999	23,552	2,850	18,995	46.997
1,000-1,999	25,462	2,126	47,219	74,807
2,000-2,999	19,257	12,785	50,888	85,132
3,000-4,999	22,836	19,238	71,888	113,962
5,000-	29,914	5,587	85,872	175,895
Total	141,807	44,636	280,261	528,604

The distribution of foreign holdings at the higher acreage brackets indicates the large estate bias. Malaysian holdings are evenly spread over various acreage sizes. The initial investment necessary for acreage of this size places it beyond the reach of the smallholder. Estimated costs of a new oil palm estate are on the order of about M$2,000 an acre. Estates of five thousand acres would require an investment of M$10,000 million with no return on capital for ten years. "The original cost of the factory and its depreciation is a particularly heavy item, nor must the equally important matter of amortizing the plantation itself at, say 4 percent per annum, be overlooked" (79, p. 5).

To enable smallholder participation in the crop, the Malaysian Government acting through the FLDA sought to design as public overhead many of the expensive internal economies of the estate industry. Their first oil palm scheme was begun in Johore in 1961 and by 1964, eight additional schemes

were added covering a total of 18,000 acres. The large Jengka Triangle scheme has remained the greatest effort thus far. About 150,000 acres were alienated for oil palm over several large contiguous plots which have attained substantial economies in capital overhead. The area under oil palm increased from 264,000 acres in 1965 to 665,000 acres in 1970; of this, about 25 percent was area established by the various FLDA schemes, along with the processing mills (49, p. 243).

The problems of integrating smallholders into high quality palm oil production are more complex than rubber. Since smallholders lack previous experience in cultivating this crop, a more intense administrative organization needs to be developed. To maintain its competitive market position, the quality controls cannot be compromised by lower standards which might possibly ensue with greater smallholder participation. Rigorous supervision of settlers is necessary in harvesting, transport, and processing. Moreover,

> "to be economically viable, each scheme will need to have central processing and inevitably central accounting and capital management; thus, by definition it would not be a collection of smallholdings but an estate. Nevertheless, it would be very different from either a European-owned one with overseas shareholders or a privately-owned Asian estate; it would perhaps be best described as an intermediate organization in which, while the settler was in one sense an estate labourer, he was a shareholder with a stake in the land and the factory" (79, p. 244).

In both the First and Second Five Year Plans, production of palm oil has exceeded all targets. The first Malaysia Plan continued replacement of rubber with oil palm on estates and public land development schemes. Production increased from 183,394 thousand tons in 1966 to 394,952 thousand tons in 1970. Under the Second Malaysia Plan (1971-75) production was projected to increase to 1 million tons by 1975 but actually attained a level of 1.3 million tons (110, p. 78). Oil Palm acreage has expanded to about 1 million acres, most of it in Johor, Pehang, and Selangor.

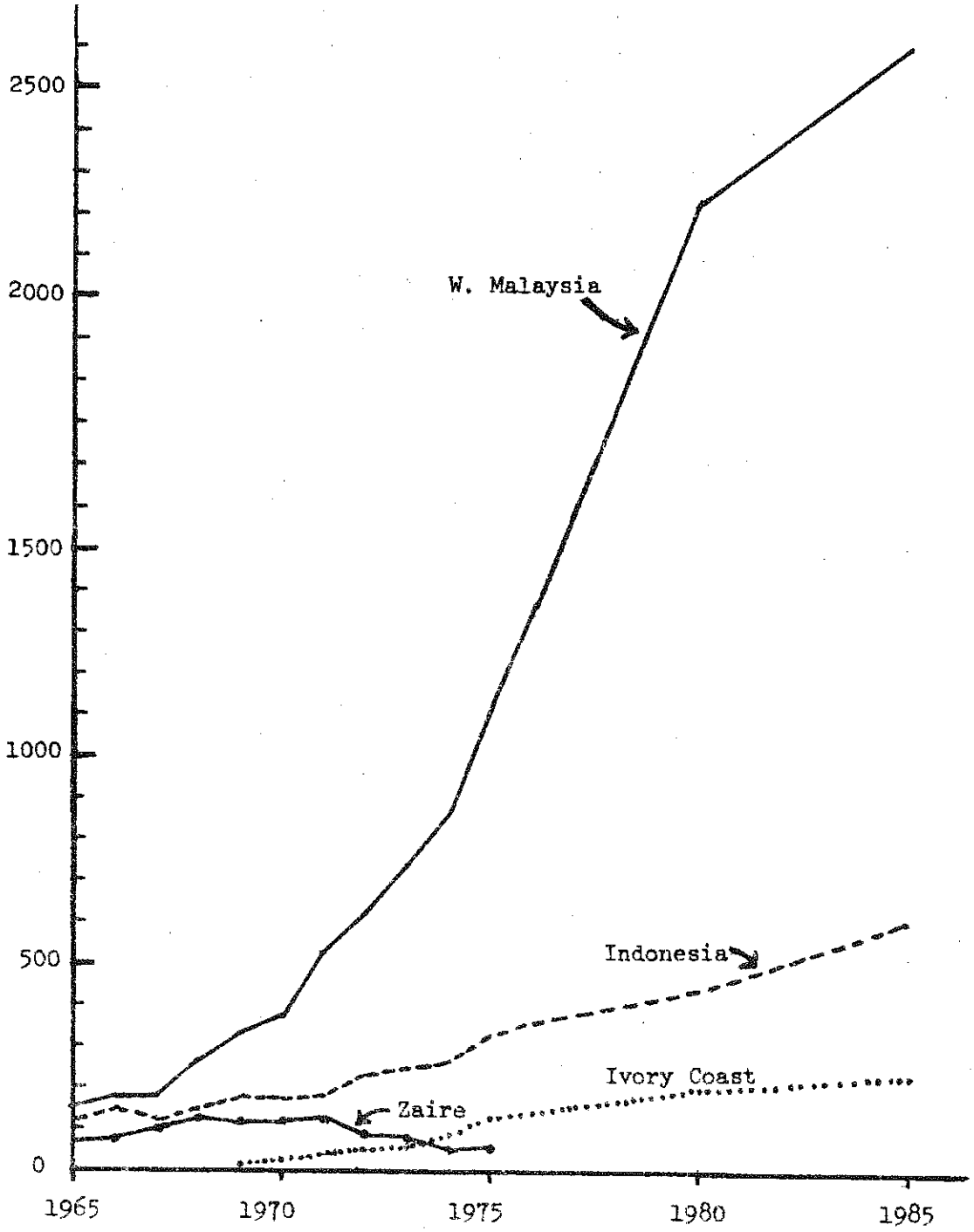
The estate sector continues to maintain a 40 percent share of the industry, but this proportion may decline as FLDA enlarges its activities. Palm oil production is expected to reach 1.54 million tons in 1976. During 1975, FLDA's share was estimated at 180,000 tons and by 1980 it is expected to attain 500,000 tons which would make the organization the world's largest single producer of palm oil. FLDA continues to plant at the rate of 9,000 to 11,000 acres per year and will probably do so until 1980. Under current rates of expansion it is expected that by 1979, Malaysia will have 1.8 million acres planted under oil palm. The USDA estimates of Malaysian oil palm acreage to 1979 are listed as follows in thousand acres (139):

Year	Bearing	Non-Bearing	Total
1975	920	568	1,488
1976	1,088	522	1,610
1977	1,287	415	1,702
1978	1,508	265	1,773
1979	1,616	180	1,796

The table indicates that the majority of acreage has yet to come into bearing.

Exports of palm oil are outlined in Figure 12. By 1985, Malaysia will outdistance Indonesia and Ivory Coast to a very considerable degree.

FIGURE 12. PALM OIL EXPORTS, 1965-75
AND PROJECTIONS TO 1985



Source: USDA, FAS, 1976.

VII

THE CHANGING DEMAND FOR PALM OIL

Shifting Patterns of Trade

Over the past twenty years demand for fats and oils has grown in complexity and sources of origin. Demand has been stimulated by rising population, but world exporters have shifted. A large amount of total production of fats and oils enters world trade; since World War II, the sources of exports have changed. The United States, once the largest importer, is now the world's largest exporter and this has done much to contribute to the fact that industrial nations have surpassed the developing nations as the leading exporters of fats and oils. Whereas the less developed nations had been the principle suppliers to the developed world, it is now the developed nations themselves which are the major exporters and the importers. This shift in the pattern of trade in fats and oils is best illustrated by comparing percentage shares of trade in 1951 and 1965. The percentage shares of world trade in animal and vegetable oils in 1951 was as follows (98, p. 23):

Exporting Nations	Developed Countries	Less-Developed Countries	Centrally Planned	Total
Developed Countries	30.7	6.6	0.1	37.4
Less Developed Countries	52.0	3.8	0.2	56.0
Centrally Planned	4.7	0.3	1.6	6.6
	87.4	10.7	1.9	100.0

From the above it can be seen that less developed countries held the lead in fat and oil exports and these were generally exported to developed areas; but by 1965, developed countries became the largest traders in fats and oils (98, 37).

	Importing Nations			
Exporting Nations	Developed Countries	Less-Developed Countries	Centrally Planned	Total
Developed Countries	36.0	12.6	3.1	51.7
Less Developed Countries	34.4	0.6	3.0	38.0
Centrally Planned	3.6	4.4	2.3	10.3
	74.0	17.6	8.4	100.0

Oil crop production organized by colonial powers has gradually been displaced by present day exchange of developed nations among themselves. Thus, Europe remains the largest importer of vegetable and animal fats; the source of

supply is no longer the developing nations, but rather North America. For example, West Germany, Great Britain, Italy, Switzerland, and the Netherlands imported 335,000 metric tons of soybean oils in 1974. The largest exporter of soybean oil in that year was the U.S. at 750,000 metric tons. With the exception of Argentina and Brazil, no developing area exports soybean oil in any significant volume. Imports into Europe of other vegetable oils have been considerably less. West Germany and Great Britain were the largest importer of cottonseed oil in 1974 at 25,000 metric tons and 20,000, respectively. Again, the United States remains the largest importer of groundnut oil, with West Garmany and Italy taking 51,000 metric tons and 35,000 metric tons in 1974. Here the African nations, especially Senegal, dominate export trade in groundnuts at well over 100,000 metric tons, but palm oil is rapidly gaining claim over soybean oil in the European and U.S. import markets. West Germany, Netherlands and Great Britain remain the biggest net importers in Europe totaling over a half million metric tons in 1974. The U.S. was the largest importer in 1974 (43).

The Slow Growth in Demand

Despite the magnitude of trade in fats and oils, growth in demand has not been remarkable. In 1970, a USDA study forecast an extremely weak import demand over the next two decades. National consumption of fats and oils is a function of population size, and rates of growth of income levels. During the 1970's world production of fats and oils increased at an annual average of 2.6 percent. Consumption of fats and oils increased at a slightly faster rate than population, or at a world average of 2.1 percent. At a world level, per capita consumption remained constant at about 10 kilograms; but at a disaggregate level per capita consumption in Western Europe and North America was around 22 kilograms a year. For the developing nations, consumption was much lower, or from 2.8 kilograms in China, 4.9 for Africa, 5.5 for Latin America and 7.1 kilograms for Japan. This is revealed in Table 3. While Western Europe and North America remain the biggest per capita consumers of fats and oils, it is likely that per capita consumption is approaching the saturation point in which case, demand will grow no faster than population. While lower levels of per capita demand may infer brighter prospects for trade, there is no trend in this direction. In Africa, Latin America and Asia, per capita consumption is one quarter of that of the industrial nations. Given the high rates of population growth, it would appear that import demand from the less developed nations would offer the most promising market. On the other hand, acute balance of payments problems would strongly impede imports.

Population, however, is not the only variable which figures in the demand for fats and oils. Changes in income account for the recent demand for selective vegetable oils. With rising incomes, preferences are strong for meats and meat products and demand for animal fat declines. High grain prices in developed importing nations -- especially Europe -- make oilcake a preferred feed substitute. Oilseeds therefore are in greater demand for meal than they are for oil. In the U.S., meal production exceeds consumption, but in Europe and Japan meal production is below consumption; thus there is considerable traffic in meal or oilcake from the U.S. to Europe and Japan.

Table 3

Level of Per Capita Demand for Fats and Oils

	1965	1975	1980
N. America			
Fats & Oils	21.2	22.2	22.2
Butter	2.8	2.1	1.9
Vegetable Oils	13.1	16.0	16.4
Animal Fats	5.2	3.9	3.9
W. Europe			
Fats & Oils	22.0	23.0	23.4
Butter	4.8	4.8	4.8
Vegetable Oils	12.2	13.3	13.7
Animal Fats	5.0	4.9	5.0
Japan			
Fats & Oils	7.1	10.9	12.1
Butter	.2	.5	.6
Vegetable Oils	5.1	7.9	8.9
Animal Fats	1.8	2.5	2.7
Africa			
Fats & Oils	4.9	5.2	5.9
Butter	.2	.3	.3
Vegetable Oils	4.5	4.8	5.4
Animal Fats	.1	.2	.2
Latin America			
Fats & Oils	5.5	6.3	7.0
Butter	1.6	1.7	1.8
Vegetable Oils	.1	.1	.1
Animal Fats	.5	.4	.5
Asia & Far East			
Fats & Oils	4.2	4.8	5.7
Butter	.8	.8	.9
Vegetable Oils	3.3	4.1	4.6
Animal Fats	.1	.2	.2

SOURCE: FAO, Agricultural Commodity Projections 1970-1980.

Meal consumption is expanding much more rapidly in developed countries than is the demand for oil. In the case of soybeans, "the farm value of soybeans, when compared with other oil and meal bearing materials, is relatively more dependent upon meal markets than upon oil markets" (65, p. 25). The value of the meal is now twice that of the oil, nevertheless, with rising incomes, demand for meat products increases, demand for animal fats decreases, and vegetable oil consumption increases in proportion. Thus, the income elasticity of demand for vegetable oils tends to be higher than that of animal fats in the case of North America and Western Europe. The income elasticities of demand for various areas of the world are as follows (37):

N. America		Japan	
Fats and Oils	-.01	Fats and Oils	.40
Butter	-.45	Butter	1.20
Vegetable Oils	.09	Vegetable Oils	.40
Animal Fats	-.03	Animal Fats	.30
W. Europe		**Africa**	
Fats and Oils	.14	Fats and Oils	.23
Butter	.09	Butter	1.44
Vegetable Oils	.20	Vegetable Oils	.02
Animal Fats	.02	Animal Fats	4.91
Latin America		**Asia & Far East**	
Fats and Oils	.50	Fats and Oils	.70
Butter	.55	Butter	.61
Vegetable Oils	.58	Vegetable Oils	.69
Aniaml Fats	.17	Animal Fats	1.32

This change in preferences does not necessarily hold for developing countries however. For example, income elasticities are extremely high for animal fats in the case of Africa and Asia, while vegetable oils are preferred in Latin America. From this we may imply that as incomes rise in these areas, demand will increase for animal fats to a greater degree than vegetable oils.

Demand for fats and oils is projected to increase at an annual average of 2.7 percent a year, but in the developed nations the rate of demand is expected to slow down to 1.6 percent a year even though these countries will account for 40 percent of world consumption by 1980. The demand for fats and oils in the developing nations is expected to increase at a faster rate, or 4.7 percent. The supply of oils from annual field crops such as soybean, cottonseed, groundnut, and sesame are expected to increase at a slightly higher rate than demand, or at an annual rate of 3.3 percent. Soybean oil, the most important single oil is expected to increase at a rate of 3.1 percent (37, pp. 147-155).

Since the growth rates of supply are expected to be greater than those of demand, prices for fats and oils will decline during the period 1975-80

from the high level of 1974. Under these conditions, substitutability among the major fats and oils becomes important. Cross elasticities of demand then become more vital than income elasticities. Oils demonstrating the greatest cross effects are ones for which there is no one particular end use. This is represented in a kinked demand curve. "The total demand curve consists of two parts: an inelastic segment (representing the market for which there exists no or only few substitutes) and a highly elastic part, in which the oil competes with other fats and oils" (68, Annex I, p. 27).

Figure 13 illustrates the price projections to 1985 for all fats and oils. Palm oil and fish oil are projected to maintain the lowest prices through 1985. Their growth rates can therefore be expected to be considerably above the average. Palm oil will have the highest growth rate of all the fats and oils. At 8.2 percent, this is more than double the world average and four times the growth rates for fats and oils for Western Europe and North America. This reflects the coming into bearing of the palm oil schemes of the sixties and seventies.

The yields per acre from oil palm are considerably higher than for any annual oil crop. The average yield per acre for the important vegetable oils are given below in pounds per acre (80, p. 4):

Oil Crop and Country	Year	Pounds/Acre
Oil palms, West Malaysia	1971	3,600
Peanut Oil, United States	1973	725
Coconut Oil, Philippines	1972	625
Sunflower Oil, U.S.S.R.	1973	530
Rapeseed Oil, Canada	1972	360
Soybean Oil, United States	1973	300
Cottonseed Oil, United States	1973	150

The low price appeal and high yields per acre have begun to alter the market demand for palm oil. Previously the European nations had been the principle importers of palm oil, especially the United Kingdom, as shown in Figure 14. The absence of the U.S. as a large purchaser was due to the increased production of vegetable oils, primarily soybean oil.

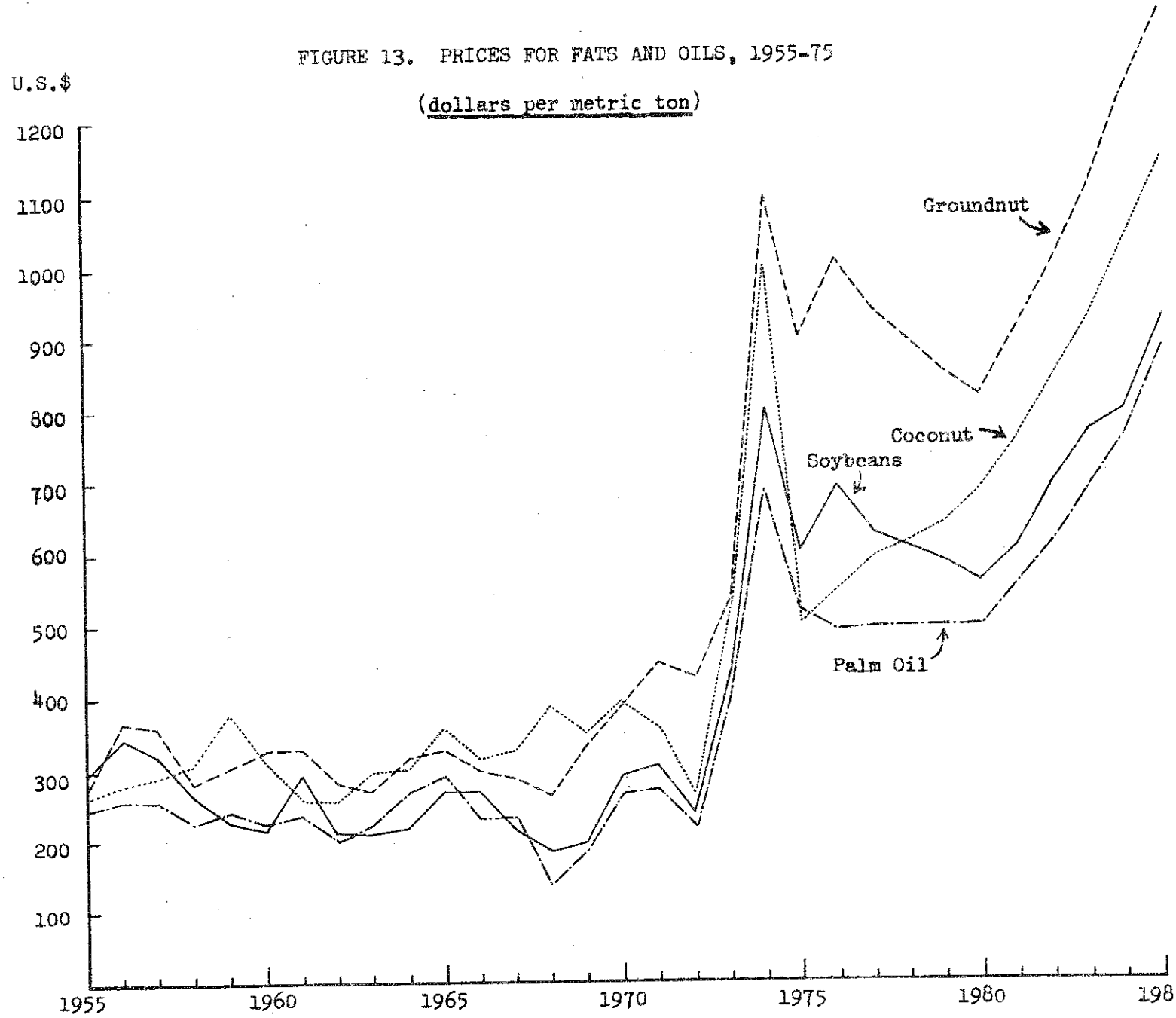
Relation Between Soybean Oil and Palm Oil

Prominant in the demand for palm oil is the nature of its relationship with soybean oil. The future of palm oil cannot be fully appraised without some discussion of the demand for soybean oil. The two are largely interchangeable in the composition of cooking oils. Thus some discussion of soybean oil demand is warranted.

Advances in corn production in the U.S. have doubled yields in the past twenty-five years. Declining corn acreage has been offset by increased yields and freed acreage for soybean production. Unfavorable market prices for corn have made soybeans an attractive alternative. The harvested acreage of major U.S. crops is as follows, in million acres (38):

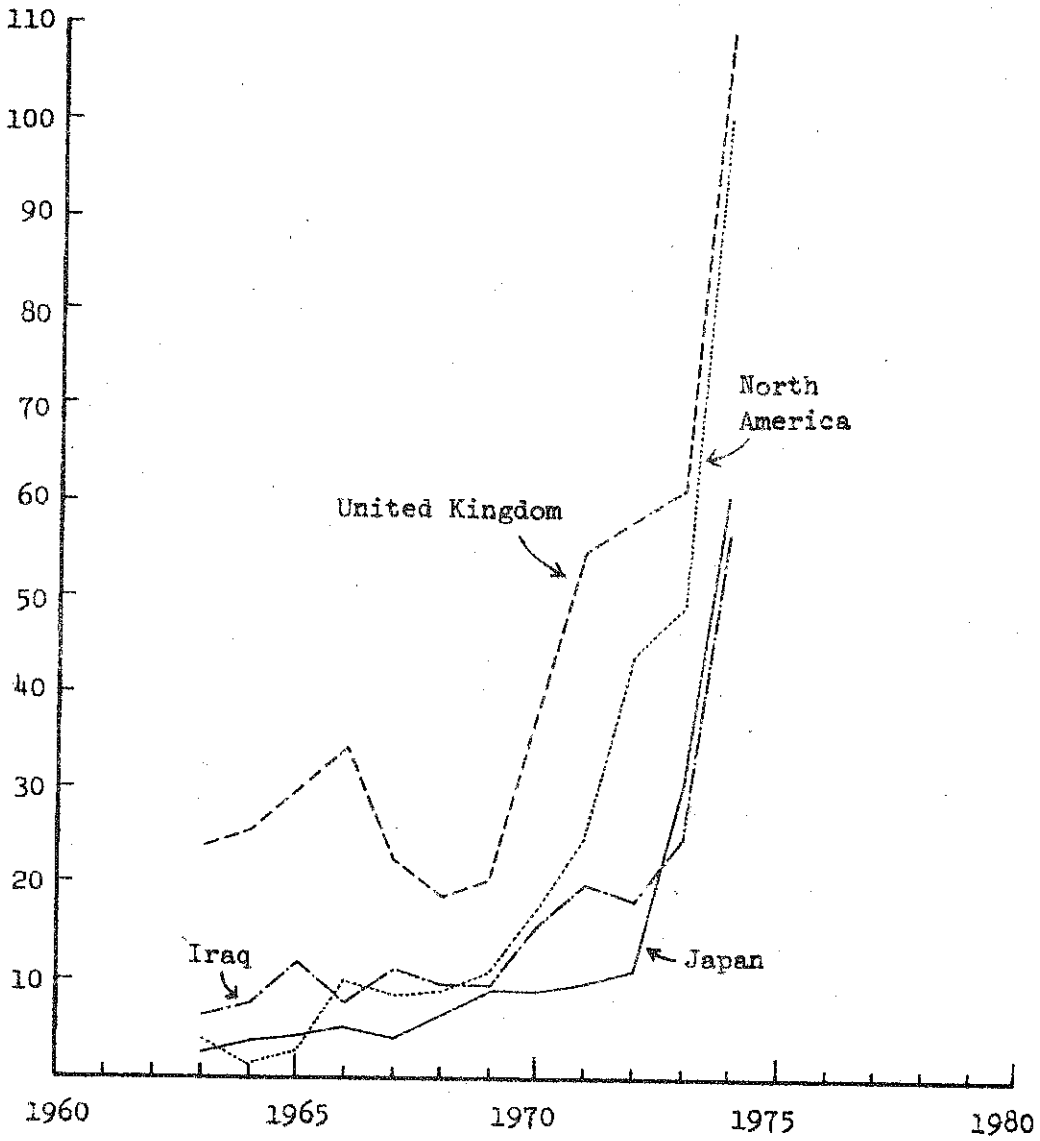
FIGURE 13. PRICES FOR FATS AND OILS, 1955-75

(dollars per metric ton)



Source: International Bank for Reconstruction and Development, 1975, personal communication.

FIGURE 14. IMPORTS OF PALM OIL IN SELECTED COUNTRIES



Source: FAO, Production Yearbook, various issues.

	Corn	Hay	Wheat	Soybeans	Oats	Cotton
1924	100.4	74.5	52.5	.4	41.9	39.5
1934	92.2	65.4	43.3	1.6	29.5	26.9
1949	85.6	72.8	75.9	10.5	37.8	27.4
1959	81.9	66.3	51.7	22.6	27.8	15.1
1965	64.6	67.4	49.6	34.4	18.5	13.6
1971	73.6	63.3	48.5	42.4	15.7	11.5
1975	65.1	60.5	65.4	52.4	13.3	12.5

As an attractive choice among production alternatives on U.S. farms, demand has also grown with output because of the demand for soybean joint products -- the oil and the meal. It is estimated that two thirds of soybean value is derived from the meal. As a high protein feed supplement, meal has been very much in demand due to the expanded market for meat products. High protein soybean meal fulfills the need for closer attention to animal nutrition and better feeding practices. Soybean oil is used in the rising output of such vegetable oil products as margarine, shortening, and cooking oils. Soybean oil is also exported where it is used for similar purposes. Improved processing technology in the 1950's enabled a change from mechanical to chemical extraction; the new methods reduced processing costs and thereby contributed to price competitiveness.

Three economic forces therefore contributed to the recent rise of soybeans: an attractive alternative in comparison with other crops; growing demand for its joint products; and cheaper processing technology (65).

Production increased from 7.3 thousand metric tons over the period 1948-58, to 9.4 thousand metric tons from 1952-56, then jumped to 33.5 thousand metric tons by 1974. Soybean meal has grown at an annual rate of 8 percent or quadrupled within the last twenty years. The meal is considered the most important high protein livestock feed used in the U.S. There has also been a large increase in the value of export meal which is attributed to the growing demand for meat, especially in Western Europe which has also increased its demand for high protein feeds. But soybean oil has had an annual growth rate of only 4 percent. Today, soybean oils dominate the edible oils market.

It is the soybean market which competes with palm oil and the one in which palm oil has successfully established a foothold. Domestic use of palm oil has increased sharply from 124 million pounds in 1970 to 870 million in 1975. It has primarily displaced soybean oil in the use of cooking oil and to a lesser extent in margarine, as shown in Tables 4 and 4a.

While it can be seen that soybean oil has increased dramatically the percentage of soybean oil in the total has actually declined. Palm oil is used primarily in cooking oil in the U.S., but in Britain, it is used in margarine production as shown in the table. Already, soybean meal prices have dropped, while production is up 2 million tons from last year. Domestic use is expected to exceed 14 million tons, as livestock feeding picks up in response to more favorable feeding ratios.

Table 4

Oilseeds, Fats, and Oils, 1975

Shortening: Fats and Oils Used in Manufacture, United States, 1963-74
(million pounds)

Year	Vegetable Oils							Animal fats		Total Primary and Secondary Fats & Oils
	Cotton-Seed oil	Soybean oil	Coconut oil	Peanut oil	Corn oil	Palm oil	Other	Lard	Beef fats	
1963	330	1,228	19	3	3	14	8	594	413	2,611
1964	378	1,388	18	5	8	11	8	446	430	2,693
1965	403	1,471	20	3	8	13	6	456	388	2,768
1966	370	1,734	38	14	8	38	8	491	491	3,192
1967	273	1,741	40	24	12	61	10	576	506	3,243
1968	248	1,842	41	21	10	72	4	601	487	3,326
1969	248	2,101	47	16	13	110	13	475	483	3,505
1970	276	2,182	45	16	12	85	7	430	546	3,599
1971	168	2,047	56	15	5	140	10	520	517	3,479
1972	189	2,163	82	16		205	20	441	610	3,720
1973	199	2,268	86	16	5	184	29	341	536	3,664
1974 1/	194	2,177	61	21	7	154	35	317	637	3,603

1/ Preliminary

Economic Research Service, Compiled from reports of the U.S. Department of Commerce, Totals computed from unrounded numbers. Data for 1949-62 in Agricultural Statistics, 1972, table 206.

SOURCE: USDA Agricultural Statistics.

Table 4a

Oils & Fats Used in the Production of Margarine in the U.K.

(Thousand Tons)

Vegetable	1964	1965	1966	1967	1968	1969	1970	1971
Groundnut	13	11	14	15	17	19	10	8
Soybean	28	31	25	21	16	24	47	60
Cottonseed	5	7	4	1	--	--	12	1
Rapeseed	--	--	--	6	12	13	2	4
Sunflower	--	--	--	10	22	33	9	4
Coconut	13	10	8	6	2	2	2	2
Palm Kernel	2	1	1	1	1	1	1	2
Palm	30	25	41	21	20	25	29	53
Lard	74	51	14	12	10	8	18	16

SOURCE: Commonwealth Sec., Veg. Oils and Oil Seeds, 1973.

Worldwide demand for vegetable oils will continue to grow, as a definite shift occurs from animal fats to vegetable oils, and the recovery of soybean production will absorb much of the displaced proportion of animal fats; other vegetable oils will also displace animal fats, and a large part of this will be dominated by palm oil. Increased production of soybeans in the U.S. may signal a downturn in the extremely bouyant palm oil trade. USDA projections indicate that the U.S. will import significant volumes of palm oil to 1980, but "less than the 1974 and 1975 levels" (162, p. 27). Thus, the demand for palm oil is a function of the availability of all other oils, especially soybean oil, its main competitor. Future demand for palm oil will hinge largely on the supply and demand for the two soybean products, the oil and the meal. Recent economic events reveal that in spite of the large number of competing products, the market for fats and oils is quite unstable. Not only do population and income changes influence demand, but policy measures taken to check the recession in the United States, have contributed to this world market instability.

During 1974, demand for oils and oilcake fell as a result of the recession on consumer spending for meat products. There was a drastic reduction of 8.5 million tons in the U.S. soybean harvest of 42 million tons in the previous year. The decline has been attributed to a six percent reduction in area and a 15 percent reduction in yields. Unlike meat products, the demand for vegetable oils remained the same; production shortfalls in soybeans brought about an extremely high price for soybean oils, and enhanced the price of palm oil which was available at a considerably lower price; with an 8 cent price spread, palm oil became very desirable, and during the crop year of 1973, palm oil imports actually doubled, as shown in Figure 14.

Soybean price fluctuations were probably exaggerated when the U.S. and Brazil imposed export regulations to maintain domestic supply and to dampen domestic prices. The overall effect in the international markets has probably been marked by increased instability. Since export availability of fats and oils is concentrated in a few countries, mainly the North Atlantic region, actions taken by them tend to weaken international market stability and this in turn cannot be checked by policy measures taken by developing nations to safeguard their interests in world markets. Therefore, the demand for fats and oils, particularly those exported from developing countries, is not only a function of population and income variables but is also dependent on the supply and demand of the competing oils, and their joint products and as recent events reveal, but this is highly sensitive to the level of economic activity in the importing nations.

The timing and extent of the economic recovery will be the critical factors in the future demand for fats and oils. "A significant increase in demand will only take place if there is an improvement in the profitability of livestock feeding and a recovery in overall demand for meat" (39, p. 112).

VIII

HOW RELEVANT IS THE MALAYSIAN CASE

Decline of the Agricultural Sector

During the past twenty years, the Malaysian economy has undergone rapid structural changes. The First Malaysia Plan 1966-70 called for a "diversification program in agriculture and industry so as to reduce the dependence on rubber and tin" (102, p. 2). We have examined one of the more important segments of the diversification programs -- the modernization of the rubber industry and the diversification into oil palm. These two activities were undertaken within the context of a declining agricultural sector in terms of national output and total employment. This is in keeping with the pattern of small agricultural sectors for nations with high national incomes. The following table indicates that a structural transformation has occurred, not only in the agricultural or primary sector, but the overall economy. Agriculture's share in domestic product has dropped seven percent while the secondary and tertiary sectors have risen by eight and two percent respectively. The origins of gross domestic product between 1960 and 1971 are as follows, in percentage shares (38b):

	1960	1971
Primary	38.	31.
Secondary	18.	26.
Tertiary	38.	40.

The increase of persons employed in the agricultural sector has slowed down. In 1962, about 1.2 million persons were employed in agriculture; by 1970, the figure had risen to only 1.4 million. Employment in the rubber industry declined with a corresponding growth in factor productivity. In 1960, 282,000 persons were employed on rubber estates and 708,000 tons of rubber were produced; by 1974, over 1.4 million pounds of rubber were produced while the number of persons employed on estates dropped to 190,000. The tea, coconut, and pineapple industries also registered a decline, but employees in the oil palm industry increased from 18,000 in 1964 to 48,000 in 1973.

The diversification program has made the economy more inward operating. Exports continue to figure large, but because the commodity composition is now diversified, fluctuations have been less volatile; manufactured goods are less susceptible than primary goods. There was a considerable decline in export instability during the 1960's and even though exports remain unusually high in terms of their relationship with Gross Domestic Product. There has been a significant decrease in export stability. A statistical analysis of price patterns from 1951 to 1973 for oil palm and rubber reveal that oil palm registered a lower standard deviation than rubber. Commodity diversification has reduced the importance of rubber in the proportion of total exports. New commodities such as palm oil, timber and iron ore are replacing the size

of rubber exports. Moreover, the share of manufactured goods in total exports has increased from 14 percent in 1958 to 27 percent by 1969. This of course, is indicative of important domestic structural alterations in addition to making an important contribution to export stability.

Reduction in export instability has also been accompanied by a dispersion of trade concentration. Exports to Japan now surpass those to Great Britain; exports to Southeast Asia are now nearly as great as those to Britain.

Results of National Effort

Yet it is rubber which still claims over 30 percent of the export goods. The following table dramatizes several important conclusions. The indices for price, value and volume of rubber production between 1960 and 1970 were as follows (90):

	Price of Natural Rubber (1960=100)	Volume of Rubber Production (1970=100)	Value of Rubber Production P.Q.
	P	Q	V
1960	100	57	57
1961	77	59	45
1962	72	59	43
1963	67	63	42
1964	63	66	41
1965	64	70	45
1966	60	75	45
1967	50	77	38
1968	49	86	42
1969	65	98	63
1970	52	100	52

Over a ten year period, the price index of natural rubber was just about halved indicating that if export volume continued at the 1960 level, the loss in earnings would have had serious consequences for the economy. "This trend in rubber prices has long been foreseen and the response of the rubber industry and the Malayan government has been one of the success stories of Asian agriculture" (47, p. 195). With the active response of the rubber industry, however, the volume of rubber increased by 43 percent over the same decade indicating in the value column of the table that Malaysia was able to hold its own with regard to earnings. The compensating effects of higher yielding clones, new plantings, replanting, and government intervention in the smallholder sector spared the West Malaysian economy of what otherwise would have been a severe setback to the nation's development prospects. The more recent effects of high petroleum prices have been highly beneficial to Malaysia's natural rubber industry. The index of price, volume, and value of rubber exports between 1964 and 1974 is as follows (90):

Year	Price (1970=100)	Value ($M Mill.)	Thousand Tons
1964	79	1,250	807
1965	85	1,307	840
1966	84	1,338	893
1967	75	1,167	923
1968	80	1,251	1,048
1969	121	1,866	1,204
1970	100	1,620	1,230
1971	85	1,388	1,287
1972	77	1,233	1,264
1973	161	2,334	1,489
1974	169	2,728	1,443

With a base year of 1970, the table indicates that 1973 and 1974 have registered a substantial increase in the demand for natural rubber. Rubber prices have risen faster than volume quite probably as a result of greater demand for the product as manufacturers begin to turn away from synthetics. As this trend continues, Malaysia can be expected to experience a renewal of earnings from natural rubber similar to the period of the Korean War.

With regard to the demand for palm oil, the next table indicates an extraordinary rise in earnings. This reflects the coming into maturity of the extensive oil palm schemes at a time when there have been shortfalls in U.S. soybean production, a drought effecting the coconut crop in the Philippines, and a failure of the fish catch off Peru. The index of price, volume, and value of palm oil exports, between 1964 and 1974 is as follows (90):

Year	Price (1970=100)	Value ($M Mill.)	Tons
1964	29	80	122,735
1965	38	105.6	138,940
1966	42	117.9	178,281
1967	40	110.7	177,128
1968	49	116.8	263,605
1969	60	142.8	325,520
1970	100	244.9	365,790
1971	142	352.7	522,763
1972	133	324.8	615,023
1973	217	428.0	713,198
1974	520	978.5	799,261

With economic recovery in the industrial nations, soybean production will expand, and it is likely that the price spread between soybean oil and palm oil will narrow sufficiently so that the demand for palm oil will subside. Since soybean meal will be in equally strong demand in Europe, it is quite possible that demand for palm oil in Europe will subside as well.

Under these conditions, the ambitious efforts to continue oil palm ex-

pansion in areas where it is mutually exclusive with rubber may not now be the most advantageous policy. Continued expansion in oil palm may invite the danger of oversupply and a price level which would not be competitive with other fats and oils.

From Malaysia's experience with both crops, several points emerge as quite plain. Malaysia chose a two-prong strategy for improving the economy -- improved efficiency in the nation's traditional exports and diversification into other export crops in addition to an industrialization program. By modernizing the natural rubber industry, Malaysia has managed to assert a position against synthetics than would otherwise have been the case had this industry been neglected. Action to improve upon and standardize market quality of natural rubber could only have been achieved by a continued and rigorous research effort applied to plantation and smallholder alike. This received steady funding based on an export cess designed exclusively for a single commodity. Whether this strategy could be adopted by other countries would perhaps depend upon the magnitude of a particular commodity in the export sector.

The experience with oil palm indicates that diversification into this crop has helped to reduce the fluctuations in export revenues. Moreover, there appears to be scope for argument that certain tropical products can compete effectively with temperate zone counterparts based on price alone within a range of substitutability. Certainly the recent appeal for this product rather than other vegetable oils was due to its low price.

Recent exogenous factors have enhanced both commodities. In 1973 the value of commodity trade exceeded that of manufactures. This favorable upswing has been attributed to high levels of economic activity in the industrialized countries, adverse weather conditions, sharp price increases for feed grains and the extraordinary rise in petroleum prices. These factors may be temporary, but it is likely that high petroleum prices are not. Because of this natural rubber may now enjoy an advantage it had previously lost.

Behind both commodities, but especially rubber, economic nationalism was pivotal. With the incorporation of a large number of smallholders in such an important export crop, modernization was as much a political demand as it was an economic argument.

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