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EXPORT EXPANSION AND INDUSTRIAL GROWTH IN SINGAPORE

by

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ABSTRACT

The objective of this study is to examine the basis of Singapore's manufacturing output growth and the expansion of industrial exports over the 1959-1974 period. It is intended to (1) examine the relationships between output growth and export expansion of manufacturing industries; (2) study the "patterns" and structural changes in these two areas; (3) delineate and evaluate the major factors responsible for industrial growth and export expansion; (4) assess the comparative advantage of manufacturing industries and the allocation of industrial resources; and (5) evaluate the strategy, scope and prospects of industrial growth and export expansion.

The analytical techniques used included simple and multiple regression, non-parametric analysis (rank correlation), shift-share analysis and constant-market-share analysis. The study begins with an examination of the growth of manufacturing output and manufactured exports after 1959 at disaggregated levels, mainly by proportional analysis. Time-series regression analysis on the behavior of manufacturing output is then carried out. An extended analysis according to a shift-share-model which isolates output (value added) growth into import substitution, domestic demand expansion and export expansion is also employed.

The basis of industrial growth is studied by assessing the comparative advantage of industries with a Leontief-type test. The empirical results are then compared with that using Keesing's approach which incorporates skill considerations. Hypotheses are advanced and implications

for industrial resource allocations derived. An extended study of the basis of manufactured exports is then carried out. Two approaches have been employed: (1) the strength of supply and demand factors as tested with regression analysis, and (2) a constant-market-share analysis which apportions export growth among (i) world trade, (ii) commodity composition, (iii) market distribution and (iv) "competitiveness" effects. Selected factors affecting the competitiveness of industry are analysed.

Regression results indicate that manufacturing value added growth can be "explained" by the expansion of manufactured exports and tend to support the hypothesis that industrial growth in Singapore is export-induced. Consumption effects are also found to be strong. Shift-share analysis a la Chenery-Lewis-Soligo shows that in the early phase (1960-1965) of the industrialization process, growth of output and value added can be attributed primarily to import-substitution and expansion of domestic demand. Export expansion became an important "source" of industrial growth after 1965. This tends to support the regression results concerning export-led growth. A non-parametric test of Singapore data does not support Linder's hypothesis that the range of a country's exportables in the manufacturing sector are determined by domestic demand.

A Leontief-type test shows that Singapore's comparative advantage tends to lie in labor-intensive lines of production. The factor-proportions hypothesis was weakly confirmed when the patterns and market orientation of manufactured exports were analysed. An extension of the orthodox theory incorporating human and skill content appears to offer a better explanation of the trade pattern in manufactures.

The regression results show that manufactured export expansion is positively related to world trade in manufactures. This demand factor was found to be strong. On the supply side, there was a positive effect of labor productivity on the expansion of manufactured exports. The effect of commodity concentration was rather weak. Geographical concentration and the exchange rate had no apparent effect on industrial exports. A "recession-boom effect" was also found to be non-existent. In addition, the constant-market-share analysis of Singapore's export growth indicates that the contribution of world trade was continuous in the following periods: 1960-1967, 1967-1969, 1969-1971 and 1971-1973. For the entire period 1960-1973, it contributed sixty five percent of total export growth. Commodity and market distribution appeared to have little effect. The "competitiveness effects" were negative in the first two sub-periods but became positive in the last two. For the entire period 1960-1973, "increased competitiveness" contributed forty six percent of the total increase of industrial exports. Assessment of technological change, economies of scale, industrial relations policy and labor productivity relative to wage levels indicates that these elements contributed to competitiveness. Finally, the scope and prospects for industrial growth and exports are assessed.

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TABLE OF CONTENTS

LIST OF TABLES

TABLE		PAGE

TABLE		PAGE
5.5	Total Capital and Labor Requirements Per Million Dollars of Exports and Competitive Import Replacements of Manufacturing Industries in Singapore, 1973 (Excluding "Petroleum")	109
5.6	Export Patterns According to Factor Proportions: Shares in Total Industrial Exports and Shares of Exports in Gross Output by Major Industry Groups, 1966 and 1974	111
5.7	Export Patterns According to Factor Proportions: Share of Exports to Developed Countries by Major Industry Groups, 1965, 1968 and 1973	113
5.8	Export Patterns According to Factor Proportions: Share of Exports to Developing Countries by Major Industry Groups, 1965, 1968 and 1973	114
5.9	Spearman Rank Correlation Coefficient (r_s) between Factor Intensities and Manufactured Exports to Developed and Developing Countries, 1973	117
5.10	Skill Coefficients and Factor Intensities for 30 Industry Groups and Their Relative Rank Orderings, 1970	125
5.11	Skill Coefficients and Distribution of Singapore's Imports and Exports by Sectors, 1970, 1973	127
5.12	Spearman Rank Correlation Coefficients (r_s) between Skill Coefficients (S_i) and Trade Composition in Manufactures, 1970, 1973/1974	219
5.13	Percentage Distribution of Industrial Exports and Weighted Average Skill Coefficients by Areas, 1973/1974	132
6.1	Analysis of Changes in Singapore's Exports: All Goods	151
6.2	Analysis of Changes in Singapore's Exports: Manufactured Goods	152
6.3	Share of Increase of Singapore's Manufactured Exports to Nine Regions of Distribution, 1960-1973	154
6.4	Analysis of Changes in Singapore's Manufactured Exports by Commodity Classess, 1960-1973...............	156

TABLE PAGE

CHAPTER I

INTRODUCTION

In the last two decades or so Singapore has achieved very impressive rates of economic growth which few developing countries* have matched and has undergone a profound structural transformation. Manufacturing growth has played a major role in the process together with an expansion of industrial exports. Although the success of Singapore's export efforts has attracted the attention of trade and development economists, little systematic analytical work has been done. It is the intent of this study to bridge the gap.

In this chapter, we shall first present a brief account of Singapore's historical-political-economic background. The scope, objectives, analytical framework and organization of our study will be explained in the concluding sections of this chapter.

1.1 Background of Singapore

(a) Historical-Political Background:[1]

Singapore is an island city-state with an area of only 586 square kilometres (255.6 square miles) and a population of 2.3 million in 1974.[2]

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* The terms "developing countries" and "less-developed countries (LDCs)" are used interchangeably in this study.

[1] This brief account of early historical and political background is based mainly on the following sources: Blackhouse (1972), Fletcher (1969) and Osborne (1964).

[2] This figure is the mid-year estimate of 1974. Of the total population of 2,219,100 Chinese ethnic group comprises 1,689,500 (76.14%), Malays 334,100 (15.06%), Indians 153,500 (6.92%) and others 42,000 (1.89%). See Yearbook of Statistics of Singapore, 1974/75, Department of Statistics, Singapore, Table 2.2, p. 11.

It is strategically located at the Southern tip of the Malayan penisula, the center of the Malay archipelago and on the crossroad between eastern, and western Asia. It had acquired the name Singapura, meaning "City of the Lion," by the late fourteenth century. The modern history of Singapore began in 1819 when Sir Thomas Stamford Raffles, the energetic and far-sighted agent of the British East India Company, arranged with the Sultan of Johore in the Malay peninsula for the establishment of a British trading post on the island of Singapore. When Raffles first landed in Singapore in 1819, there were some 120 Malay fishermen and 30 Chinese farmers and traders.

Singapore, Malacca and Penang, the three out-posts in the Malayan peninsula, became "Straits Settlements" in 1826 under the rule of British India. In 1867 the Straits Settlement became a Crown Colony with Singapore as its headquarters. Because of its geographic location and free port policy, Singapore quickly became a major commercial center in Southeast Asia.

Singapore became a separate Crown Colony in March 1946. Penang and Malacca, together with the nine Malay states on the peninsula, were combined into a British-protected Union which became the Federation of Malaya in 1948. On 31st August 1957, the Federation of Malaya became an independent nation under the premiership of Tunku Abdul Rahman.

The British Government agreed to grant full internal self-government to Singapore in June 1959 while retaining control over its external affairs and defence. In the general election of May 1959, the People's Action Party (henceforth the P.A.P.),[3] led by Lee Kuan Yew, won forty-three out of the fifty-one seats in the Legislative Assembly. Immediately after being sworn into office, Lee and his government prepared to implement their two major election promises: industrialization and merger with Malaya. Despite the P.A.P.'s attachment to the Malayan culture,[4] the conservative Malayan Government was disinclined to merge with Singapore because the Chinese would then out-number the Malays.

In the two years following the election victory, there were a series of defections from the P.A.P. Fearing that Lee's moderate government was losing control to the left-wing extremists of his own party, the Malayan premier made a historic suggestion on May 27th 1961 to establish some form of political union between Malaya, Singapore and the British Borneo territories, Sarawak, North Borneo and Brunei. The concept of "Malaysia" was thus publicly announced. On 24 August 1961, the Tunku and Lee announced that agreement in principle had been reached for Singapore to attain independence through merger with Malaya to form Malaysia. It was agreed that external affairs, defence and security would be the concern of the Central Government, while Singapore would retain autonomy in education and labor. The merger referendum held in Singapore on September 1, 1962 revealed popular support for Malaysia. Lee's P.A.P. Government was re-elected in the 1963 general election with entry into Malaysia as the main issue.

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[3] The People's Action Party was formed in 1954 by a group of professionals and unionists and proclaimed itself a "democratic socialist" party.

[4] The P.A.P. Government proclaimed Malay as the national language of Singapore and actively promoted Malay culture.

A common market was one of the key issues under discussion between the Singapore and Malayan Governments. In a series of meetings in London, agreement on common market matters was finally reached and the terms of agreement were embodied in the Annex of the Malaysia Agreement.[5] Malaysia was formally proclaimed on September 16, 1963.[6]

The Indonesian Government under the leadership of Sukarno had expressed strong opposition to the formation of Malaysia, condemning it as a "neo-colonialist" plot. Immediately after Malaysia came into being, Sukarno activated the policy of "Confrontation" under which trade with Malaysia was boycotted. "Confrontation" was a serious blow to Singapore's extrepôt trade since Indonesia had been one of Singapore's largest trading partners.

The optimism which accompanied the creation of Malaysia was short-lived. Singapore's postmerger relations with the Malaysian Government came under increasing strain. On 9 August 1965 Singapore and the Malaysian

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[5] Malaya was initially reluctant to create a common market. The basic reasons were that Malaya's economy, in contrast to Singapore's entrepôt economy, was based on the export of primary products, principally rubber and tin. To expand its economic base, Malaya decided to industrialize and offered tax concession and benefits to "pioneer industries." Malaya was reluctant to open its tariff walls to competition from Singapore which enjoyed a higher per capita income. So long as Singapore preserved its entrepôt trade and free port system, it could obtain materials for use in its manufactures at a more favorable rate than was available to Malaya's manufacturers. When a Malaysian Federation was proposed, the Malayan Government decided to seek advice from the World Bank (I.B.R.D.). The The World Bank Mission, headed by Jacques Rueff, accepted the feasibility of a common market in its Report. See Report on the Economic Aspects of Malaysia, Mission of the International Bank for Reconstruction and Development (IBRD), (Kuala Lumpur, 1963).

[6] Brunei opted not to join Malaysia and remained a British protected state with the Sultan as its ruler. North Borneo was later renamed Sabah as one of the two states in East Malaysia.

Central Government decided that Singapore would withdraw from Malaysia. After Singapore's withdrawal, its trade links with Indonesia were resumed. One notable feature of the political scene in Singapore after independence is that Lee's P.A.P. has continued as the dominant political party.

(b) Post-war Economic Development Problems and Plans for Industrialization:

After World War II, Singapore encountered formidable economic problems. First, it was faced with one of the highest population growth rates in the world. The annual rate of increase between the census years 1947 and 1957 was 4.3 percent and exceeded 3 percent per annum until 1961 (Appendix Table A-1.1). With a large population of young people, unemployment would become a very serious problem if the economy did not grow to absorb the expanding labor force.

Second, Singapore is a small island economy with virtually no resources except manpower and a strategic location. Its arable land can provide only a small portion of the food supply needed. Its domestic market was not large enough to serve as the basis for industrialization.

Third, Singapore had been overwhelmingly the entrepôt of China and Southeast Asia. As an entrepôt, it carried out essential distribution, financial, transportation and related commercial functions. It collected the hinterland's products - natural and manufactured - from the producers or through middlemen. By combining, sorting, grading, semi-processing and storing the products, it served to meet the specific quantity and quality requirements in surrounding countries. It also re-exported foreign raw materials and manufactured goods required by its hinterland. These activities required shipping, insurance, banking and communications development. The very existence of Singapore, therefore, depended on entrepôt trade. By the late 1950s, many Southeast Asia countries tended to bypass Singapore and established direct trade links. Thus, the 1961-64 State Development Plan concluded that entrepôt trade "has very limited possibilities of expansion."[7]

The need for industrialization was raised as early as 1955 by the I.B.R.D. Mission[8] which concluded that:[9]

> Malaya must... continue to broaden its base of secondary manufacturing to supplement the contribution to additional employment and income likely to be made by primary production.

Guide-lines for industrial development were laid down by the Bank Mission. Industrial development must enter fields of foreign competition since the domestic market was small. It stated that small scale enterprises over a wide range of industries, rather than the establishment of large mass-producing units along "Westernized" lines could be expected to make a major contribution to economic expansion. The Mission stressed that industrial development must be a private enterprise process. The process could be facilitated if government would adopt the following measures: (a) provision of adequate infrastructure; (b) improvement of the climate for private investment; (c) assistance in feasibility studies, expansion of vocational training facilities and improvement of industrial credit

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[7] Singapore, State of Singapore Development Plan, 1961-1964, (Singapore, 1961), pp. 10-12.

[8] The Mission was headed by Sir Louis Chick. The Economic Development of Malaya, Report of a Mission organized by IBRD (1955).

[9] Ibid. p. 31.

arrangements, and (d) introduction of tariffs to protect infant industries in appropriate cases.[10]

In 1960, the Singapore Government asked the United Nations to send an Industrial Survey Mission to undertake the necessary investigation and to help speed up its industrialization program. The Mission was headed by Dr. A. Winsemius and submitted a report entitled "A Proposed Industrialization Programme for the State of Singapore" (henceforth Winsemius Mission) in 1961. The Winsemius Mission suggested that the Singapore economy could stand on its own.[11]

The Winsemius Mission looked at industrial growth as a long term activity. It emphasized the need for a crash program to alleviate the immediate unemployment problem. Its main theme was to combat the declining trend in existing manufacturing industries which was due to political uncertainty and unfavorable industrial relations, and to make Singapore's manufactured products competitive in world markets. The Mission recommended (1) import protection to selected industries to secure domestic markets without damaging entrepôt trade; (2) tax relief and other favorable terms such as protection against nationalization and expropriation to attract

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[10] Economic Development of Malaya (1955), pp. 31-32. The following steps were taken by the colonial government of Singapore to implement the Bank Mission's suggestions: (1) In 1957, an Industrial Promotion Board was created; (2) the Pioneer Industrial (Relief from Income Tax) Ordinance (No. 1 of 1959) was brought into effect on April 20, 1959.

[11] This conclusion was in contrast to an earlier report by F. J. Lyle. Lyle, a Colombo Plan Industrial Development expert, was requested by the colonial government of Singapore to advise on its industrialization policy. His report, entitled "A Industrial Development Programme," was delivered on 15 November 1958 and tabled in the Legislative Assembly on January 15, 1959. His recommendations included the establishment of a Joint Industrial Council with the Federation to formulate pan-Malayan policies and that tariff protection and incentives should be applied to both territories. His recommendations were never implemented.

foreign investment; (3) training programs to improve the quality of Singapore's labor force; (4) measures to promote better industrial relations, and (5) the establishment of an Economic Development Board to take charge of the industrial development effort.

The following types of industry were recommended by the Winsemius Mission for development: (a) industries making the best use of the relatively high aptitude and skills of the workers in Singapore, (b) industries having the best possibilities for immediate market expansion, and (c) industries based on the central location of Singapore in Southeast Asia.[12] The Mission also recommended the development of industrial sites at various locations throughout Singapore as well as the development of a large industrial estate at Jurong.

The State Development Plan, 1961-1964 was published in 1961 with industrialization as its central theme. The Plan stressed that there would be no significant reduction of entrepôt trade within the Plan period even though industrialization was to be pursued vigourously.[13]

When Malaysia was formed in September 1963, one of the most important issues was the setting up of a common market. A Tariff Advisory Board was established and a long list of commodities were discussed for protection. Import substitution thus became the dominant development strategy for

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[12] The industrial activities which the Mission favored were (i) the expansion of the ship-building and ship-repairing industries, (ii) the expansion of the metal engineering industries, (iii) the establishment of an electrical equipment and appliance industry, and (iv) the improvement in quality of chemical industries, including an expansion in the production of plastics, rubber processing, various oil industries, and soya bean processing.

[13] State Development Plan 1961-1964, pp. 10-11.

Singapore. Import duties were increased in 1964 and 1965. Import quotas on goods competing with "pioneer industries" were also imposed.

After separation from Malaysia, Singapore was forced to look out-ward. An export-oriented industrialization strategy was thus adopted. The Singapore Government decided that direct investment by experienced foreign firms would be the quickest way to meet its needs. Hence, efforts to encourage private foreign investment were intensified (see Chapter III and Appendix B).

1.2 Scope and Objectives of the Study

This study is concerned with export expansion and the industrial growth of Singapore.[14] It analyzes the growth of manufacturing output and the expansion of industrial exports, and the interrelationships between the two.

The study covers the period 1959 to 1974. The reasons for choosing year 1959 as the first year are two-fold: (1) Singapore obtained self-government rule in 1959 and, by coincidence, also published the first annual Census of Industrial Production; (2) in contrast to the period prior to 1959, the industrial growth of Singapore after 1959 has been described as "planned industrialization."

The specific objectives of the study are:

---

[14] Broadly speaking, industrialization means the dynamic process of creating or expanding a series of economic activities in the industrial sector which usually includes manufacturing, utilities, construction, transportation and other services. In this thesis, we are mainly concerned with the development of manufacturing industries in Singapore. The terms "industrial growth/development," or "manufacturing growth" will be used interchangeably unless stated otherwise.

(1) to examine the relationships between output growth and export expansion of manufacturing industries;

(2) to study the "patterns" and structural changes in these areas;

(3) to delineate and evaluate the major factors responsible for industrial growth and export expansion;

(4) to assess the comparative advantage of manufacturing industries and the allocation of industrial resources; and

(5) to evaluate the strategy, scope and prospects of industrial growth and export expansion.

1.3 Analytical Framework and Organization of Study

This study tests the hypothesis that the growth of manufacturing industries in Singapore is export-induced. Export-induced manufacturing growth can be expressed in the following functional form:

$$Q_m = f\ (X_m)$$

where Q_m denotes value added of manufacturing industries and X_m manufactured exports.

We shall present a brief review of the economy of Singapore with special reference to the export sector in Chapter II. Growth performance and structural changes in the economy during the period will be examined. Some salient features of the export sector such as export trends, commodity and geographical concentration, "stability" of exports and terms of trade will be analyzed.

In Chapter III, we shall examine the growth of manufacturing output (Q_m) and manufactured export (X_m) at a disaggregated level. This will shed light on the patterns and structural changes in industrial growth. We shall then examine the factors responsible for manufacturing output growth. The analysis will be based on a model adapted from Chenery's (1960) cross-section analysis of industrial growth. Since there is a problem of specification in applying a cross-section model to time-series data, we shall reformulate the model. Manufactured exports will be incorporated as one of the explanatory variables. The role of private foreign investment in manufacturing growth will also be analysed.

Chapter IV will continue the analysis of the relationships between output growth and export expansion. We employ a shift-share analysis based on a Chenery-Lewis-Soligo (1960, 1969) model which apportions output growth of manufacturing industries to (i) import substitution, (ii) domestic demand expansion, and (iii) export expansion. The analysis will shed further light on the "patterns" and structural changes of industrial growth.

In Chapter V, we evaluate the comparative advantage of industries in Singapore using a Leontief-type test. The empirical results will be compared with those using Keesing's approach (1966, 1968, 1971) which incorporates human and skill content. The findings will also give an indication of whether Singapore's industrial resources are efficiently allocated.

Chapter VI will examine the "sources" of manufactured export expansion. Two approaches will be employed. The first will test the strength of supply and demand factors as they affect the growth of manufactured exports. The explanatory variables include: (a) commodity and geographical concentration of exports as measured by the Gini-Hirschman coefficients; (b) world export trade in manufactures; (c) exchange rates; (d) labor productivity; and (e) the rate of capacity utilization. A second somewhat different statistical approach, the Constant-Market-Share model _á la_ Tyszynski (1951) et al., will be employed to "explain" manufactured export performance by looking at the portions of export growth that can be attributed to (i) world trade effects; (ii) commodity composition effects, (iii) market distribution effects, and (iv) "competitiveness".

The "competitiveness" effect represents a host of factors operating on the supply side which affect the export capacity of the home industry. We shall assess competitiveness by analyzing (i) technological change and economies of scale; (ii) industrial relations policy and (iii) wage levels. Finally, the scope and prospects for further expansion of industrial exports will be examined.

CHAPTER II

AN OVERIVEW OF EXPORTS AND ECONOMIC GROWTH IN SINGAPORE

In this chapter we shall first examine the performance and structural changes of the economy during the period 1959-1974. We will then review some salient features of the export sector such as export trends, commodity and geographical concentration of exports, "stability" of exports and terms of trade.

2.1 Performance of the Economy

Singapore's rate of growth of gross domestic product (GDP) during the period 1959-1974 is shown in Table 2.1. It has achieved an annual real growth rate of 9.30 percent. The 1964 negative growth rate of 0.41 percent was due to Indonesia's "Confrontation" policy towards Malaysia. A real growth rate of 12 percent was achieved during 1968-1974 (Table 2.3). The low rate of 7.43 percent recorded in 1974 was due primarily to the worldwide recession of that year. Singapore has achieved the highest growth rate among developing Asian countries during the 1960-1973 period (see Appendix Table A-2.4).

Table 2.2 shows the absolute level and annual growth rates of real GDP per capita. Singapore has the highest annual per capita GNP[1] among Southeast Asian countries and, excluding the Middle Eastern oil-rich countries, is second only to Japan in Asia (Appendix Table A-2.4). Annual growth rates of per capita real GDP, population and the consumer

[1] GNP at market price = GDP at factor cost + indirect taxes + net factor income from abroad.

Table 2.1

Growth of Gross Domestic Product of Singapore:
1959 - 1974

(at 1960 constant prices)

Year	Amount (S$ million)	Growth Rate (%)
1959	1,968	-
1960	2,046	3.96
1961	2,263	10.61
1962	2,395	5.83
1963	2,684	12.07
1964	2,673	-0.41
1965	2,983	11.60
1966	3,236	8.48
1967	3,550	9.70
1968	3,781	6.51
1969	4,292	16.16
1970	4,854	13.09
1971	5,474	12.77
1972	6,223	13.68
1973	6,957	11.80
1974	7,474	7.43

Source: Derived from Appendix Table A-2.2.

price index are presented in Table 2.3. Population growth rates have declined over the period. The consumer price index remained fairly stable during 1960-1972 but rose in 1973-1974 (Appendix Table A-2.2) due to massive crop failures in major producing countries and the "oil

Table 2.2

Growth of Per Capita GDP at 1960
Constant Prices: 1959-1974

Year	Amount in S$	Amount in US$	Growth Rate (%)
1959	1,246	407	-
1960	1,252	409	0.48
1961	1,341	440	7.11
1962	1,382	452	3.06
1963	1,495	489	8.18
1964	1,452	472	-2.88
1965	1,582	517	8.95
1966	1,673	543	5.75
1967	1,796	585	7.35
1968	1,879	610	4.62
1969	2,101	680	11.82
1970	2,340	757	11.38
1971	2,594	895	10.86
1972	2,898	1,028	11.72
1973	3,184	1,279	9.80
1974	3,368	1,458	5.78

Source: Derived from Table 2.1 and Appendix A-2.1

crisis". The inflation abated in 1975 and 1976.[2] The record indicates a strongly expanding economy and substantial gains in the standard of living.

[2] The inflation rates in 1975 and 1976 were 3.2 percent and -2.4 percent respectively (CPI index: base period 1973 = 100, 1974 = 122.3, 1975 = 125.5, 1976 = 123.1). United Nations, Monthly Bulletin of Statistics, May 1977.

Table 2.3

Compound Annual Growth Rates of Real GDP, Per Capita Real GDP, Population and Consumer Price Index, 1959-1974

Economic Indicators	1959-1965	1965-1968	1968-1974	1959-1974
Real GDP	7.18	8.22	12.02	9.30
Per Capita Real GDP	4.06	5.90	10.23	6.83
Population	3.01	2.16	1.65	2.29
Consumer Price Index* (1963 = 100)	0.33	1.67	9.0	4.13

Note: *Average annual rates.

Sources: Derived from Table 2.1, Table 2.2 and Appendix Tables A-2.1 and A-2.2.

Trade is the lifeblood of the Singapore economy. In spite of its persistent trade deficits, the overall balance of payments has shown a comfortable surplus over the last sixteen years except during the Indonesian Confrontation period (Appendix Table A-2.5). The deficit has been financed by invisible earnings such as tourism and the inflow of investment capital. Singapore's balance of payments for the three selected years 1968, 1971 and 1974 are shown in Appendix Table A-2.5. The balance of payments surplus has permitted a build-up of Singapore's international reserves to S$6,512 millions in 1974 (Appendix Table A-2.6). Along with Japan, Kuwait, Saudi Arabia, Malaysia and Hong Kong, Singapore is among the few Asian countries that have made their currencies fully convertible.

Another key economic indicator of the expanding economy is the decline in the rate of unemployment which fell from 9.1 percent in

1966[3] to 6.7 percent in 1969 and was further reduced to 4.0 percent in 1974 (Appendix Table A-2.3).

2.2 "Openness" of the Economy

An open economy is highly dependent on international trade. "Openness" may also refer to dependence on flows of foreign capital which is measured by the ratio of gross capital inflows to income.[4] In this study, we measure "openness" by the commonly-used trade-flow concept.

The trade-flow openness of an economy can be measured by the foreign trade ratio (T_r) first employed by Kuznets (1959) who defined it as the ratio of foreign trade to national income or availability (i.e. national products plus imports):[5]

$$(2.1) \qquad T_r = \frac{\text{Exports} + \text{Imports}}{\text{GNP} + \text{Imports}}$$

The magnitude of the foreign trade ratio reflects the relative importance of foreign trade. To calculate Singapore's foreign trade ratio, Kuznets' definition of "availability" was modified to cover GDP and retained imports (i.e. total imports minus re-exports) in order to take account of the entrepôt feature of the economy. Hence, the foreign trade ratio for Singapore becomes:

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[3] In 1966, a sample survey found out that the overall unemployment rate was 9.1 percent. If underemployment was accounted for, the unemployment rate could be as high as 13 percent. See You, Rao and Shantakumar (1971), pp. 72-73.

[4] The two concepts of openness are certainly related but are by no means identical.

[5] Kuznets (1959), p. 100.

$$(2.2) \quad T'_r = \frac{\text{Exports (f.o.b.)} + \text{Imports (c.i.f.)}}{\text{GDP} + \text{Retained Imports}}$$

Foreign trade ratios for Singapore and selected developed and developing countries are presented in Table 2.4. Singapore's trade ratio at 1.24 for 1968-1974 (average) is the highest among the countries. Hong Kong ranked second (1973-1974 average). On the other hand, Indonesia's trade ratio is relatively low. For the six selected developed countries, the United States had the lowest trade ratio.

Table 2.4

Foreign Trade Ratio (T_r) for Singapore and Selected Developed and Developing Countries

(Average: 1968-1974)

Countries	T_r	Ranking
<u>Developing Countries</u>:		
Singapore	1.24	1
Hongkong	1.17 1/	2
Malaysia	0.59	3
South Korea	0.36	4
Thailand	0.30	5
Philippines	0.25	6
Indonesia	0.19 2/	7
<u>Developed Countries</u>:		
Canada	0.36	1
West Germany	0.33	2
United Kingdom	0.33	2
France	0.26	3
Japan	0.21	4
United States	0.10	5

Notes: 1/ 1973-1974 (average); 2/ 1968-1973 (average).

Sources: Calculated from Appendix Table A-2.7 and United Nations, <u>Statistical Yearbook</u> (various years), <u>Quarterly Bulletin for Asia and the Pacific</u> (1976) and IMF, <u>International Financial Statistics</u> (various issues).

2.3 Structural Changes and Characteristics of the Economy

In the course of rapid development, the economy of Singapore has experienced significant structural changes. The share of GDP originating in agriculture and fishing fell from 3.77 percent in 1960 to 1.86 percent in 1974. In contrast, output in manufacturing increased from 11.87 percent in 1960 to 24.80 percent in 1974 (see Appendix Table A-2.8). The annual growth rate of manufacturing output during the period was 20 percent. The "construction" sector increased its contribution to GDP from 3.61 percent in 1960 to 7.91 percent in 1974. It is one of the fastest growing sectors in Singapore, showing an annual growth rate of 20.37 percent. The contribution of entrepôt trade to GDP declined from 22.69 percent in 1960 to 10.47 percent in 1973. But the "entrepôt and domestic trade" sector remained important and accounted for approximately 27 percent of the total product in 1974 (see Appendix Table A-2.9).[6] The contribution of "banking, insurance and real estates" sector to GDP has also increased.

The decline in "other services" from 15.37 percent in 1960 to 7.67 percent in 1974 was due primarily to the reduction of the "military service" sector. "Military services," mainly British military expenditure on the island, accounted for 13.87 percent in 1960. By 1973, the share of "military services" in gross domestic product declined to 1.7

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[6] A "free-trade zone" was set up in 1969 to preserve Singapore's entrepôt trade. The free-trade zone provides handling and storage facilities and assists in the entrepôt trade of dutiable commodities.

percent.[7] "Tourism" increased its contribution to GDP from only 1.5 percent in 1960 to 5.8 percent in 1973 (Appendix Table A-2.8). It has thus become an important sector and constitutes a noteworthy change in the economy of Singapore. Manufacturing, entrepôt and domestic trade, and services including "banking and insurance," "transportation and communication," "shipping and wharfage" and "tourism" are the main pillars of the Singapore economy today.

2.4 Some Salient Features of Exports and Manufactured Exports

(a) Trends and Performance of Exports:

The value of exports at market prices is shown in Appendix Table A-2.9. Domestic-origin exports have increased in absolute amount over the years under study, except in 1964 as a result of the Indonesia Confrontation, and have accelerated in the late 1960s and early 1970s. Its share in total exports (X_d/X) has also increased at a rapid rate (Table 2.5). The absolute value of reexports has also increased in recent years (Table 2.5 and Appendix Table A-2.9). The ratio of manufactured exports to total exports as well as the ratio of manufactured exports to GDP have shown a rising trend over the period (Table 2.5).

Singapore has the largest per capita value of manufactured exports among the Southeast Asian countries. Its share of manufactured exports in GDP is also the highest among the six selected Southeast Asian countries as shown in Table 2.6.

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[7] "Military services" was important in its contribution to GDP during the period 1959-1967. In January 1968 the British Labor Government announced an early withdrawal of the British military personnel east of Suez. The British Government originally planned to eliminate its military presence by the end of 1975, then decided to accelerate the withdrawal to end of 1971.

Table 2.5

Selected Ratios of Export Trade and GDP, 1959-1974

(Percentages)

Year	X_d/GDP	X_d/X	X_r/X	X_m/X	X_m/GDP
1959	10.93%	6.25%	n.a.	4.37%	7.54%
1960	10.61	6.24	93.76	4.73	8.03
1961	10.40	7.04	92.96	5.41	8.00
1962	10.29	7.14	92.86	6.37	9.17
1963	12.71	9.81	90.19	6.44	8.35
1964	10.26	9.99	90.01	9.61	9.87
1965	12.93	14.11	85.89	11.63	12.13
1966	28.68	28.60	71.40	12.00	12.04
1967	30.09	31.82	68.18	14.56	13.77
1968	40.09	40.92	59.08	15.38	15.07
1969	46.86	45.56	54.44	26.69	27.45
1970	40.26	45.04	54.96	32.02	28.63
1971	38.48	44.98	55.02	36.39	31.13
1972	40.31	49.32	50.68	42.96	35.11
1973	49.80	53.79	46.21	49.94	44.38
1974	73.28	62.88	37.12	55.19	64.32

Notations: GDP = gross domestic product; X = total exports; X_d = domestic-origin exports; X_r = re-exports; X_m = domestic-origin manufactured exports.

Notes: 1/ Exports (X) includes trade with Indonesia during 1959-1963; thereafter it was excluded.

2/ GDP at current factor cost.

Source: Derived from Appendix Table A-2.9.

Table 2.6

Manufactured Exports of Selected Southeast Asian Nations[1]

Country	Per Capita Value[2] 1965	1972	Percentage of GDP 1965	1972
Singapore[3]	US$ 151.34	US$ 417.72	27.04%	30.92%
Malaysia	6.80	14.87	2.32	4.05
Philippines	2.08	2.14[4]	0.77	0.77[4]
Thailand	1.69	3.41	1.33	1.73
Indonesia	n.a.	0.30	n.a.	0.22
Burma	0.06	0.27	0.08	0.40

Notes: 1 SITC Sections 5 to 8 excluding 687.1 (tin);
2 valued at current market prices;
3 including re-exports;
4 1971 figures.

Sources: Derived from Appendix Table A-2.10.

Domestic-origin exports at 1960 prices recorded a 25-fold increase and domestic manufactured exports a 32-fold rise over the 1959-1974 period (Appendix Table A-2.11). The size of the increase is partly due to the small industrial base at the beginning of the period.

Growth rates of GDP at factor cost and exports at 1960 constant prices are shown in Table 2.7. The growth rates of the selected indicators in sub-period 1968-1974 were all higher than that of sub-period 1959-1968, indicating that industrialization gathered momentum in the later period. Domestic manufactured exports grew at a faster rate than GDP in both sub-periods.

Table 2.7

Compound Rates of Growth of GDP, Exports, Domestic Exports, Re-exports and Manufactured Exports, 1959-1974

(at 1960 constant prices)

	1959-1968	1968-1974
GDP at factor cost	7.28%	12.03%
Exports[1]	1.27	15.31
Domestic Exports	27.51[2]	23.87
Re-exports	-5.10[2]	6.71
Domestic Manufactured Exports	16.13	42.67
Manufactured Exports (SITC 5 to 8)[3]	6.83	30.44

Notes: 1 Since 1964, Singapore did not publish trade figures to Indonesia; to maintain comparability exports to that country during 1959-1964 were excluded;

2 1960-1968;

3 Manufactured exports Sections 5 to 8 is the narrower definition of manufactured exports. Singapore's figures shown in the UN Yearbook of International Trade Statistics includes re-exports.

Sources: Derived from Appendix Tables A-2.[illegible] and A-2.12.

(b) Structural Characteristics of Exports

Developing countries are concerned not only with the level of export earnings but also with the commodity and market structure of exports and imports. A diversified commodity and geographical export structure is likely to reduce the adverse effects of price fluctuations. Changes in the commodity and market composition of exports can be measured by the Gini-Hirschman coefficients of commodity and geographical concentration.[8] The former coefficient refers to the degree of concentration in commodity trade while the latter refers to the degree of concentration of a nation's trade with respect to other nations.

(i) Commodity Concentration of Exports:

The Gini-Hirschman coefficient of commodity concentration of exports by country j in year t, denoted by $C_{jx,t}$, is defined as

$$(2.3) \qquad C_{jx,t} = 100 \sqrt{\sum_{i=1}^{n} \left(\frac{X_{ij,t}}{X} \right)^2}$$

where $X_{ij,t}$ = the value of exports of commodity i by country j to the rest of the world in year t,

$X = \sum_{i=1}^{n} X_{ij,t}$, i.e. total value of exports by country j to the rest of the world in year t,

n = number of commodities

The commodity concentration coefficient is equal to 100 if only one commodity is exported. The larger the number of goods exported (diversification of exports) and/or the more even distribution among these goods the lower the coefficient. The lowest possible value of the commodity concentrate ratio is $100/\sqrt{n}$ where n is the largest number of goods which may be exported.

The export commodity concentration index is based on the SITC commodity groups which number 40 items. These export values include re-exports since data on domestic-origin exports in SITC groups were not available. For manufactured exports, measurements were based on

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[8] Hirschman (1964).

two different sources. An index based on the SITC 3-digit commodity groups was calculated as well as one index based on the ISIC 4-digit and 5-digit codes (see note 3 in Table 2.8).

The coefficients of commodity concentration for both total and manufactured exports are shown in Table 2.8. The commodity concentration index for total exports declined from 1959 to 1965, subsequently increased to 1969 and then declined again. The index for manufactured exports using the SITC 3-digit level data also showed a declining trend through 1967 but has remained relatively stable in recent years. In the case of ISIC export data (excluding "petroleum refinery and petroleum products"), a declining trend was observed from 1960 to 1968 and an upward movement since that year.

The coefficient of commodity concentration and the growth rates of exports for fourteen developing countries of the ECAFE region[9] are given in Table 2.9. The degree of commodity concentration of exports of ECAFE developing countries in 1966 ranged from 73.8 for South Vietnam to a low of 21.0 for Taiwan. Considering Southeast Asia alone, Singapore's commodity exports were the most diversified. A similar ranking was also obtained for the ECAFE region in a United Nations study.[10] In the latter study, however, the index for India was higher than that of Hong Kong and Thailand's was lower than that of the Philippines. When the concentration indices are considered in relation to the growth rates of exports

[9] ECAFE (United Nations Economic Commission for Asia and the Far East) region has been renamed ESCAP (United Nations Economic and Social Commission for Asia and the Pacific) region in 1973.

[10] See UN, <u>Economic Survey of Asia and the Far East</u>, 1967, Table I-4, p. 23.

Table 2.8

Coefficients of Commodity Concentration for Exports of All Commodities and Manufactured Products, 1959 - 1974

Year	All Commodities[1]	Manufactured[2] Products (SITC, 3-digit level)	Manufactured[3] Products (ISIC)
1959	47.61	32.41	n.a.
1960	43.97	31.78	26.57
1961	38.10	31.98	27.13
1962	36.32	32.18	25.34
1963	33.15	31.56	23.93
1964	30.47	28.97	24.98
1965	30.47	29.41	20.13
1966	31.81	27.12	21.05
1967	32.60	24.48	22.70
1968	36.82	22.51	21.00
1969	39.61	23.46	22.54
1970	35.52	23.70	23.01
1971	33.54	24.91	24.67
1972	31.77	25.18	29.67
1973	31.43	25.37	32.65
1974	37.82	25.16	28.66

Notes: 1 including re-exports; SITC commodity groups amount to 40 items;

2 including re-exports; based on SITC Sections 5-8;

3 manufactured products are broadly defined, but "petroleum refinery and petroleum products" are excluded; Census data are based on ISIC Industrial Code 4-digit (before 1970) and 5-digit level (after 1970). The 5-digit level industries correspond to that of 4-digit level as a result from changes in classification system in Singapore.

Sources: United Nations, Yearbook of International Trade Statistics, (various years); Singapore, Report on the Census of Industrial Production, 1959-1974.

Table 2.9

Developing ECAFE Countries: Coefficients of Commodity Concentration of Exports, 1966

Country	C_{jx} [a]	Exports; Annual Rates of Growth: 1960-1966 [b]
Vietnam, Rep. of	73.8	-16.1 %
Burma	64.7	- 1.8
Sri Lanka (Ceylon)	65.1	0.7
West Malaysia	52.4	2.1
Cambodia	51.7	6.4
Indonesia	45.7	- 2.9
Thailand	41.0	9.2
Philippines	37.0	8.7
Pakistan	36.2	7.6
Singapore	32.5*	27.38[c]
Hong Kong	31.6	12.3
India	25.6	4.3
Korea, Rep. of	24.3	41.8
Taiwan	21.0	23.5

Sources: a Coefficients of commodity concentration (C_{jx}) are taken from UNCTAD, Handbook of International Trade and Development Statistics, 1969. *Index for Singapore's exports is slightly different from that of my calculation which is due to different sources of data.

b Rates of growth in exports are extracted from UN Economic Survey of Asia and the Far East, 1967, Table I-4, p. 23.

c Author's calculation; this is the domestic-origin export growth rate.

during 1960-1966, it appears that countries with negative or low export growth rates are also those with the highest commodity concentration indices. The Spearman rank correlation coefficient between the level of commodity concentration ratios and the growth rates of exports is -0.833

which is significant at the 0.01 level. This supports the hypothesis that "countries with a higher degree of diversification of commodity exports are also those with a faster growth of exports."[11]

(ii) <u>Geographical Concentration of Exports:</u>

Country j's Gini-Hirschman coefficient of geographical concentration in year t, denoted by $G_{jx,t}$, is defined as

$$(2.4) \qquad G_{jx,t} = 100 \sqrt{\sum_{s=1}^{n} \left(\frac{X_{sj,t}}{X} \right)^2}$$

where $X_{sj,t}$ = value of exports of country j to country s in year t,

$X = \sum_{s=1}^{n} X_{sj,t}$, i.e. total value of exports by country j to the rest of the world in year t,

n = number of countries

The coefficients of geographical concentration for Singapore are presented in Table 2.10. The index for manufactured products is not calculated since detailed directions of trade data are not available.[12] The index does not indicate any clear trend. Singapore is still heavily reliant on its traditional export markets, Malaysia, Indonesia, the United States, Japan, the EEC countries, Hong Kong and Australia. The share of total export going to these seven was 68.24% in 1959 and 66.34% in 1974 (Appendix Table A-2.13).

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[11] United Nations, <u>Economic Survey of Asia and the Far East, 1967</u>, p. 22.

[12] In the <u>Census of Industrial Production</u>, only direct exports to Malaysia and "overseas" as a group are shown.

Table 2.10

Coefficients of Geographical Concentration of Exports: 1959-1974

Year	G_{jx}	Year	G_{jx}
1959	27.02	1967	29.58
1960	28.81	1968	31.76
1961	31.01	1969	27.27
1962	32.19	1970	26.61
1963	32.41	1971	26.82
1964	36.41*	1972	29.52
1965	34.35*	1973	28.70
1966	31.55	1974	27.59

Note: Exports to Indonesia is excluded.

Sources: International Monetary Fund, Direction of Trade, (annual) various years.

* computed from UN, Yearbook of International Trade Statistics.

Malaysia is still Singapore's most important trading partner. Although the absolute value of exports to Malaysia has increased, its relative share declined over the period from 35.27 percent in 1963 to 16.58 percent in 1974 (Appendix Table A-2.13). The decline in the share going to Malaysia is due to the decrease in entrepôt exports to Malaysia and (2) Malaysia's import substitution industrialization program. The share of exports purchased by the United States, Japan and Hong Kong has increased steadily over the period.

(c) "Stability" of Exports:

It would be useful to examine briefly whether the "stability" of

Singapore's exports has been increasing over the years. An approach similar to that of Massell[13] will be employed to estimate the index of export instability. Assuming that exports grow exponentially, the following semi-logarithmic function has been estimated:

$$\text{(2.5)} \qquad \text{Log } X_t = a + bt + e_t$$

where X_t is the value of exports in year t and e_t is the unexplained residuals. Instability of exports is defined as the standard deviation of the residuals, e_t, $t = 1, 2, \ldots, n$.

The instability indices for total exports (X) and domestic-origin exports (X_d) at current prices over 1956-1974 are shown in Table 2.11. For total exports (X), the instability indices for the periods 1959-1974, 1959-1974 and 1964-1974 are compared. The statistical results suggest an increase in the stability of total export earnings over time. For domestic-origin exports (X_d) during 1959-1974 and 1964-1974, the instability index remained unchanged.

(d) Terms of Trade:

The terms of trade affect the purchasing power over time of a given amount of exports. A rise in the index means that the unit value of exports is rising compared to the unit value of imports. Ordinarily, such a change is considered advantageous. In this section, we shall examine Singapore's terms of trade movements.

Export and import unit price indices for Singapore have been published only since 1972. Although the Department of Statistics of

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[13] Massell (1970).

Table 2.11

Estimated Semi-logarithmic Time Trends of Exports and Instability Indices over Selected Periods

Time Periods	a	b	t-ratio	R^2	D.W.	Instability Index[a]
Total Exports (X):						
1956 - 1974	7.7495	0.0570	4.8806	0.58	0.3029	0.2638
1959 - 1974	7.8055	0.0945	3.1203	0.95	0.8340	0.1543
1964 - 1974	7.6350	0.1600	5.1108	0.98	0.8436	0.1290
Domestic-origin Exports (X_d):						
1959 - 1974	4.7595	0.1727	4.4555	0.80	0.8169	0.1914
1964 - 1974	5.2859	0.2086	3.8989	0.88	0.5903	0.1905

Note: a. Instability index is the standard deviation of residual errors.

Sources: Estimated from Appendix Table A-2.9.

Singapore had prepared quarterly indices from 1964 to 1973 using 1964 as the base, these were restricted for internal use only. It was recognized that "the year 1964 was a rather abnormal year when Singapore was still part of the Federation of Malaysia which was in a state of "confrontation" with Indonesia. ..... With the termination of confrontation and the significant changes in trade pattern in the past decade due to rapid industrialization and the adoptation by neighbouring countries of a direct-trade policy, the 1964 pattern was no longer suitable as a base....."[14]

The unpublished commodity terms of trade, provided by the Department

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[14] Singapore, Department of Statistics, Memorandum on Unit Value and Volume Indices of External Trade (July 1974).

of Statistics, together with the figures for 1972 through 1974, are presented in Table 2.12. The commodity terms of trade was approximately 100 and have remained relatively stable over the period except for 1967, 1968 and 1971.

Table 2.12

Singapore's Commodity Terms of Trade, 1964 - 1974

Year	Export Unit Value	Import Unit Value	Commodity Terms of Trade
1964	100.00	100.00	100.00
1965	98.75	99.75	99.90
1966	96.75	95.50	101.30
1967	88.50	93.00	95.16
1968	84.75	88.75	95.50
1969	96.50	94.75	101.90
1970	96.25	97.25	99.00
1971	90.00	96.75	93.00
1972	100.00	100.00	100.00
1973	122.00	113.50	107.50
1974	137.00	130.00	105.40

Notes: Unit value indices of exports and imports for 1964 through 1971 (1964 = 100) are based on all commodities. Rubber was, however, excluded in calculating the unit value index for 1972-1974 (1972=100). Hence, the two sub-periods are not strictly comparable.

Sources: 1964-1971: unpublished data provided by Singapore, Department of Statistics;

1972-1974: Singapore, Department of Statistics, Memorandum on Unit Value and Volume Indices of External Trade (July 1974).

An attempt was made by Morgan and Chua[15] to calculate the income terms of trade adjusted for the entrepôt characteristics of the economy from 1962 through 1966. Their results showed the income terms of trade rising over that period. Unfortunately, such estimates are not available for later years. A recent estimate by the Department of Statistics showed that the commodity terms of trade exceeded 100 for both 1973 and 1974 using 1972 as the base (see Table 2.12). However, the estimates did not adjust for entrepôt trade.

Summary

We have completed an overview of the economy of Singapore with special reference to export trends, commodity and geographical concentration, "stability" of exports and terms of trade. One of the major factors responsible for the rapid growth during the period is the high degree of industrialization associated with the expanding level of domestic exports of industrial products.[16] The main purpose of this study is to examine Singapore's export expansion and industrial growth and the relationships between the two. These will be discussed in the chapters that follow.

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[15] Morgan and Chua (1970).

[16] Other strategic factors of economic performance may include (a) sound fiscal and monetary management, (b) flexibility and pragmatism of governmental policy, (c) internal political stability, (d) improved infrastructure and efficient government administration, (e) high rate of investment, (f) development as a regional and international financial center, and (g) high literacy rates and industry of local people. It is not our intention to examine these factors in this study, except industrial policies which will be discussed later.

CHAPTER III

EXPORT EXPANSION AND OUTPUT GROWTH OF MANUFACTURING INDUSTRIES

In this chapter, we shall analyze (1) the growth and structural changes of output and exports and (2) the inter-relationships between output/value added growth and export expansion of the manufacturing industries. We shall test the hypothesis that the growth of the manufacturing industries has been export led. The analysis will be based on a model adapted from Chenery's (1960) cross-section study of industrial growth "patterns". Chenery's model has been reformulated for single country time-series use. The rôle of direct foreign investment will also be briefly examined. We shall conclude with an assessment of industrialization policies in Singapore.

3.1 Industrial Growth Prior to 1959

Before 1959, only limited industrial activity took place in Singapore. Local industries were protected by high transport costs or based on processing regional primary products. These included timber, lumber, bricks and furniture. Unfortunately there were no manufacturing output data prior to the first Census of Industrial Production conducted in 1959.[1] An index

[1] The annual Census of Industrial Production covered establishments with at least 10 workers engaged in manufacturing activities as well as "rubber processing." Rubber processing was treated as a separate group from other types of processing activities in order to avoid distortion of the census results because "it was not possible to separate the activities of sorting, grading and packing which do not conceptually belong to manufacturing as nearly all establishments which are engaged in rubber smoking and milling were also engaged in the former group of activities." (See Report on the Census of Industrial Production 1959, p. 22). Furthermore, it was noted that rubber processing activity has a very high ratio of cost

of manufacturing employment gives an indication of manufacturing growth in Singapore during 1952-1959 (Appendix Table A-3.1). Some growth of manufacturing employment was recorded during the period 1952-1954 (5.8 percent), but the rate declined over the period 1952-1959 (-1.6 percent per annum). Expansion occured only in "textiles," "clothing," "paper and paper products," and "printing and publishing" industry groups (Appendix Table A-3.1).

3.2 Growth of Manufacturing Industries, 1959-1974

(a) Major Indicators of Growth:

The manufacturing sector went through a period of rapid growth in the 1959-1974 period. The growth rate of value added was 23.1 percent, gross output 24.5 percent, direct exports 33.1 percent,[2] employment 15.3 percent and establishments 10.4 percent (Table 3.1).

The period 1959-1974 can be divided into two sub-periods: 1959-1965 and 1965-1974, corresponding to the self-government and within Malaysia, and the post-independence periods respectively. A major shift of industrialization policy from "import substitution" to an outward-looking strategy took place in 1965. The growth rates of gross output, value added,

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of material input as compared to other manufacturing activities, but its contribution to total manufacturing employment and value added is of relatively lesser significance. Hence, we have excluded rubber processing in our study. In 1963, 1968 and 1973, the Census of Industrial Production also provide separate statistics on manufacturing establishments employing 5-9 workers. This study is mainly confined to establishments employing 10 or more workers unless stated otherwise.

[2] The figure was for the period 1960-1974. In the Census report, sales of establishments are classified into two broad categories: sales in Singapore and direct exports. Sales in Singapore are further subdivided into those to wholesalers, retailers, direct consumers and others. It was noted by the Department of Statistics that some of the output sold to wholesalers may be exported. (See Census of Industrial Production 1966, p. 5) Hence, figures on direct exports are downward biased.

Table 3.1

Average Annual Growth Rates of Manufacturing Industries: Selected Indicators[a]

(Percentage)

All Industries[b]	1959-1965	1965-1974	1959-1974
Gross Output	18.4	28.6	24.5
Value Added	16.4	27.6	23.1
Direct Exports	16.7 1/	42.1	33.1 2/
Employment	11.1	18.1	15.3
Establishments	11.9	9.4	10.4
Pioneer Firms	**1961-1965**	**1965-1973**	**1961-1973**
Gross Output	82.6	40.8	54.7
Value Added	99.7	51.3	67.4
Direct Exports	n.a.	58.4	n.a.
Employment	168.5	33.4	78.4
Establishments	92.5	16.3	41.7

Notes: a. Gross output, value added and direct exports are based on current prices;
b. Industries employing 10 or more workers;
1/ 1960-1965; 2/ 1960-1974.
* n.a. denotes "not available".

Sources: Derived from Appendix Tables A-3.2 and A-3.3.

direct exports and employment were all higher in later period 1965-1974. In 1974 manufacturing establishments numbered 2,179 (1959: 531) employing 206,067 workers (1959: 25,607) with a gross output of S$10,258.6 million (1959: S$398.9 million), value added of S$3,060.2 million (1959: S$142.8 million) and direct exports of S$5,776.4 million (1960: S$659.5).[3] During

[3] Due to the quadrupling of crude petroleum prices between October 1973 and December 1974, the market value for "petroleum refinery and petroleum products" industry group in 1974 had been adjusted by using the HWWA-Index (Fuel) compiled by the Hamburg Institute for International Economics, (See Appendix Table A-3.5).

the 1959-1974 period, establishments increased 4.1 times, employment 12.4 times, gross output 26-fold, value added 21.4-fold and direct exports 8.8-fold.

Growth rates of all major indicators of "pioneer firms"[4] during 1961-1973 were much higher than that of total manufacturing (Table 3.1). The high growth rates of pioneer firms in sub-periods 1961-1965 and 1965-1973, particularly the first sub-period, are partly due to the small industrial base in the early 1960s.

(b) Relative Growth of Manufacturing Industries á la Chenery-Taylor Method

A useful method with which to examine the relative growth of manufacturing industries is the "growth elasticity" formulated by Chenery-Taylor in their pioneering study of industrial growth patterns.[5] The following equation is used for Singapore:[6]

$$(3.1) \qquad \log V_i = a + b \log y + e_i$$

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[4] "Pioneer industries" enjoyed certain economic incentives. An industry may be declared a "pioneer industry" and its products "pioneer products" if the industry is one which is not being carried out in Singapore on a scale adequate to the economic needs of Singapore and for which there appear to be favorable prospects for development. For detailed requirements of granting "pioneer" status to industries, see Appendix B.

[5] The two main references are Chenery (1960) and Chenery-Taylor (1968). The basic theoretical framework of the Chenery-Taylor model was first developed by Chenery (1960). Chenery's basic equation is $V_i = \alpha Y^{\beta} N^{\gamma}$ where V_i=value added of sector i, Y = per capita income, N = population, α= constant, β= "growth" or income elasticity and γ= size elasticity. In log-linear form, the equation can be expressed as $\log V_i = \log\alpha + \beta \log y + \gamma \log N$. ~~See~~ also Section 3.5, this chapter.

[6] Chenery-Taylor used the same equation for an individual country given time-series data. See Chenery-Taylor (1968).

where V_i = value added of sector i

y = per capita income

b = growth elasticity $(\delta V_i/V_i)/(\delta y/y)$

a = constant

e_i = error terms

In equation (3.1), value added rather than gross output is used since value added appears to be a more appropriate measure of the importance of an industry. The parameters are estimated by means of least-squares regression. The "growth elasticities" ($\hat{b}$'s) of total manufacturing and the major industry groups for Singapore for 1959-1974 are presented in Table 3.2. The regression equation gives a reasonably good "fit" for all sectors since the $\bar{R}^2$s are high for total manufacturing as well as most manufacturing sub-sectors.

The growth elasticity of output for total manufacturing ($\hat{b}_{io}$) is 1.828; that is to say, the manufacturing value added increases 1.828 percent for every one percent increase in per capita income. The growth elasticity of "food," "beverages," "tobacco", "wood and cork products," "furniture and fixtures," "printing and publishing," "rubber products," "non-metallic mineral products," "metal products" and "miscellaneous" is less than that of total manufacturing. On the other hand, "paper and paper products," "textile, clothing, footwear and leather products," "chemicals, chemical and petroleum products," "basic metal products," "non-electrical machinery," "electrical machinery and appliances" and "transport equipment" have larger elasticities than $\hat{b}_{io}$. The latter five sub-sectors are the high growth industries. It is of particular significance that all $\hat{b}_i$'s are larger than unity except that of beverage ($\hat{b}_{i2} < 1$). Autocorrelation

Table 3.2

Growth Elasticities of Manufacturing Industries
Based on Time-Series Data, 1959-74

Manufacturing Sector (i = 0, 1, 2,..., 17)	Constant	$\hat{b}i$	$\bar{R}^2$	D.W.
(0) Total Manufacturing	-0.875	1.828 (10.752)	0.985	0.711
(1) Food	1.112	1.242 (0.979)	0.976	0.937
(2) Beverages	6.789	0.457 (5.618)	0.926	1.652
(3) Tobacco	1.844	1.009 (1.873)	0.778	2.228
(4) Wood and Cork Products	-0.329	1.376 (3.898)	0.917	1.747
(5) Furniture and Fixtures	-1.701	1.338 (3.215)	0.823	1.563
(6) Paper and Paper Products	-5.390	1.832 (5.653)	0.885	1.596
(7) Printing and Publishing	2.448	1.075 (23.808)	0.993	1.801
(8) Textiles, Clothing, Footwear, and Leather Products	-6.075	2.084 (3.619)	0.743	1.679
(9) Rubber Products	-1.353	1.345 (3.089)	0.840	1.747
(10) Chemicals, Chemical and Petroleum Products	-5.313	2.137 (4.518)	0.829	1.008
(11) Non-metallic Mineral Products	1.339	1.510 (6.417)	0.870	1.999
(12) Basic Metal Products	-7.986	2.257 (4.585)	0.754	1.531
(13) Metal Products	-1.617	1.557 (5.805)	0.946	1.642
(14) Non-electrical Machinery	-8.596	2.418 (10.888)	0.952	1.398
(15) Electrical Machinery and	-11.666	2.899 (6.917)	0.895	1.446
(16) Transport Equipment	-7.569	2.408 (6.515)	0.911	1.409
(17) Miscellaneous	-2.673	1.518 (2.432)	0.611	1.137

<u>Test of Significance</u>: all regression coefficients are statistically significant at 0.05 level or 0.01 level except $\hat{b}_1$ ("growth elasticity" for food); t-values in brackets under regression coefficients.

Sources: Estimated from Table 2.2 and Appendix Table A-3.5.

as detected by the Durbin-Watson statistic exists in a number of cases.

3.3 Growth and Structural Changes of Value Added by Major Industry Groups

Data on value added growth by industry groups over two sub-periods 1959-1965 and 1965-1974 are presented in Table 3.3, Column (2).[7] All except "beverages," "non-electrical machinery" and "electrical machinery and appliances" have achieved impressive growth rates during the period 1959-1965. During the 1965-1974 period, most industries grew at higher annual rates than in 1959-1965. Industries such as "textiles", "paper and paper products," "non-electrical machinery," "electrical machinery and appliances," "transport equipment," "plastic products" and "photographic and optical goods" had achieved growth rates higher than that of total manufacturing in the sub-period 1965-1974 (Table 3.3.).

We shall now consider the extent to which the growth of an industry has contributed to the overall growth of the manufacturing sector. Industry contribution to the increase of value added in manufacturing between periods 0 and t is measured by $(V_{it} - V_{io})/(V_t - V_o)$. V_{it} and V_{io} are the value added of industry group i at periods t and 0 respectively. V_t and V_O are the value added of all manufacturing at periods t and 0.[8]

Data show that the most significant development was the expansion of "chemicals and chemical products" and "petroleum products." They grew at a cumulative average annual rate of 36.11% and 28.23% respectively and

[7] All values are based on current market prices unless otherwise stated.

[8] It is likely that the parameter $(V_{it} - V_{io})/(V_t - V_o)$ may under-estimate the real contribution of sector i because of the external economies it might have generated. On the other hand, it may overestimate its real contribution if production price of sector i has increased relatively more than prices of other sectors in early 1960's.

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Table 3.3

Growth and Structural Change of Manufacturing Value Added by Major Industry Groups: 1959-1974
(Percentage)

Industry Groups (1)	Compound Annual Growth Rates (2)		Sectoral Contribution to Total Value Added Growth (3)	
	1959-1965	1965-1974	1959-1965	1965-1974
Food	11.61%	18.44%	7.54	4.24
Beverages	5.32	5.85	3.55	0.68
Tobacco	35.02	5.20	10.79	0.57
Wood and Cork Products	13.24	19.59	4.96	2.87
Furniture and Fixtures	20.92	16.04	1.68	0.53
Paper and Paper Products	17.27	28.20	1.17	1.20
Printing and Publishing	7.57	14.84	6.00	3.17
Textiles, Clothing and Leather Products	23.13	34.00	4.48	6.16
(a) Textiles	n.a.	60.14[a]	n.a.	5.98
(b) Clothing & Footwear	n.a.	29.87[a]	n.a.	
(c) Leather Products	n.a.	19.54	n.a.	0.17
Rubber Products	19.23	14.47	2.38	0.66
Chemicals, Chemical & Petroleum Products	36.11	28.23	24.44	18.40
(a) Chemicals & Chemical Products	n.a.	29.36[a]	n.a.	n.a.
(b) Petroleum Refinery & Petroleum Products	n.a.	26.18[a]	n.a.	n.a.
Non-metallic Mineral Products	16.33	18.20	6.85	3.03
Basic Metal Products	34.59	29.15	4.53	3.71
Fabricated Metal Products	23.51	19.43	10.30	4.29
Non-electrical Machinery	1.44	46.50	0.35	9.61
Electrical Machinery & Appliances	2.26*	52.56	-0.25	18.09
Transport Equipment	16.60	53.75	7.68	18.75
Plastic Products	n.a.	50.07[a]	n.a.	4.04
Photographic and Optical Goods & Precision Equipment	n.a.	129.14[b]	n.a.	
Miscellaneous Industries	33.48	16.84	3.56	
Total Manufacturing	17.90	25.95	100	100

Table 3.3 (Cont'd)

Growth and Structural Change of Manufacturing Value Added by Major Industry Groups: 1959-1974
(Percentage)

Industry Groups (1)	Shares of Sectoral Value Added (4)		
	1959	1965	1974
Food	11.64	9.22	4.81
Beverages	14.05	7.85	1.49
Tobacco	3.07	7.62	1.37
Wood and Cork Products	6.44	5.57	3.17
Furniture and Fixtures	1.13	1.45	0.63
Paper and Paper Products	1.05	1.12	1.19
Printing and Publishing	15.72	9.99	3.95
Textiles, Clothing and Leather Products	2.59	3.70	5.88
(a) Textiles	n.a.	3.27	2.81
(b) Clothing & Footwear	n.a.		2.88
(c) Leather Products	n.a.	0.34	0.19
Rubber Products	1.83	2.15	0.83
Chemicals, Chemical & Petroleum Products	6.57	17.11	18.26
(a) Chemicals & Chemical Products	n.a.	n.a.	5.30
(b) Petroleum Refinery & Petroleum Products	n.a.	n.a.	12.96
Non-metallic Mineral Products	6.48	6.78	3.48
Basic Metal Products	1.32	3.22	3.66
Febricated Metal Products	5.87	8.46	4.76
Non-electrical Machinery	5.56	2.49	8.80
Electrical Machinery & Appliances	8.12	3.20	16.40
Transport Equipment	7.32	7.53	17.48
Plastic Products	n.a.	n.a.	1.52
Photographic and Optical Goods & Precision Equipment	-	n.a.	1.17
Miscellaneous Industries	1.10	2.56	1.18
Total Manufacturing	100	100	100

Notes: * 1969/60 - 1965. [a] 1966-1974; [b] 1969-1974; [c] 1966; [d] 1969.
Sources: Computed from Appendix Table A-3.5.

together contributed 24.44 percent to the overall growth of manufacturing value added in the 1959-1965 period (1965-1974: 18.4%). Other industry groups such as "textiles and clothing," "non-electrical machinery," "electrical machinery and appliances," "transport equipment", "plastic products" and "photographic and optical goods" have significantly increased their respective contributions to the value added growth of the total manufacturing in sub-period 1965-1974 as compared to sub-period 1959-1965. (Table 3.3)

The growth of value added resulted in changes in the structure of the manufacturing sector. Manufacturing activity in 1959 was concentrated in "printing and publishing," "beverages," "food," "electrical machinery and appliances," "transport equipment," "chemicals, chemical and petroleum products," "non-metallic mineral products," "wood and cork products," and "metal products" in descending order of importance. However, there has been a relative decline of value added in "food," "beverages," "tobacco," "wood and cork products," "printing and publishing" and "metal products" industries from 1965 to 1974. In contrast, relative gains have been recorded by "paper and paper products," "textiles and clothing," "chemicals, chemical and petroleum products," "basic metal products," "non-electrical machinery," "electrical machinery and appliances," "transport equipment," "plastic products," and "photographic and optical goods."

3.4 Growth and Structural Changes in Manufactured Exports

Over the 1960-1965 period, manufactured exports increased at a annual rate of 16.3 percent.[9] The rate of increase rose to 36.58 percent over the

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[9] Manufactured exports are based on Census data which were first available in 1960.

1965-1974 period. This indicates that the outward-looking industrialization policy after 1965 has significantly contributed to the growth of manufactured exports.

The growth "patterns" of manufactured exports by major industry groups were similar to that of manufacturing value added. Most manufacturing subsectors experienced higher annual export growth rates in the 1965-1974 period. The high growth industries for the 1965-1974 period included "textiles," "chemical and chemical products," "petroleum refinery and petroleum products," "non-electrical machinery," "electrical machinery and appliances," "transport equipment," "plastic products" and "photographic and optical goods" (Table 3.4). For "electrical machinery and appliances," "plastic products" and "photographic goods" the high rates were due partly to small or negligible exports in the base year. It is noteworthy that out of 23 industry groups covering the manufacturing sector, only two (i.e. "beverages" and "tobacco") achieved an annual export growth of less than 10 percent (Table 3.4).

The outward-looking industrialization policy generated not only a general upsurge of industrial exports but also a marked diversification of export structure (see Gini-Hirschman commodity composition index in Table 2.8). The relative shares of traditional exports such as "food," "beverages," "wood and cork products," "paper and paper products," "printing and publishing," "footwear and leather products," "rubber products" and "non-metallic mineral products" have dropped over the years. At the same time, new industrial exports increased in importance. The performance of sectors such as "petroleum products," "non-electrical machinery," "electrical machinery and appliances," "transport equipment," "plastic products" and "photographic and optical goods" are cases in point.

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Table 3.4

Growth and Structural Change in Manufactured Exports: 1960-1974

(Percentage)

Industry Groups (1)	Compound Annual Growth Rates (2)		Sectoral Contribution to Total Export Growth (3)	
	1960-1965	1965-1974	1960-1965	1965-1974
Food	17.98	24.25	16.22	5.96
Beverages	-4.79	4.47	-2.04	0.13
Tobacco	113.15	2.57	4.15	0.04
Wood and Cork Products	12.28	23.82	7.31	3.31
Furniture and Fixtures	6.34	26.62	0.24	0.23
Paper and Paper Products	13.27	21.56	0.64	0.23
Printing and Publishing	8.99	17.00	2.09	0.63
Textiles, Clothing, Footwear and Leather Products	53.21	31.74	16.18	6.84
(a) Textiles	n.a.	65.46[a]	n.a.	6.64
(b) Clothing	n.a.	28.56[a]	n.a.	
(c) Footwear	n.a.	25.56[a]	n.a.	
(d) Leather Products	n.a.	10.23[a]	n.a.	0.20
Rubber Products	-5.00	11.89	-1.50	0.32
Chemicals, Chemical and Petroleum Products	21.01	43.09	25.05	33.51
(a) Chemicals and Chemical Products	n.a.	21.06[a]	n.a.	n.a.
(b) Petroleum Refinery and Petroleum Products	n.a.	46.39[a]	n.a.	n.a.
Non-metallic Mineral Products	6.17	11.63	2.82	0.63
Basic Metal Products	32.16	14.90	4.89	0.55
Febricated Metal Products	14.95	17.14	7.05	1.51
Non-electrical Machinery	11.22	51.15	1.52	7.22
Electrical Machinery and Appliances	1.95	65.35	0.75	25.34
Transport Equipment	107.35	40.18	13.85	9.64
Plastic Products	n.a.	67.38[a]	n.a.	3.95
Photographic and Optical Goods and Precision Equipments	-	316.87[b]	-	
Miscellaneous Industries	40.35	42.46	0.79	
Total Manufacturing	16.28	36.58	100	100

Table 3.4 (Cont'd)

Growth and Structural Change in Manufactured Exports: 1960-1974
(Percentage)

Industry Groups (1)	Shares of Sectoral Exports (4)		
	1960	1965	1974
Food	14.21	15.28	6.52
Beverages	11.00	4.09	0.37
Tobacco	0.19	2.29	0.17
Wood and Cork Products	10.49	8.80	3.64
Furniture and Fixtures	0.76	0.49	0.25
Paper and Paper Products	0.84	0.73	0.26
Printing and Publishing	4.38	3.17	0.79
Textiles, Clothing, Footwear and Leather Products	2.45	9.72	7.02
(a) Textiles	n.a.		3.07
(b) Clothing	n.a.	7.51	3.42
(c) Footwear	n.a.		0.20
(d) Leather Products	n.a.	2.21	0.32
Rubber Products	7.82	2.88	0.48
Chemicals, Chemical and Petroleum Products	17.70	21.60	32.79
(a) Chemicals and Chemical Products	n.a.	(7.59)	2.57
(b) Petroleum Refinery and Petroleum Products	n.a.	(20.47)[a]	30.22
Non-metallic Mineral Products	9.10	5.78	0.94
Basic Metal Products	1.82	3.44	0.73
Fabricated Metal Products	7.88	7.44	1.87
Non-electrical Machinery	2.43	1.95	6.90
Electrical Machinery and Appliances	8.32	4.31	24.07
Transport Equipment	0.42	7.53	9.51
Plastic Products	n.a.	n.a.	0.78
Photographic and Optical Goods and Precision Equipments	-	-	2.18
Miscellaneous Industries	0.20	0.52	0.75
Total Manufacturing	100	100	100

Notes: [a] 1966-1974; [b] 1969-1974.
Sources: Calculated from Appendix Table A-3.7.

The ratios of domestic exports to gross domestic output by major industry groups are shown in Table 3.5. The export ratio for total manufacturing increased from 30.3 percent in 1965 to 58.53 percent in 1974. The ratios are subject to downward bias because the export figures do not include sales to domestic wholesalers which may be exported.[10] Rising export ratios are found in 15 out of 23 industry groups. For industry groups which did not experience increases, the value added growth rates are generally lower than the growth rate for all industries. The declining trend of export ratios in "non-metallic mineral products," "basic metal products" and "fabricated metal products" is at least partly due to rapidly expanding domestic demand (See section 4.3, Chapter IV).

The export ratios of Singapore's industries are the third highest among the 15 major semi-industrial countries.[11] This is partly due to the small size of its domestic market. Pioneer firms in Singapore are mainly export-oriented except "non-metallic mineral products" and "basic metal" industries. The ratios of direct exports to gross output for pioneer firms by industry groups in 1969, 1971 and 1973[12] are shown in Table 3.6. Export

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[10] See Census of Industrial Production, 1960.

[11] In a comparative survey of fifteen semi-industrialized countries, Donges (1976) calculated that the ratio of manufactured exports to manufacturing output for Hong Kong was 66.8 percent (1972), the highest ratio among the fifteen nations. Taiwan and Singapore ranked second and third with 52.6% and 30.9% respectively (1973 figures). Export ratios of other countries are significantly lower except South Korea (24.8%). My calculation of the export ratio for Singapore was 58.53% (1974) which was higher than that given by Donges whose study was based on a narrower definition of manufactured exports, i.e. SITC commodity groups 5-8.

[12] Direct export data for pioneer firms are not available for the period 1961-1968. The latest published data were for the year 1973 at time of writing.

Table 3.5

Ratio of Direct Exports to Gross Output by Major Industries: 1960, 1965 & 1974

(Percentage)

Industry	1960	1965	1974	Change 1960-65	Change 1965-74
Food	31.00	34.41	40.84	+	+
Beverages	45.91	29.32	21.65	-	-
Tobacco	0.97	11.21	7.01	+	-
Wood and Cork Products	48.27	46.70	58.92	-	+
Furniture and Fixtures	32.46	15.49	31.40	-	+
Paper and Paper Products	26.49	23.67	14.34	-	-
Printing and Publishing	16.87	17.92	20.56	+	+
Textile, Clothing, Footwear & Leather Prod.	26.90	71.22	65.96	+	-
(a) Textiles	n.a.	39.22[a]	60.67	*	+[c]
(b) Clothing & Footwear	n.a.	63.40[a]	70.58	*	+[c]
(c) Leather Products	n.a.	80.95	72.90	*	-
Rubber Products	70.85	46.13	35.86	-	-
Plastic Products	n.a.	13.45[a]	30.85	*	+[c]
Chemicals, Chemical & Petroleum Products	45.70	28.89	64.84	-	+
(a) Chemicals and Chemical Products	n.a.	34.46[a]	37.84	*	+[c]
(b) Petroleum Refinery and Products	n.a.	12.23[a]	66.70	*	+[c]
Non-metallic Mineral Products	86.34	39.47	18.61	-	-
Basic Metal Products	60.52	43.77	18.80	-	-
Metal Products	42.35	27.66	25.05	-	-
Non-electrical Machinery	23.83	34.15	72.08	+	+
Electrical Machinery & Appliances	79.92	59.05	86.92	-	+
Transport Equipment	2.16	38.83	48.11	+	+
Photographic and Optical Goods and Scientific Instruments	n.a.	9.43[b]	87.64	*	+[d]
Miscellaneous	3.51	4.72	37.52	+	+
Total Manufacturing	38.46	30.30	58.53	+	+

Notes: [a] 1966; [b] 1969; [c] 1966-1974; [d] 1969-1974.

Sources: Derived from Appendix Tables A-3.6 and A-3.7.

Table 3.6

Ratio of Direct Exports to Gross Output of Pioneer Firms by Industry Groups: 1969, 1971, 1973

(Percentage)

Industry	1969	1971	1973	Change 1960-71	Change 1971-73
Food and Beverages	36.00	33.50	33.98	–	+
Wearing Apparels and Made-up Textiles Goods	73.47	66.27	82.58	–	+
Textiles	—		80.00		
Wood and Cork Products	97.14	91.30	96.10	–	+
Paper and Paper Products	50.00	57.14	38.10	+	–
Leather and Leather Products	35.71	40.63	32.35	+	–
Basic Industrial Chemicals	40.63	31.92	30.19	–	–
Other Chemical Products		34.38	68.18		+
Petroleum Refinery and Retroleum Products	24.26	49.01	49.02	+	+
Non-metallic Mineral Products	12.50	3.03	8.51	–	+
Basic Metals	14.00	12.16	16.91	–	+
Metal Products and Mechnical Engineering	34.55	23.40	44.25	–	+
Electrical Products			61.35		
Electronic Products	61.80	85.14	91.04	+	+
Electronic Components			97.87		
Transport Equipment	96.97	83.87	83.51	–	–
Plastic Products	30.00	42.31	52.17	+	+
Photographic and Optical Goods and Precision Equipments	69.57	88.89	77.44	+	–
Miscellaneous		82.86	75.00		
Total Manufacturing	38.33	53.83	80.97	+	+

Sources: Derived from Appendix Table A-3.9.

ratios for some pioneer firms such as "textiles," "clothing," "wood and cork products," "petroleum refinery and petroleum products," "electronic products and components," "transport equipment," "plastic products," and "photographic and optical goods" are exceptionally high.

3.5 Factors Affecting Manufacturing Output Growth

We turn next to examine the factors responsible for the growth of manufacturing value added and exports. These may include restructuring of the institutional framework for development, economic incentives given to industries, control of unions, the policy of wage restraint and direct private foreign investments. Many of these factors cannot be quantified. Our analysis of factors affecting manufacturing output growth will be based on a model adapted from Chenery's (1960) cross-section study of industrial growth "patterns."

(a) The Model

Chenery's model (1960) was designed to analyse industrial growth patterns among countries. Since there is a problem of specification in applying a cross-section model to time-series data, we shall reformulate the model.

We begin with the following accounting identity for an open economy:

$$(3.1) \qquad Q_i = D_i + X_i - M_i$$

where Q_i = domestic production of manufactured product i,

D_i = domestic demand of i, broadly defined

X_i = the export of i

M_i = the import of i

Domestic demand of manufactured product i (D_i): Final demand for each product is dependent upon per capita income (y). Furthermore, we have a priori belief that the size of the domestic market may be a constraint on domestic output growth. Rising income will enlarge effective demand, but the small size of the domestic market constitutes a permanent constraint to the increase of domestic output, particularly for those industries that are subject to the principles of economies of scale. Year-to-year variation of population size (N) can be used as a proxy for changes in the size of the economy. However, in the short run, it could be assumed that there would be no appreciable "size" effect on the industrial output. Thus, year-to-year variation of population could also be interpreted as one of the explanatory variables responsible for the consumption changes of commodities. Domestic demand for product i can therefore be expressed in the following functional form:

(3.2) $D_i = D_i\ (y,\ N)$

Exports and Imports of Product i (X_i and M_i): In an open economy, foreign trade will have an important impact on the level of domestic production. For a resource-rich country, it may export raw materials in exchange for manufactured imports rather than produce them locally. This will enable the country in question to reap the comparative advantage of trade. On the other hand, a resource-poor country may resort to developing a strong industrial sector based on manufactured exports, which generally have high import content of materials, so as to obtain the necessary foreign exchange to pay for the imports of primary products.

Exports are dependent on the export price of Singapore ($P_{xi,s}$) relative to that of the rest of world ($P_{xi,w}$) or ($P_{xi,s}/P_{xi,w}$). Hence, the export function can be expressed in the following form:

$$(3.3) \qquad X_i = X_i \, (P_{xi,s}/P_{xi,w})$$

The level of imports depends on domestic per capita income. Furthermore, the size of the domestic market will have an impact on the cost of local production and hence the fraction of imported goods. Thus, the following function can be presented:

$$(3.4) \qquad M_i = u_i \, (D_i + X_i)$$

$$(3.5) \qquad u_i = u_i \, (y, N)$$

where u_i = fraction of total output that comes from imports.

Substituting (3.4) into (3.1), we get

$$\begin{aligned} Q_i &= D_i + X_i - u_i \, (D_i + X_i) \\ &= D_i + X_i - u_i D_i - u_i X_i \\ &= (1-u_i)D_i + (1-u_i)X_i \\ &= (1-u_i) \, (D_i + X_i) \end{aligned}$$

or: $$(3.6) \qquad Q_i = \left[1 - u_i(y, N)\right] \left[D_i(y, N) + X_i(P_{xi,s}/P_{xi,w})\right]$$

Equation (3.6) is the basic function of our time-series model. According to Chenery, equation (3.6) can be expressed as the following functional form:

$$(3.7) \qquad Q_i = f \, (y, N, P_{xi,s}/P_{xi,w})$$

In equation (3.6), the export price index for Singapore relative to the rest of the world posed a problem in our statistical analysis since there is no industrial export price index in Singapore. On the other hand, industrial exports depend on a host of other supply and demand factors such as exchange rates, marketing, commodity composition, market distribution and others (see Chapter VI). To simplify the analysis, we use manufactured exports (X_i) as a composite or proxy variable for relative price changes and other supply and demand factors. The effects of these variables are subsumed in the year-to-year variation of manufactured exports. It is hypothesized that there exists a positive relationship between manufacturing output and exports in the process of industrial growth. With an outward-looking industrialization policy beginning in 1965, there was an emergence of manufactured exports which provides a chain mechanism for an increase in investment, "learning by doing," economies of scale and qualitative improvements. Hence, growing manufactured exports will affect the growth of industrial output.

We also believe that changes in government's policy may have an effect on the level of expansion of domestic output. The underlying hypothesis is that a policy shift from protectionist import substitution to active promotion of manufactured exports influenced the output growth of the manufacturing sector. Due to the lack of statistical data to measure the effects of specific policy measures such as economic incentives, we measure this impact through inclusion of a dummy variable (G). The value of this variable is 0 for the years 1960-1965, indicating a period of import substitution and 1 for the years 1966-1974 which were outward-looking.

The regression model of the above formulation can thus be expressed as follows:

(3.8) $Q_i = f\ (y, N, X_i, G)$

where subscript i denotes individual industry groups.

The double-logarithmic equation has been chosen for statistical verification as it gives a better "fit" of industrial growth than the linear function. This double-logarithmic function was also used by Chenery (1960), the United Nations Study (1963) and Temin (1967). The function fitted was as follows:

$$(3.9) \quad \log Q_i = a + b_1 \log y + b_2 \log N + b_3 \log X_i + b_4 G + e_i$$

where a is the constant, $b_{i's}$ the respective regression coefficients (or elasticities) and e_i the error term. The objective of the equation is to explain the value added (Q_i) of total manufacturing and of individual sectors in terms of the observed values of the explanatory variables in Singapore.

(b) Empirical Results

The results of the regression estimated by ordinary least-squares (OLS) methods are given in Table 3.7. In all cases, the selected variables explained a large part of the behavior of manufacturing value added as indicated by the high $\bar{R}^2$'s. All regression equations were statistically significant at 0.01 level by using F-tests. The first equation in Table 3.7 indicates that there was a positive effect of consumption in total manufacturing output with respect to per capita income. The estimated income elasticity of output for total industries ($\hat{b}_{01}$) was 0.410; that is to say, assuming other independent variables were held constant, the value added of total manufacturing increased 0.410 percent for every one percent increase in per capita income. This consumption effect was statistically significant. Eleven industries had positive income elasticities and seven of them (i.e. "food," "paper and paper products," "printing and publishing," "textiles, clothing and footwear," "metal products," "non-electrical

[redacted]

Table 3.7

Multiple Regressions of Manufacturing Output: Time-series Analysis, 1960 - 1974[a]

Manufacturing Sector (i = 0,1,2,....,17)	Regression Coefficients[b] $\hat{a}$	$\hat{b}_{i1}$	$\hat{b}_{i2}$	$\hat{b}_{i3}$	$\hat{b}_{i4}$	$\bar{R}^2$	D.W.
(0) Total Manufacturing	-21.216	0.410	3.388*	0.425*	-0.046	0.999	2.303
		(2.781)	(8.683)	(6.150)	(-1.118)		
(1) Food	-17.367	0.429*	2.865*	0.273*	0.058	0.990	1.475
		(2.067)	(2.190)	(2.185)	(0.551)		
(2) Beverages	-6.306	0.049	1.564	0.451*	0.103	0.795	2.679
		(0.231)	(1.173)	(2.302)	(0.891)		
(3) Tobacco	-44.617	-0.599	7.696*	0.120	-0.219	0.782	1.657
		(-1.451)	(2.572)	(1.271)	(-0.742)		
(4) Wood and Cork Products	-14.195	-0.653	2.538*	0.951*	0.881	0.995	1.322
		(-3.447)	(3.750)	(8.758)	(1.208)		
(5) Furniture and Fixtures	-62.542	-0.629	9.789*	0.276*	-0.218	0.964	1.836
		(-2.250)	(7.081)	(2.302)	(-1.405)		
(6) Paper and Paper Products	-19.998	0.786*	2.426*	0.531*	0.031	0.984	1.884
		(2.554)	(1.879)	(2.993)	(0.163)		
(7) Printing and Publishing	-1.222	0.695*	0.622	0.198*	0.023	0.991	2.499
		(4.510)	(1.336)	(2.650)	(0.381)		
(8) Textiles, Clothing, Footwear and Leather Products	55.080	0.750*	-8.329	1.106*	0.583*	0.975	2.003
		(1.844)	(-1.649)	(3.392)	(2.147)		
(9) Rubber Products	-38.438	-0.365	5.908*	0.566*	0.451*	0.972	2.780
		(-1.278)	(3.905)	(4.025)	(2.621)		
(10) Chemicals, Chemical and Petroleum Products	-84.328	-0.114	12.552*	0.141	-0.128	0.987	2.250
		(0.337)	(7.352)	(0.943)	(-0.703)		

Table 3.7 (Cont'd)

Multiple Regressions of Manufacturing Output: Time-series Analysis, 1960 - 1974[a]

Manufacturing Sector (i = 0,1,2,....,17)	$\hat{a}$	$\hat{b}_{i1}$	$\hat{b}_{i2}$	$\hat{b}_{i3}$	$\hat{b}_{i4}$	$\bar{R}^2$	D.W.
	Regression Coefficients[b]						
(11) Non-metallic Mineral Products	-46.824	0.433	7.094*	0.035	-0.487	0.872	1.750
		(0.941)	(2.830)	(0.145)	(-1.454)		
(12) Basic Metal Products	-56.505	0.569	7.936*	0.185*	-0.135	0.950	1.567
		(1.369)	(2.703)	(1.919)	(-0.481)		
(13) Metal Products	-35.396	0.457*	5.182*	0.321**	-0.197	0.992	1.254
		(2.749)	(5.017)	(1.656)	(-2.335)		
(14) Non-electrical Machinery	22.380	2.925*	-4.650	0.630	0.328**	0.969	1.663
		(3.031)	(-1.998)	(0.033)	(1.395)		
(15) Electrical Machinery and Appliance	-19.260	-0.738	3.316*	0.940*	-0.068	0.995	2.869
		(-1.663)	(2.610)	(11.065)	(-0.508)		
(16) Transport Equipment	-47.328	1.456*	6.159**	0.052	-0.002	0.968	0.948
		(3.978)	(1.562)	(0.382)	(-0.005)		
(17) Miscellaneous Manufacturing	-70.003	0.093	10.241*	0.155	-0.300	0.944	1.944
		(0.212)	(3.419)	(1.321)	(-0.980)		

Notes: t-values are in brackets under regression coefficients; $\bar{R}^2$ = correlation coefficient of determination corrected for degrees of freedom; D.W. = Durbin - Watson Statistic.

Test of significance: [a] All regression equations are statistically significant at 0.01 level by using F-tests;
[b] The regression coefficients with an asterisk are significant to at least 0.05 level as performed by t-tests;
** = significant at 0.10 level.

Sources: Estimated from Appendix Table A-3.5 and A-3.7, A-3.8.

machinery" and "transport equipment") were significantly different from zero. The income coefficients of "non-electrical machinery" and "transport equipment" exceeded unity, i.e. output rose more than proportionately with income. Income coefficients of other industry groups were either negative or statisticantly insignificant.

Table 3.7 also indicates that there was a positive "size" effect in the changes of total manufacturing output. The regression coefficient ($\hat{b}_{o2}$) was 3.388 which was statistically significant at the 0.05 level. Among the seventeen industry groups, fifteen population regression coefficients ($\hat{b}_{i2}$) had positive signs and thirteen were statistically significant ("food," "tobacco," "wood and cork products," "furniture and fixtures," "paper and paper products," "rubber products," "chemicals, chemical and petroleum products," "non-metallic mineral products," "basic metal products," "metal products," "electrical machinery and appliances," "transport equipment" and "miscellaneous products.") Two positive regression coefficients were statistically insignificant ("beverages" and "printing and publishing") and two had negative signs ("textiles, clothing and footwear" and "non-electrical machinery.") Taking both income and population coefficients together, there was a considerable domestic "consumption" effect in the expansion of manufactured output.

Manufactured exports (X_m) were positively related to manufacturing output for total industries and all industry groups (Table 3.7). The elasticity of value added of total industries with respect to manufactured exports was 0.425. Regression coefficients of eleven industry groups out of seventeen were significantly different from zero. These industries are mainly export-oriented. Production of industries such as "tobacco," "non-metallic mineral products" and "basic metals" is mainly geared to the domestic market and their regression coefficients were not statistically significant. The strong positive association between Q_m and X_m for total manufacturing and other high-growth industries tends to support our hypothesis that manufacturing growth in Singapore is export-induced.[13]

The dummy variable added little to the explanation of output variance. In eight cases, the policy shift influenced output behaviour in a positive direction, but in only two cases was statistically significant. In nine cases, there did not appear to be a positive effect. This, however, does not necessarily mean that the relationship is non-existent. A manufacturing upsurge did take place when the government began to actively promote exports after 1965. The fiscal policy measures described in Appendix B could have had an independent effect on output growth, but this could not be verified empirically due to the lack of adequate data.

The above findings from time-series regression analysis suffered from the shortcoming that the observed period is short and hence the degrees of freedom dropped to a low level. This may result in a higher standard error of regression coefficients and lower t-values for some industries. With a larger number of observations, it is possible that some coefficients could become statistically significant. Furthermore, multicollinearity between per capita income and manufactured exports appeared to be high for some industries. In addition, regression disturbances were serially correlated in some cases as detected by the Durbin-Watson test. Although our findings should be interpreted with caution because of the above limitations, it nonetheless suggests that manufacturing output is significantly influenced by manufactured exports.

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[13] Further evidence using a different approach will be demonstrated in Chapter IV.

3.6 Role of Direct Foreign Investment

Before 1960 there were several foreign manufacturing firms operating in Singapore. However, the main surge of foreign direct investment did not come until the industrialization impetus of the 1960s. As shown in Appendix Table A-3.10, total foreign investment in fixed assets was S$157 million in 1965. By 1970 this had increased to S$995 million and to S$3,054 million in 1974, a 20-fold increase within 10 years. In 1965 United Kingdom led all other countries in total investments, followed by the Netherlands, Japan and the United States. By 1969, United States had surpassed all other countries.[14] In 1974, U.S. foreign investment accounted for 35.4 percent of total foreign investment, the United Kingdom 13.9 percent, the Netherlands 13.8 percent, Japan 11.6 percent, West Germany 3.5 percent and others 21.8 percent (see Appendix Table A-3.10).

Foreign investment in the manufacturing sector by industry groups as of the end of 1965, 1970 and 1974 are shown in Appendix Table A-3.11. In 1965 "petroleum refinery and petroleum products" accounted for 63.1 percent of total foreign investment. Other industries were "basic metal industries, metals and engineering and transport equipment" (12.1 percent), "food and beverages" (5.7 percent) and "chemicals" (3.2 percent). In 1974, petroleum refinery and petroleum products was still the single largest area of foreign investment, but "electrical products," "electronic products," "scientific equipment, photographic and optical goods" and "plastic products" industries showed significant expansion. Oil refineries now make Singapore the world's third largest refinery center.[15] In the past, Japanese

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[14] See Singapore, <u>Economic Development Board Annual Report 1974-1975</u>, p. 16.

[15] The two largest refinery centers in the world are Rotterdam and Houston.

investment was concentrated in shipbuilding andrepair, but is now branching out into machinery and equipment, including precision ball bearings, photographic and precision equipment. Electronic and electrical products and components are the major fields for U.S., Dutch and German firms. Hong Kong and Taiwan investments are mainly in textiles, clothing, radio and other consumer goods.[16]

Foreign investment contributed significantly to industrial activity in Singapore. Some of the major indicators are shown in Table 3.8. In 1971, firms with foreign investment made up 25.7 percent of the total number of firms, but accounted for 63.2 percent of total employment, 64.9 percent of total output and 75.3 percent of value added. Although it has

Table 3.8

Contribution of Firms with Foreign Investment*
in the Manufacturing Sector, 1971

	Census Total	With Foreign Investment	% of Census Total
No. of Establishments	1813	466	25.7
Employment	140,552	68,674	63.2
Output Value (S$m)	4,699	3,050	64.9
Value Added (S$m)	1,367	1,029	75.3
Direct Exports (S$m)	1,955	1,763	90.2

Note: * including wholly foreign firms and joint ventures with 10 or more workers.

Source: Singapore, Economic Development Board Annual Report 1971-72, p. 9.

[16] Hughes and You (1969).

been claimed that foreign investment limits export expansion,[17] this does not seem to be the case of Singapore. On the contrary, foreign investors helped Singapore develop export markets. Firms with foreign investment accounted for 90 percent of total direct exports. This is an exceptionally high proportion.[18]

A study conducted by the National Productivity Board found that foreign firms performed better than local firms in terms of value added per worker.[19] Similar results were obtained in a 1972 study by the same board of manufacturing firms in Jurong. Foreign-owned companies had a higher level of labor productivity performance ~~than joint~~ ventures and local firms.[20] One of the factors which accounts for the greater productivity of foreign firms is the high degree of export orientation of the firms. With larger markets, these firms could enjoy economies of scale.

In the early 1960s most foreign investors were welcome in Singapore as a means of easing unemployment. Beginning in the late 1960s, high technology industries were given priority primarily because they were expected to make the most significant contribution to skill development and technological advancement. In addition, the products would be marketable on a world-wide

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[17] Evidence on this point varies and depends greatly on a country's general situation. For example, Safarian (1964) found that foreign-owned firms in Canada had a better record of exports than Canadian-owned firms.

[18] Hughes (1969) reported in the survey that "some of the foreign investors limited the ability of their Singapore-affiliated forms to export, but they were a minority. In other cases a company's international policy had the same result although no formal agreement to this effect was signed, but the number of such companies was again small."

[19] The study covered 12 industries and 165 firms over the period 1968-1970. Goh and Chew (1973).

[20] Lau (1972).

basis and had good growth prospects.

In summary, the participation of foreign investment in the industrial activities of Singapore has contributed significantly to the country's industrial growth. The beneficial effects of multinational corporations on LDCs are the technological know-how and the ready international markets they bring with them. These two factors were stressed by the Government of Singapore.[21] The experience of Singapore indicates that it is possible for a small country with limited natural resources to develop an expanding variety of modern, sophisticated manufactured goods for exports. As stated by Helleiner, "manufacturing for exports is the "new frontier" for international business in the less-developed world, and process and component specialization is likely to become the chief, or at any rate the easiest, avenue for less-developed countries seeking to expand their manufactured exports."[22]

3.7 Assessment of Singapore's Industrialization Strategy and Policies

During 1959-1965 Singapore adopted a protectionist import-substitution policy,[23] hoping that a Singapore-Malaysia Common Market would be established

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[21] Goh Keng Swee, architect of Singapore's industrialization and one time Finance Minister (now Deputy Prime Minister), once stated that "we have made long and strenuous efforts to attract foreign investment into Singapore, but not because we need the money. The high level of our overseas assets show that we have more than we can usefully spend in Singapore. We welcome foreign investors for two things they brought with them - technology and market." Goh (1972), p. 278.

[22] Helleiner (1973), p. 31.

[23] Unlike many developing countries whose protection applied to wide-ranging import-competing industries, Singapore's protective tariffs were applied to selected commodities only.

in the near future. With the separation of Singapore from the Federation of Malaysia in August 1965, Singapore switched to an outward-looking policy (see Chapter I). This proved to be a wise policy shift as shown by rapid industrial growth after 1965 (see Tables 3.1 and 3.2). Many developing countries which have vigorously pursued import substitution policy have faced difficulties after the "easy phase" of import replacement has been completed. This phase comes to an end because of the limited domestic market and the lack of foreign exchange to pay for the raw materials and other imports required. This policy also leads to a distortion of resource allocation with high-cost domestic industries. The experience of the Philippines and Thailand which vigorously pursued protectionist import substitution policies in the 1950's and 1960's are cases in point. Myint, in a summary report on Southeast Asia's economy writes:[24]

> The Philippines went through the easy phase of import substitution during the 1950's, but suffered from slow industrial expansion and balance of payment difficulties during the 1960's. This is characteristic of the difficult phase of import substitution. Thailand, having gone through the easy phase of import substitution during the 1960's, may now be approaching the difficult phase.

However, there are also successful cases of import substitution development. Taiwan and South Korea concentrated their import-substituting efforts initially on light and relatively labor-intensive industries which did not involve significant economies of scale. Hence, these industries could be run reasonably efficiently with low output volumes. Although both Taiwan and South Korea shifted their policies from import substitution to manufactured export expansion in the 1960's, they did not remove all

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[24] Myint (1972), p. 59.

government intervention inherited from the former strategy.[25] Singapore's experience is rather unique in the sense that the inward-looking policy lasted only a brief period from 1959-1965. Furthermore, its import substituting efforts also concentrated on selected labor-intensive commodities and light industries. Its tariffs were also generally lower than those of other Southeast Asian countries.[26] When the policy shift took place in 1966, custom tariffs for the protected commodities were gradually removed.[27] As a consequence, the competitive efficiency of the formerly protected industries has increased.

The institutional arrangements and policy measures implemented are outlined in Appendice B and C. Singapore was successful in creating a modern infrastructure to meet industrial needs. Few developing countries can match the quality of public services such as water, power, telephone, communication and port facilities provided by Singapore. Another achievement was the creation of industrial estates in Jurong Town and other locations on the island. These estates were used to overcome two potential barriers: (a) the limited availability of land at reasonable prices, and (b) the effective provision of economic infrastructure. The industrial estates in Singapore have reduced investors' capital requirements by providing factory buildings and land on easy terms. The Jurong industrial estate has absorbed a high proportion of the new industries and appears to have been a

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[25] Donges (1976).

[26] See Asian Development Bank Special Report (1971), pp. 250-251, Appendix IV.

[27] By 1973, only 106 items of commodities were under protective tariffs as compared to 315 items in 1969. See Lim-Nair-Razak (1974). p. 117.

substantial incentive for the industrial development of Singapore.

The Economic Development Board (EDB) of Singapore is efficient and successful in promoting investment.[28] EDB initially concentrated on assisting new entrepreneurs, particularly foreign investors (The specific functions of EDB are outlined in Appendix C). Investors were not faced with long and tedious negotiations with a number of government organizations. This undoubtedly played a role in Singapore's industrialization.

To increase manufactured exports, assistance by government is needed in certain cases in order to offset higher costs of industries created by protection and other obstacles in foreign markets. In Singapore, exporters can obtain drawbacks on imported inputs and receive substantial income tax concessions for developing new markets (see Appendix B). These forms of export-subsidy may enable exporters to practice marginal cost pricing without a large domestic market base. Such export incentives could be justified on infant-industry ground. However, there is no evidence to show that these tax concessions have reinforced Singapore's export drive.

Singapore has granted income tax concessions varying from five to ten years to "pioneer firms" as a stimulant to investment (see Appendix B). These provisions are probably more attractive to local entrepreneurs. Their value to foreign investors is doubtful. In a survey of foreign investment in Singapore, it was found that other factors such as government's "pro-business attitude," internal political stablity and effective government

[28] Singapore's EDB, established in 1961, was the first agency of its kind set up in Southeast Asian countries to deal with the problems of stimulating investment in industries. See Asian Development Bank Special Report (1971), Part III.

administration were given more weight by the respondents.[29] Tax concessions involve potential loss of revenue to the government.

A bottleneck faced by Singapore was the shortage of skilled workers and qualified technicians, engineers, and professionals. Technical and professional schools have been expanded and on-the-job training intensified (see Appendix C). The main obstacle to attracting skilled workers into manufacturing activities is the wage structure of the economy which is biased against blue-collar workers. At present, earnings of skilled workers are not much higher than an ordinary white-collar worker in the service and commercial sectors.[30] The long-term solution is to restructure the wage system in favor of the skilled workers.

In Singapore, the manufacturing sector has a large number of small- (5 to 29 workers) and medium-scale (30 to 99 workers) establishments. In 1973, 72.1 percent of all establishments were small, 17.9 percent medium and 10 percent large-scale. Despite the large number of small and medium establishments, their contribution to employment, gross output and value added were less than 30 percent (Appendix Table A-3.12). Although scale economies are an important constraint on the development of small firms, there are a considerable number of industries whose plants can operate

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29 Hughes and You (1969). In a summary report on Southeast Asia's economy in the 1970s, Myint also stated that "the first thing that should be emphasized is that foreign investors are less influenced by the "hand-out" of tax concessions than by factors which affect the total business environment. They are more concerned with the reduction of bureaucratic controls and administrative inefficiency which hinders the day-to-day running of the business, and with the longer-term sense of security and freedom from political uncertainties which enable them to make long-term business decisions." Myint (1972), p. 101.

30 Singapore, National Productivity Board, A Preliminary Study of Wage Structure in Singapore (mimeographed), June 1973.

efficiently at low levels of output. Staley and Morse[31] have shown a large number of small industries co-exist side by side with large corporations in the American economy, evidently at efficient levels of production. For the domestic market, the advantage of minimum transport costs would allow many local firms to operate at competitive levels. In the past, the Government of Singapore has largely assisted large industry. Increased government support of the modernization of techniques and skills, management and marketing for small industry offers considerable potential.

Summary

We have outlined the performance and salient characteristics of output growth and export expansion of the manufacturing sector in Singapore after 1959. In our time-series regression analysis of the behavior of manufacturing output, we have shown that manufacturing output growth can be partially "explained" by the expansion of manufactured exports which tends to support our hypothesis that manufacturing growth was export-led. In addition, we have found positive consumption effects as indicated by positive income and population coefficients for the majority of industry groups. We have also examined the role of private foreign investment. Data showed that foreign firms contributed significantly to manufacturing activity in terms of gross output, value added and direct exports. In the next chapter, we shall undertake an extended analysis of "sources" and patterns of manufacturing growth by means of a shift-share model.

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[31] Staley and Morse (1965).

CHAPTER IV

"SOURCES" OF GROWTH OF MANUFACTURING INDUSTRIES: A SHIFT-SHARE ANALYSIS

In this chapter, we shall focus our attention on the process of transition from initial import-substitution industrialization to one oriented towards exports. A shift-share analysis based on a modified Chenery-Lewis-Soligo model[1] which apportions output and value added growth in manufacturing to (i) import substitution, (ii) domestic demand expansion, and (iii) export expansion will be utilized.

As there is disagreement about an appropriate measure of import substitution, we shall first assess the possible alternatives. We shall argue that Chenery's reference framework of non-proportional growth is a sound measure with reference to a small open economy such as Singapore. The shift-share analysis will provide additional data on the interrelationships between output (value added) and manufactured exports and on structural changes in manufacturing.

4.1 Concepts and Measures of Import Substitution

Various measures of import substitution have been developed. The several measures will be examined and the most appropriate one selected.

(a) Zero Growth:

Some define any increase in domestic output of an import-competing industry as import substitution since in its absence additional imports

[1] Chenery (1960), Lewis-Soligo (1965) and Lewis (1969).

would have been necessary to maintain the same availability.[2] Hence, import substitution is said to take place in industry i when

$$Q_{i2} > Q_{i1} > 0$$

where Q_{i2} is the output of industry i in period 2 and Q_{i1} output of industry i in initial period 1. This definition is valid only under zero growth when all increases of domestic production can be considered import replacement. This does not take into account growth due to internal market or export expansion.

(b) Optimal Growth:

Desai[3] suggests an alternative measure of import substitution based on optimality in a general equilibrium framework for an economy.[4]

Let O_1M_1, O_2M_2 and O_1S_1, O_2S_2 denote optimum imports and supplies of commodity x respectively. (Subscripts represent initial and later periods.) If $O_1M_1/O_1S_1 > O_2M_2/O_2S_2$, then there is a positive import substitution. In other words, either an import decrease or supply increase in period 2 (in "optimum" amount) leads to positive import substitution. This measure is based on the assumption that optimum policies were followed in each period.[5]

The limitations of this measure have been explored by the same author.[6] Desai's concept of "optimal" import substitution is of use only if optimum

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[2] This was pointed out in a study by Hoffmann and Tan (1971).

[3] Desai (1969).

[4] Optimality is defined here as the point of tangency of social indifference curve and production possibility curve in a two-factor two-good trade model.

[5] Desai (1969), p. 315.

[6] Desai (1969), pp. 316-317.

imports and supplies can be meaningfully defined and empirically identified. The basic problem with this concept is the difficulty of identifying such an optimum empirically.

(c) Balanced Growth:

Hoffmann and Tan suggest the use of balanced growth a la Nurkse as a reference framework, i.e. "growth according to the development of internal market."[7] Nurkse's[8] premise is that savings are not necessarily a scarce factor in the process of industrialization because there are potential savings in such forms as disguised unemployment and unproductive consumption. It is rather the shortage of demand resulting from the small size of the domestic market or the low level of purchasing power for domestically produced goods that has discouraged industrial development. Therefore, the doctrine of balanced growth was advanced:[9]

> The solution seems to be a balanced pattern of investment in a number of industries, so that people working more productively, with more capital and imported techniques, become each others' customers. In the absence of vigorous upward shifts in world demand for exports of primary products, a low income country through a process of diversified growth can bring about upward shifts in the domestic demand schedules by means of increased productivity and therefore increased real purchasing power. In this way, a pattern of mutually supporting investments in different lines of production can enlarge the size of market and help to fill the vacuum in the domestic economy of low income areas.

A measure of import substitution following Nurkse' balanced growth framework can be derived as follows:

Let D be the size of internal market. The size of the internal market

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[7] Hoffmann and Tan (1971), p. 146.

[8] Nurske (1953).

[9] Nurkse (1958), reprinted in Meier (1970), 2nd ed., p. 363.

can be defined as total supply net of exports, hence:

$$D = Q + M - X$$

where Q is the domestic output, M imports and X exports. The measure of import substitution thus becomes the import-market ratio:

$$\frac{M}{Q + M - X} = \frac{M}{D}$$

If the import-market ratio decreases due to a decrease in M and/or an increase in production net of exports, import substitution has taken place. This approach may be applicable to large countries where it is possible to grow in line with the internal market for an industry and where exploitation of scale economies does not depend on external markets. However, Nurkse's doctrine is not applicable to a small country like Singapore where economies of scale and the lack of a variety of resources preclude the simultaneous establishment of a large number of industries producing for the domestic market.

(d) <u>Non-proportional Growth</u>:

Non-proportional growth has been incorporated into Chenery's[10] concept of import substitution. Chenery apportions the increase of domestic industrial output to (i) growth in demand and to (ii) changes in the ratio of domestic output to total supply, which he calls import substitution. We shall reformulate Chenery's model as follows:

Notations:

Q = domestic production of manufactures
M = manufactured imports
S = Q + M, total supply of manufactures

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[10] Chenery (1960).

H = domestic demand for manufactures[11]

X = manufactured exports

D = H + X, total demand for manufactures

Y = GNP

Subscripts 1 and 2 represent base and later periods respectively.

We begin with the identity:

$$Q + M \equiv S \equiv D \equiv H + X \quad \text{.................. (1)}$$

where total supply equals total demand.

Define:

$$u \equiv \frac{Q}{S} \quad \text{..................... (2)}$$

Chenery analyses the difference between the actual growth of output in an industry and the growth which would have occured if that industry had grown by the same proportion as GNP. He describes the difference as "the deviation from proportional growth," δQ. By definition, the following identity holds:

$$\delta Q \equiv Q\left[\frac{dQ}{Q} - \frac{dY}{Y}\right] \quad \text{.............. (3)}$$

From (2),

$$Q \equiv uS \quad \text{......................... (4)}$$

$$dQ \equiv udS + Sdu \quad \text{............... (5)}$$

Since: $Q \equiv uS \equiv u(H + X)$

In addition: the definitions of δS, δH and δX are analogous to that of δQ,

Hence:

$$\delta Q \equiv u(\delta H + \delta X) + Sdu \quad \text{......... (6)}$$

$$(\because \delta S \equiv \delta H + \delta X)$$

[11] The domestic demand for manufactures includes both intermediate and final demand, broadly defined.

or:[12] $$\delta Q = u_1 (\delta H + \delta X) + (u_2 - u_1) S_2 \quad \ldots\ldots (7)$$

On the basis of equation (7), Chenery states that the non-proportional growth of domestic output, δQ, is due to two causes:

(a) Deviation from proportional growth of demand for Q:

$u_1 (\delta H + \delta X)$

This growth in demand is based on the assumption that the ratio of output to total supply is held constant.

(b) Import Substitution: $(u_2 - u_1) S_2$

In essence, this portion is the change in domestic output implied by the actual change in the ratio of domestic output to total supply.

Define: $$m = \frac{M}{S} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

where m is the ratio of imports in total supply.

$$\because \; u + m = 1 \quad (\because \; S = M + Q) \ldots\ldots (9) .$$

It can thus be verified that $(u_2 - u_1)S_2 = - (m_2 - m_1)S_2$. This means that an increase in the ratio of domestic production to total supply implies a decrease in import content, or vice versa. Therefore, import substitution can be defined in terms of the proportion of imports in total supply. If domestic production rises faster than imports, import substitution is said to have taken place; if imports rise at a more rapid rate than domestic output, the opposite of import substitution (negative import substitution or "import liberalization") is occuring.

Chenery's definition of import substitution with reference to non-proportional growth has some theoretical justification for small open

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[12] It can also be expressed in the following discrete form:

$$\Delta Q = u_2 S_2 - u_1 S_1 = u_1 (S_2 - S_1) + (u_2 - u_1) S_2$$
$$= u_1 \Delta S + (u_2 - u_1) S_2 .$$

economies. Theoretically, a small country faces a given set of prices at which it is able to exchange commodities. Harry Johnson demonstrated that in a neo-classical two-factor two-good model, growth based on Hicksian neutral technical progress in one industry will lead to an absolute reduction in the output of the other at constant terms of trade.[13] Similarly, Rybczynski has shown that in the same neo-classical trade model, the growth of a factor will lead to a decline in the output of the industry using the other factor intensively.[14] In both of these cases, non-proportional growth would be the consequence. Furthermore, from a policy point of view, non-proportional growth has compelling relevance for a small open economy like Singapore which lacks natural resources.

4.2 A Modified Model of "Sources" of Industrial Growth á la Lewis-Soligo

Having discussed the various measures of import substitution, we shall present a modified model of "sources" of industrial growth along the line of Lewis-Soligo[15] which parallels that used by Chenery.

(a) Analysis of Growth in Gross Output:

We shall first deal with the analysis of growth in terms of gross output. Lewis and Soligo start with the following identity (notations same as the preceeding section):

$$S \equiv D \equiv Q + M \equiv H + X$$

$$Q \equiv uS \equiv u(H + X)$$

[13] Johnson (1961), Chapter III.

[14] Rybczynski (1965).

[15] Lewis and Soligo (1965) and Lewis (1969).

$$\therefore \quad dQ = u\,(dH + dX) + S\,du \quad \ldots\ldots\ldots\ldots\ (10)$$

For finite changes,

$$\Delta Q = u_1\,(\Delta H + \Delta X) + (u_2 - u_1)\,S_2 \quad \ldots\ldots\ (11.a)$$

or: $$\Delta Q = (u_2 - u_1)\,S_2 + u_1\,\Delta H + u_1\,\Delta X \quad \ldots\ldots\ (11.b)$$

Since $\Delta S \equiv \Delta D \equiv \Delta H + \Delta X$,

$$\therefore \quad \Delta Q = \underbrace{(u_2 - u_1)\,S_2}_{(IS)} + \underbrace{u_1\,(\Delta S - \Delta X)}_{(EDD)} + \underbrace{u_1\,\Delta X}_{(EE)} \quad \ldots\ (12)$$

The change in domestic output has now been separated into three components: (i) import substitution (IS); (ii) expansion of domestic demand (EDD) and (iii) expansion of exports (EE). In order to facilitate inter-industry comparisions of the relative contribution of each component to the change in output, we can divide both sides of equation (12) by ΔQ to express the contribution of each component as a percentage of the total change in industry output. Hence, we obtain:

$$1 = \frac{(u_2 - u_1)\,S_2}{\Delta Q} + \frac{u_1\,(\Delta S - \Delta X)}{\Delta Q} + \frac{u_1\,\Delta X}{\Delta Q} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (13)$$

where the shares of output increases are related to

(i) import substitution

$$\frac{(u_2 - u_1)\,S_2}{\Delta Q},$$

(ii) expansion of domestic demand

$$\frac{u_1\,(\Delta S - \Delta X)}{\Delta Q}$$

and

(iii) export expansion

$$\frac{u_1 \Delta X}{\Delta Q}$$

(b) <u>Analysis of the Growth in Value-added:</u>

The analysis above has been carried out in terms of the gross value of domestic output. From a policy point of view, it is of considerable importance to know the impact of import substitution and export expansion on income and resource allocation. Income creation can be analysed in terms of the growth of value added since this measures the contribution of domestic factors of production to output. If price ratios among activities remain generally unchanged and there are no substantial monopoly rents, the value added figures indicate how factor allocation is affected by import substitution and export expansion. For this reason it is useful to analyse the growth of value added.

The changes in value added can be attributed to the same "sources" as the changes in gross output. However, in addition to changes in demand, the changing relationship between value added and gross output over time and between industries should also be taken into account. Let r be the ratio of value added (V) to gross output (Q), i.e. $r = V/Q$; if r remains constant over time, then the proportion of the change in gross output due to any "sources" would be identical to the proportion of the change in value added. A separate analysis of value added would, therefore, not be necessary. However, different ratios for different industries would imply that if industries grow at different rates over time, the ratio for the sector as a whole will change.

To decompose the change in value added into its components, first define:

$$r = \frac{V}{Q} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (14)$$

then:

$$V = r\,Q$$

$$= urS \quad (\because\ u = \frac{Q}{S}) \ldots (15)$$

$$\therefore\ dV = u\,r\,dS + r\,S\,du + u\,S\,dr \ldots\ldots (16)$$

For finite changes, equation (16) can be expressed as:[16]

$$\Delta V = u_1 r_1 (\Delta H + \Delta X) + (u_2 - u_1) r_1 S_2 + (r_2 - r_1) u_2 S_2$$

or: $$\Delta V = \underbrace{u_1 r_1 \Delta H}_{\text{(EDD)}} + \underbrace{u_1 r_1 \Delta X}_{\text{(EE)}} + \underbrace{(u_2 - u_1) r_1 S_2}_{\text{(IS)}} + \underbrace{(r_2 - r_1) u_2 S_2}_{\text{(Residual)}} \ldots (17)$$

The first two terms on the right hand side of equation (17) measure the change in value added due to expansion of domestic demand (EDD) and expansion of exports (EE) respectively when both u and r are the same as in the base period, and third term measures the importance of import substitution (IS) while keeping the value added ratio in the initial period constant. The last term in the equation is a "residual" or the change in the ratio of value added (CRVD) times the value of output in the second period (since $u_2 S_2 \equiv Q_2$). According to Lewis-Soligo, "it measures, among other things, the effect of intra-industry changes in the composition of domestic output as well as changes in technical efficiency. These factors are grouped together and called 'technical change.'"[17]

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[16] From equation (15), changes in value added can also be written as:

$$\Delta V = u_2 r_2 S_2 - u_1 r_1 S_1$$

or: $$\Delta V = u_1 r_1 (S_2 - S_1) + (u_2 - u_1) r_1 S_2 + (r_2 - r_1) u_2 S_2.$$

This result is identical to equation (16).

[17] Lewis and Soligo (1965), p. 105.

Eysenbach has criticized Lewis-Soligo's implicit assumption of "technical change" that "for each industry, changes in the ratio of value added to value of gross output (which depend on the changes in the composition of domestic output) are independent of the "sources" of gross output growth, i.e. of the relative importance of import substitution versus home and export demand growth." It has been shown that "intra-industry changes in the composition of gross output will not be independent of the "sources" of growth and hence neither will the ratio of value added to gross output be independent of the sources of growth."[18] It should also be pointed out that a number of other factors could affect the ratio of value added to gross output, for example, the degree of mechanization and the ratio of skilled to unskilled labor. Changes in the structure of final demand could also have an impact on the "residual."

The empirical analysis of the "sources" of industrial growth in Singapore will be based on the Lewis-Soligo model.[19] It should be noted that Chenery-Lewis-Soligo's measure of import substitution has limitations. As demonstrated in equations (7) and (9), import substitution is considered to have taken place whenever domestic production increases at a faster rate than imports. However, in the case where domestic production remains constant while imports are reduced as a result of austerity measures and import control, import substitution does not occur despite the fact

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[18] Eysenbach (1969), pp. 62-63.

[19] An alternative method to Lewis-Soligo's measurement has been developed by Fane (1971). Fane argues that "the correct measurement of IS, EDD and EE in large changes involves summing the values of the sources of growth in all the component small changes." Yet his statistical results did not differ significantly from that of Lewis-Sologo's. See Fane (1971).

that the measure has a positive value. Furthermore, perfect substitutability between domestic products and competing imports is implicitly assumed in Chenery's definition. This may not be the case because of product differentiation.

4.3 "Sources" of Industrial Growth in Singapore

(a) Definitions and Statistical Problems:

As indicated in equations (12) and (17), the calculation of the "sources" of industrial growth is based on production, import and export data. Production data are taken from Singapore's Report on the Census of Industrial Production which are based on the International Standard Industrial Classification (ISIC). Trade data are taken from the United Nations' Yearbook of International Trade Statistics which are based on the Standard International Trade Classification (SITC). Problems arise when two sets of data which are based on different classification systems are brought together. This problem has been solved by looking at the correspondence of individual commodity groups in the two different classification systems. This is presented in Appendix D.

In Singapore's published trade statistics, only imports and exports are given. However, imports (M) include both retained imports (M_r) and entrepôt imports (M_e), hence: $M = M_r + M_e$. On the other hand, exports (X) includes both domestic exports (X_d) and entrepôt exports (X_e), hence: $X = X_d + X_e$. Therefore, in order to reflect the true picture of total supply ($S = Q + M$) and total demand ($D = H + X$) of manufactures in equations (12) and (17), entrepôt imports and exports should be excluded from M and X. In other words, total supply of manufactures should be considered as the sum of domestic output and retained imports ($S = Q + M_r$) and total demand the sum of domestic demand

and domestic exports ($D = H + X_d$). Unfortunately, entrepôt trade statistics are not published. However, direct manufactured exports data, which are a part of the total sales, are readily available in the Census of Industrial Production after 1960. The latter is used as the measure of "domestic exports", though it is subject to some under-estimation because part of domestic wholesaler sales may be exported.[20] Re-entry exports are estimated by deducting domestic exports from total exports. We are able to estimate retained manufactured imports by deducting entrepôt exports from total manufactured imports. These estimates are subject to two qualifications: first, entrepôt exports are assumed to be equal to entrepôt imports which may not be the case; second, export data is expressed in f.o.b. prices and import data in c.i.f. prices.[21]

Production data covers firms which employ 10 or more workers. Output data for firms employing 5-9 workers are available only for 1965, 1968 and 1973 and are therefore not included. It should be noted, however, that production of industries employing 5-9 workers is only a small proportion of total output.

Finally, it may be noted that all production and trade data are in current prices because no suitable price deflators could be obtained. Therefore, the "sources" of industrial growth as shown in the following tables should be interpreted only as probable orders of magnitute.

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[20] See Report on the Census of Industrial Production, 1960.

[21] Both exports and imports are used in equation 13. Since the export and import valuation systems are different, they will affect the magnitude of our estimates.

(b) "Sources" of Growth in Manufacturing Gross Output:

Six benchmark years have been chosen for the analysis of growth: 1960, 1963, 1965, 1968, 1971 and 1974. We have selected 1960 rather than 1959 as the initial year because of the lack of data on domestic exports in 1959. The periods under review were divided into five sub-periods: 1960-1963, 1963-1965, 1965-1968, 1968-1971 and 1971-1974. These sub-periods correspond to the early development, within Malaysia, early adjustment (post-Malaysia) and two post-adjustment periods.[22] Table 4.1 below gives the results for individual manufacturing industries and for total manufacturing for each of the sub-periods. Results for industries covering 5-9 workers during 1968-1973 were also shown in Table 4.1.

We shall first look at total manufacturing. The empirical results show that import substitution was a major source of growth in sub-periods 1960-1963 and 1963-1965 and accounted for more than 50 percent of total growth. Negative values of import subsitution were found in sub-periods 1965-1968 (-20.86 percent) and 1968-1971 (-1.53 percent). This indicates that import substitution did not contribute to the growth of manufacturing output in these periods. In sub-period 1971-1974, import substitution accounted for some 22 percent of total output growth.

The expansion of domestic demand accounted for over 45 percent of the expansion of output except for the 1963-1965 period. It was particularly important in the 1965-1968 period when it accounted for 110 percent of output growth.

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[22] Critical industrial-relations laws were passed in 1968 and 1971 (see Appendix B).

Table 4.1

Relative Effects of Import Substitution, Expansion of Domestic Demand and Export Expansion on Manufacturing Output by Major Industries

(Percentage)

Year/Industry	IS $\frac{(u_2-u_1)S_2}{\Delta Q} \times 100$	EDD $\frac{u_1(\Delta S-\Delta X)}{\Delta Q} \times 100$	EE $\frac{u_1 \Delta X}{\Delta Q} \times 100$
1960-1963:			
Total Manufacturing	51.50%	46.58%	1.93%
Food	127.78	-34.64	6.83
Beverages	-271.95	532.50	-160.35
Tobacco	15.66	72.58	11.77
Textile, Footwear and Wearing Apparels and Leather Products	-166.84	200.96	15.88
Printing and Publishing & Allied Products	-111.38	178.46	32.93
Paper and Paper Products	295.29	-194.74	-0.54
Rubber Products	388.52	-452.57	164.05
Chemicals, Chemical and Petroleum Products	91.89	6.03	2.09
Non-metallic Mineral Products	50.01	44.56	5.43
Basic Metal Products	71.59	23.35	5.06
Metal Products (excluding machinery and transport equipment)	-23.79	109.34	14.45
Non-electrical Machinery	1664.28	-3178.89	1614.61
Electrical Machinery and Appliance	-490.00	598.06	-8.05
Transport Equipment	-60.72	127.18	33.54
1963-1965:			
Total Manufacturing	50.55	24.25	25.20
Food	108.05	34.42	26.37
Beverages	236.72	-165.05	28.33
Tobacco	14.47	66.01	19.53
Textile, Footwear and Wearing Apparels and Leather Products	100.72	-8.59	7.87
Printing and Publishing	0.12	96.32	3.58
Paper and Paper Products	7.12	72.61	20.28

(Cont'd)

Table 4.1

Industry/Year	IS	EDD	EE
1963-1965: (Cont'd)			
Rubber Products	7.12%	72.61%	20.28%
Chemicals, Chemical and Petroleum Products	5.62	38.19	56.29
Non-metallic Mineral Products	95.06	3.62	1.32
Basic Metals	29.78	62.75	7.43
Metal Products	38.53	69.14	12.33
Non-electrical Machinery	147.40	-61.52	14.12
Electrical Machinery and Appliance	1.08	89.81	9.11
Transport Equipment	-11.97	57.30	54.67
1965-1968:			
Total Manufacturing	-23.25	110.74	12.50
Food	-43.51	117.14	26.37
Beverages	-226.17	329.88	-3.71
Tobacco	-16.56	149.06	-32.50
Textile, Clothing and Footwear and Leather Products	-33.21	122.32	10.89
(a) Textiles[a]	60.17	38.10	1.73
(b) Clothing and Footwear[a]	0.81	72.94	26.25
Printing and Publishing	-46.41	197.97	-51.56
Wood and Cork Products	-7.06	76.42	30.64
Paper and Paper Products	37.99	59.04	2.97
Rubber Products	68.25	33.18	-1.43
Chemicala, Chemical and Petroleum Products	-0.38	90.93	9.45
(a) Chemicals and Chemical Products[a]	-3.39	82.21	21.18
(b) Petroleum Refinery & Petroleum Products[a]	-23.09	106.64	16.45
Non-metallic Mineral Prod.	-23.98	115.74	8.23
Plastic Products[a]	45.63	50.38	3.99
Basic Metals	54.96	37.35	7.70
Metal Products	-41.25	116.83	24.42
Non-electrical Machinery	-197.00	302.55	-5.55
Electrical Machinery and Appliance	66.63	28.36	5.01
Transport Equipment	-32.49	121.88	10.61

(Cont'd)

Table 4.1

Industry/Year	IS	EDD	EE
1968-1971:			
Total Manufacturing	-1.53%	76.59%	24.93%
Food	22.13	64.25	13.62
Beverages	91.56	200.42	-8.87
Tobacco	-122.14	198.21	23.94
Clothing and Footwear	76.12	-7.42	31.30
Printing and Publishing	0.15	75.48	24.38
Photographic and Optical Goods & Scientific Instruments[b]	97.86	1.67	0.48
Wood and Cork Products	0.88	39.25	59.87
Paper and Paper Products	5.82	90.87	3.31
Rubber Products	-61.88	110.85	51.03
Chemicals and Chemical Prod.	225.19	-191.57	66.38
Petroleum Refinery and Petroleum Products	0.87	54.64	44,49
Non-metallic Mineral Products	-34.97	143.01	-8.03
Textiles	79.73	12.27	3.00
Plastic Products	7.65	76.05	16.30
Basic Metals	-376.44	496.70	-20.24
Metal Products	-40.15	134.85	5.30
Non-electrical Machinery	-129.53	218.61	10.92
Electrical Machinery & Appl.	43.48	33.30	23.23
Transport Equipment	7.61	80.27	12.12
1971-1974:			
Total Manufacturing	22.26	45.70	32.05
Food	0.11	67.97	31.93
Beverages	22.48	58.50	19.02
Tobacco	7.90	86.44	5.66
Clothing & Footwear	35.78	1.06	63.16
Printing and Publishing	13.07	69.26	17.67
Photo. & Optical Goods	52.49	36.25	11.26
Wood and Cork Products	-4.27	45.70	58.56
Paper and Paper Products	12.65	83.26	4.09
Rubber Products	-45.57	138.39	7.81
Chemicals and Chemical Prod.	50.11	33.68	16.21
Petroleum Refinery & Petr. Prod.	20.32	26.14	53.53
Non-metallic Mineral Products	-6.34	96.43	9.90
Textiles	75.04	14.57	10.39
Plastic Products	11.40	75.85	12.67
Basic Metals	-29.92	126.22	3.70
Metal Products	-12.71	95.94	16.77
Non-electrical Machinery	69.60	22.92	7.48
Electrical Machinery & Appl.	12.83	48.75	38.42
Transport Equipment	19.26	55.72	25.02

(Cont'd)

Table 4.1

Industry/Year	IS	EDD	EE
1968-1973:*			
Total Manufacturing	12.57%	56.95%	30.48%
Food	15.19	69.53	15.28
Beverages	-72.17	172.99	-0.82
Tobacco	7.52	89.60	72.88
Clothing and Footwear	43.96	16.54	39.49
Printing and Publishing	9.81	70.99	19.20
Photographic and Optical Goods and Scientific Instruments	98.30	1.10	0.60
Wood and Cork Products	1.61	40.50	57.90
Paper and Paper Products	-115.09	201.58	13.51
Rubber Products	-47.17	117.74	29.43
Chemicals and Chemical Products	10.62	74.13	15.25
Petroleum Refinery and Petroleum Products	17.59	26.23	56.19
Non-metallic Mineral Products	-26.09	121.70	4.40
Textiles	85.63	10.47	3.90
Plastic Products	13.95	73.25	12.81
Basic Metals	-126.66	230.00	-3.34
Metal Products	-19.01	108.98	10.03
Non-electrical Machinery	16.65	73.67	9.69
Electrical Machinery and Appliance	48.61	26.02	25.37
Transport Equipment	17.56	64.03	18.41

Notes: [a] 1966-1968;

[b] 1969-1971;

[c] 1969-1973;

* including 5-9 workers.

Sources: Derived from Appendix Tables A-4.2 and A-4.3.

Export expansion was a negligible "source" of growth in sub-period 1960-1963. In 1963-1965, this increased to 25 percent due primarily to the expansion of petroleum refinering.[23] Its effect declined to 12.5 percent over the 1965-68 period and rose to 32 percent in 1971-1974. The export expansion effect may be understated because part of export expansion will be credited to import substitution if exports are expanding in an industry that is also experiencing import substitution a la Chenery.[24] Export expansion and import substitution could, therefore, be combined and regarded as the "trade-related" effect.

Chenery's study concluded that import substitution was the most important impetus to the industrial growth of many countries.[25] Our findings with reference to the experience of Singapore after 1965 showed that expansion of domestic demand and export expansion are the dominant sources of manufacturing output growth. This implied an increasing trend in the import content of total supplies in Singapore. It can be explained by rapid increase of capital formation in the industrial sector and the increase in imported inputs for export processing.

The industries were categorized into three sub-groups: consumer,

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[23] Petroleum refinery industry, which is mainly export-oriented, first started production in 1963. It has become increasingly important in Singapore's industry in terms of both gross output and value added ever since (see Chapter III).

[24] According to Chenery's definition of import substitution, an increase of exports will be totally attributed to export expansion only if there are no competing imports with the base-period output of the industry.

[25] Chenery found that the contribution of import substitution to industrial growth was 67 percent in a cross-section analysis of some 51 countries. See Chenery (1960), p. 641.

intermediate and capital goods industries.[26] The statistical results are shown in Table 4.2. The salient features are discussed below:

(1) <u>Consumer Goods</u>: Table 4.2 indicates that import substitution for consumer goods is important in the two early sub-periods, particularly in sub-period 1963-1965. As Hirschman puts it, the process of industrial development "starts predominantly with the manufacture of finished consumer goods that are previously imported and then moves on .... to the higher stages of manufacture, that is, to intermediate goods and machinery, through backward linkage effects."[27] In Singapore, import substitution in consumer goods occured principally in "food" and "tobacco" during 1960-1963 and in "food", "beverage" and "textile, clothing and footwear and leather products" during 1963-1965. The decline in the import content of the total supply of these products was also reflected in the decreasing share of retained manufactured imports to total retained imports as shown in Table 4.3.

The import substitution effect for consumer goods became negative in 1965-1968 and the value remained small, though positive, in sub-periods 1968-1971 and 1971-1974. The expansion of domestic demand has been an important "source" of growth and accounted for over half of output growth after 1963-1965. Expansion of domestic demand in consumer goods took place

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[26] The classification of industries is given in Appendix D. It was adapted from Chenery (1960), ~~Lewis-Soligo (1965) with minor changes.~~ "Textile, clothing and footwear and leather products," originally classified as consumer goods in sub-periods 1960-1963 and 1963-1965, was divided into two sub-groups after 1965 due to the availability of more detailed production data: "clothing and footwear" was categorized as consumer goods and "textiles" as intermediate goods.

[27] Hirschman (1968), p. 6.

Table 4.2

"Sources" of Output Growth by Sub-groups of Industries: 1960-1963, 1963-1965, 1965-1968, 1968-1971, 1971-1974

(Percentage)

Industry/Year	IS $\frac{(u_2-u_1)S_2}{\Delta Q}100$	EDD $\frac{u_1(\Delta S-\Delta X)}{\Delta Q}100$	EE $\frac{u_1\Delta X}{\Delta Q}100$
1960-1963:			
Consumer Goods	40.48%	50.85%	8.68%
Intermediate Goods	86.63	11.40	1.97
Capital Goods	-72.62	183.06	-10.44
Total Manufacturing	51.50	46.58	1.93
1963-1965:			
Consumer Goods	95.85	-18.32	22.47
Intermediate Goods	-11.38	61.52	49.86
Capital Goods	33.64	51.87	14.49
Total Manufacturing	50.55	24.25	25.20
1965-1968:			
Consumer Goods	-83.89	162.96	20.93
Intermediate Goods	3.54	86.18	10.28
Capital Goods	-21.19	112.22	8.97
Total Manufacturing	-23.25	110.74	12.50
1968-1971:			
Consumer Goods	23.21	57.50	19.29
Intermediate Goods	17.74	54.42	27.84
Capital Goods	-12.75	94.05	18.70
Total Manufacturing	-1.53	76.59	24.93
1971-1974:			
Consumer Goods	2.38	64.87	32.73
Intermediate Goods	33.65	29.16	37.18
Capital Goods	18.88	57.58	23.54
Total Manufacturing	22.25	45.70	32.05
1968-1973:*			
Consumer Goods	7.12	54.47	34.41
Intermediate Goods	29.58	29.26	41.17
Capital Goods	39.76	35.60	24.64
Total Manufacturing	25.49	40.41	34.10

Note: * including 5-9 workers.

Sources: Derived from Appendix Tables A-4.2 and A-4.3.

Table 4.3

Ratio of Retained Manufactured Imports to Total Retained Imports: 1960, 1963, 1965, 1968, 1971, 1973

(Percentage)

Industries	1960	1963	1965	1968	1971	1973
Food	14.97	6.21	3.60	7.82	5.54	4.74
Beverages	0.75	1.19	0.13	0.71	0.70	0.61
Tobacco	0.77	0.62	0.62	0.40	0.37	0.18
Wood and Cork Products	n.a.	n.a.	1.01	10.07	0.51	0.75
Furniture and Fixtures	-	-	-	-	-	-
Paper and Paper Product	3.01	1.11	0.20	1.79	1.59	1.67
Printing and Publishing	n.a.	0.66	0.73	0.53	0.49	0.35
Textile, Clothing & Footwear and Leather Products	8.25	11.37	9.44	15.51	-	-
(a) Textiles	n.a.	n.a.	9.17[a]	13.27	10.69	9.03
(b) Clothing & Footwear	n.a.	n.a.	2.22[a]	2.08	0.56	0.92
(c) Leather Products	-	-	n.a.	n.a.	n.a.	n.a.
Rubber Products	n.a.	0.71	0.96	0.35	0.59	0.42
Plastic Products	n.a.	n.a.	0.86[a]	0.81	1.03	1.40
Chemicals, Chemical & Petroleum Products	16.49	6.13	6.74	10.42	12.16	7.34
(a) Chemicals and Chemical Products	n.a.	n.a.	5.48[a]	4.74	3.50	3.26
(b) Petroleum Refinery and Products	n.a.	n.a.	3.25[a]	5.68	8.67	4.08
Non-metallic Mineral Products	1.67	1.57	1.98	1.76	1.84	2.31
Basic Metal Products	2.91	2.58	4.84	3.41	5.32	5.71
Metal Products	1.17	1.97	1.91	1.91	2.67	2.39
Non-electrical Machinery	1.43	3.02	2.21	6.04	12.56	8.70
Electrical Machinery and Appliance	2.62	5.49	6.41	4.03	7.97	12.21
Transport Equipment	1.58	3.55	4.12	5.59	8.77	8.74
Photographic and Optical Goods and Scientific Instruments	n.a.	n.a.	n.a.	3.26[b]	2.87	3.18
TMM_r/TM_r[c]	55.57	46.16	47.26	60.83	80.27	70.65

Notes: a. 1966; b. 1969; c. TMM_r=total retained manufactured imports, TM_r=total retained imports.

Sources: Derived from Appendix Table A-4.1.

mainly in "food" and "beverages" for most of the periods under study. Limitations of the classification system as discussed in section 4.2 (a) have probably distorted the effects of expansion of domestic demand in "food" in sub-period 1963-1965. For industries including 5-9 workers in sub-period 1968-1973, "food" and "beverages" have accounted for 70 percent or more of the output growth (see end of Table 4.1).

Export expansion of consumer goods was a minor "source" of output growth in the early 1960's. It accounted for only 8.68 percent of output growth in sub-period 1960-1963. However, it has become an increasingly important "source" of output growth in the late 1960's and early 1970's and provided 33 percent of the output growth of consumer goods in sub-period 1971-1974. Expansion of exports in consumer goods was dominant in "food" and "clothing and footwear."

(2) Intermediate Goods: Table 4.2 indicates that import substitution was the most important "source" of growth during 1960-63 in intermediate goods and provided 86 percent of output growth. Import substitution declined in importance in the later sub-periods and did not contribute to output growth in 1963-1965. It became more important in the last two sub-periods. The following industries are worth noting:

(a) For textiles, import substitution accounted for 60 percent of output growth during 1966-1968.[28] Import substitution remained an important "source" of growth in the last two sub-periods and accounted for over 75 percent of output growth. It should be noted that the industrial base of the textile industry was small in the early period of industrialization.

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[28] Separate output data for the textile industry was not available before 1966.

The expansion of production started in 1964.[29] The experience of the industrialization process in LDCs shows that the establishment of the textile industry is usually first developed before most others, even though required raw materials have to be imported. Based on the factor-proportion approach, this may be explained by the fact that textiles are relatively labor-intensive products in which LDCs may expect to develop a comparative advantage. An alternative explanation by Linder[30] is that textiles are mass-consumption products for which even small LDCs may provide a significant home market. A third explanation is offered by the product cycle model which states that textiles are mature products and its manufacturing process is suitable for introduction in labor-abundant countries.[31]

(b) Import substitution effects in the non-metallic mineral products accounted for over half of the output growth in the two early sub-periods. However, in the later sub-periods the expansion of domestic demand has greatly surpassed that of import substitution which in fact was reduced to a nagative value. This was mainly due to the expansion of construction activity in Singapore.[32]

Expansion of domestic demand for intermediate goods accounted for 11.40 percent of output growth in sub-period 1960-1963. This increased to 61 percent during 1963-1965 and reached a record high of over 85 percent of output growth in sub-period 1965-1968. Since then it has declined relatively and provided 54 percent and 29 percent of output growth in the last two sub-periods respectively.

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[29] See Appendix Tables A-3.5 & A-3.6, Chapter III.

[30] Linder (1961).

[31] Vernon (1966) and Hirsch (1967).

[32] Cement is the most important industry in this group.

Intermediate goods became increasingly export-oriented, particularly petroleum refining and petroleum products. In the early 1960's, the export expansion effect was relatively small. However, over 40 percent of output growth of intermediate goods including 5-9 workers during 1968-1973 was due to this effect (See end of Table 4.1).

The production of the petroleum refinery industry started in 1963 and was primarily for export. Export expansion in petroleum refinery provided almost half of the output growth in sub-period 1963-1965. Output growth of wood and cork products in this sub-group was due to expansion of domestic demand and export expansion. Import substitution contributed little or nothing to output growth since 1965.

(3) Capital Goods: In contrast to consumer and intermediate goods industries, the import substitution effect on the capital goods industries was negative in sub-period 1960-1963. The effects remained negative during 1965-1968 and 1968-1971. This was accompanied by a large value for the expansion of domestic demand. In sub-period 1971-1974, import substitution in capital goods provided about 19 percent of the output growth. This was accompanied by a relative decline in the expansion of domestic demand. However, the latter effect still accounted for 58 percent of the output growth.

Among capital goods industries, high domestic demand dominated "basic metal products," "metal products," "electrical machinery and appliances" and "transport equipment". In the early 1960's, because of the political uncertainty and confrontation by Indonesia over the formation of Malaysia, expansion of domestic demand did not provide any output growth for non-electrical machinery. However, after Singapore's separation from Malaysia, it contributed significantly to output growth. This was evidenced by the rapid increase of investment in the second half of 1960's.[33] The effect of domestic demand expansion in non-electrical machinery accounted for over 73 percent of output growth. Because of the rapid increase in domestic demand, machinery was imported in large quantities as shown in Table 4.3. It should be noted, however, that export expansion has become important in recent years.

In general, a rising trend of the export expansion effect on capital goods was observed. The export expansion effect in "electrical machinery and appliance" was dominant in the late 1960's and early 1970's. The domestic demand effect on transport equipment, though important throughout the period under review, has lost ground somewhat in the late 1960's and early 1970's.

(c) Relationships between Growth of Domestic Demand and Exports: A Test of Linder's Thesis

Having analyzed the "sources" of growth in manufacturing output, we shall now briefly examine the relationships between domestic demand and the ability to export in the case of Singapore. This is basically a test of the Linder (1961) hypothesis which states that the range of a country's manufactured exportables is determined by domestic demand. He advances the prosposition that "it is a necessary, but not a sufficient condition that a product be consumed (or invested) in the home market for this product to be a potential export product."[34] In this formulation, economies of scale provided by domestic demand are essential in making exports profitable. In other words, there exists a positive relationship between the growth of

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[33] See Appendix Table A-2.14.

[34] Linder (1961), p. 87.

domestic demand and exports.

One way of testing Linder's hypothesis for an individual country is through detailed industry analysis which is beyond the scope of this study. An alternative approach is to examine cross-industry relationships. For an individual country, a large proportion of industry groups which show a close relationship between domestic demand and exports will also exhibit such a relationship in the aggregate. Our cross-section analysis of 17 industry groups including 5-9 workers during 1968-1973 shows that the Spearman's rank correlation coefficient (r_s) between the growth of domestic demand ($\Delta H/H$)[35] and growth of exports ($\Delta X/X$) was 0.149 which is statistically insignificant (r_s was derived from Appendix Table A-4.8). Hence, Linder's thesis does not appear to be valid in the case of Singapore. Pioneer industries in Singapore are predominantly export-oriented in character (Table 3.6) and multinational corporations[36] with their existing world-wide marketing links were encouraged to establish their subsidiaries in Singapore (See chapter III, section 3.6).

(d) <u>"Sources" and "Patterns" of Growth in Value Added:</u>

The discussion of the previous section (b) has centered on gross output changes. In this section we shall examine the "sources" of growth in value added. The results will shed light on the impact of industries and individual industrial sub-groups on income and resource allocation as value added is a measure of the industry's contribution to national income.

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[35] Domestic demand (H) is defined as the sum of domestic output and retained imports minus domestic exports.

[36] All multinational corporations in Singapore have acquired pioneer industry status and produced export-oriented products.

Table 4.4 gives the statistical results. The "sources" of growth in value added by individual industries are shown in Appendix Table A-4.7.

The ranking of the "sources" of growth in value added are similar to that of gross output growth except that the orders of magnitude are different. From equation (17),

$$\Delta V = u_1 r_1 (\Delta S - \Delta X) + u_1 r_1 \Delta X + (u_2 - u_1) r_1 S_1 + (r_2 - r_1) u_2 S_2$$

$$\text{or: } \Delta V = r_1 \left[u_1 (\Delta S - \Delta X) + u_1 \Delta X + (u_2 - u_1) S_1 \right] + (r_2 - r_1) u_2 S_2 \qquad \text{.............. (18)}$$

The first term in equation (18) is simply the "sources" of output growth (within the squared bracket) of equation (12) multiplied by r_1, the ratio of value added to gross output in the initial period. Hence, in absolute terms, the sources of growth in value added differ by a weighting factor (r_1) as compared to gross output growth.

Table 4.4 indicates that import substitution was a major "source" of growth before 1965. Over half of the total value added growth was accounted for by import substitution during 1960-1963. The effect of import substitution on consumer goods industries remained powerful during 1963-1965 where it accounted for over 81.32 % of the value added growth. Its importance has declined in subsequent periods. The expansion of domestic demand has, except for 1963-65, been an important "source" of value added growth.

Export expansion has become increasingly important as a contributor to value added growth, increasing from 2.08 percent in sub-period 1960-1963 to 37.26 percent in sub-period 1971-1974. The increase for intermediate goods has been particularly marked.

The rates of growth of consumer-goods, intermediate-goods and capital-

Table 4.4

"Sources" of Growth in Value Added by Sub-Groups of Industries: 1960-1963, 1963-1965, 1965-1968, 1968-1971, 1971-1974

(Percentage Distribution)

Industry/Year	IS $\frac{(u_2-u_1)r_1S_2}{\Delta V}$	EDD $\frac{u_1r_1(\hat{\Delta}S-\Delta X)}{\Delta V}$	EE $\frac{u_1r_1\Delta X}{\Delta V}$	Residual $\frac{(r_2-r_1)u_2S_2}{\Delta V}$
1960-1963:				
Consumer Goods	50.69%	63.69%	10.87%	-25.25%
Intermediate Goods	69.61	9.16	1.58	19.65
Capital Goods	-57.95	146.08	-8.33	20.21
Total Manufacturing	55.73	40.40	2.08	-8.21
1963-1965:				
Consumer Goods	81.32	-15.55	19.07	15.16
Intermediate Goods	-4.63	25.06	20.30	59.27
Capital Goods	38.02	58.62	16.38	-13.02
Total Manufacturing	37.36	17.92	18.62	26.09
1965-1968:				
Consumer Goods	-171.61	333.36	42.82	-104.57
Intermediate Goods	4.51	110.01	13.13	-27.66
Capital Goods	-18.68	98.93	7.91	11.84
Total Manufacturing	-31.34	149.32	16.86	-34.84
1968-1971:				
Consumer Goods	25.03	62.00	20.80	-7.83
Intermediate Goods	18.50	56.76	29.04	-4.30
Capital Goods	-11.70	86.30	17.16	8.24
Total Manufacturing	-1.43	71.80	23.37	6.26
1971-1974:				
Consumer Goods	2.19	59.42	29.97	8.42
Intermediate Goods	47.03	40.75	51.96	-39.73
Capital Goods	20.21	61.61	25.18	-6.70
Total Manufacturing	25.88	53.13	37.26	-16.26

Sources: Derived from Appendix Table A-4.6.

goods industries by sub-periods are shown in Table 4.5. Intermediate- and capital-goods industries have been growing more rapidly than consumer-goods, particularly in the last three sub-periods.

Table 4.5

Rate of Increase in Value Added
by Industrial Sub-groups
(Percentage)

Industry/Year	1960-1963	1963-1965	1965-1968	1968-1971	1971-1974
Consumer Goods	30.91	39.81	27.29	54.80	81.90
Intermediate Goods	173.45	36.83	131.87	107.43	159.75
Capital Goods	75.49	39.17	89.98	207.32	208.86
Total Manufacturing	73.53	38.61	73.81	126.75	163.05

Sources: Derived from Table A-4.9.

The percentage distribution of value added by industrial sub-groups for selected goods is given in Table 4.6. It indicates that the share of consumer-goods industries has declined over the period from a high of 52 percent in 1960 to just over 13 percent in 1974. On the other hand, intermediate-goods and capital-goods industries have increased their shares significantly and contributed 41 percent and 45 percent to manufacturing value added in 1974.

It can also be observed from the same table that the ratio of consumer goods to capital goods (C/K) has continually declined throughout the period under study. It has declined from 2.07 in 1960 to 0.31 in 1974 (Table 4.6). This "pattern" of industrial growth conforms to Hoffmann's (1958) results of

Table 4.6

Percentage Share of Manufacturing Value Added (Q) by Industrial Subgroups and Output (Value Added) Ratio of Consumer Goods (C) to Capital Goods (K)

Year	Percentage Share of Value Added (Q)				C/K
	C	I	K	Total*	
1960	52.55	21.92	25.53	100.0	2.07
1963	39.64	35.54	25.82	100.0	1.54
1965	39.98	34.09	25.93	100.0	1.54
1968	29.28	45.48	28.34	100.0	1.03
1971	19.99	41.60	38.41	100.0	0.51
1974	13.82	41.08	45.10	100.0	0.31

Notations: C = consumer goods: I = intermediate goods; and K = capital goods.

Note: * Figures may not add up to 100 due to rounding.

Sources: Derived from Appendix Table A-4.9.

several "free" economies:[37]

> Whatever the relative amounts of the factors of production, whatever the location factors, whatever the state of technology, the structure of the manufacturing sector of the economy has always followed a uniform pattern. The food, textile, leather and furniture industries — which we define as "consumer goods industries" — always develop first during the process of industrialization. But the metal-working, vehicle building, engineering and chemical industries — the "capital-goods industries" — soon develop faster than the first group. This can be seen throughout the process of industrialization. Consequently the ratio of net output (value added) in the consumer-goods industries continually declines as compared with the output of the capital-goods industries.

Summary

The shift-share analysis à la Chenery-Lewis-Soligo has shown that in

[37] Hoffmann (1958), p. 2.

the early phase (1960-1965) of the industrialization process in Singapore, the growth of gross output and value added by the various industries could be attributed mainly to import substitution and the expansion of domestic demand. Export expansion has become increasingly important in its contribution to gross output and value added growth after a major shift of government policies from import substitution to manufactured exports took place in 1965. The increase in intermediate and capital-goods industries have been particularly marked. The empirical results supplement the regression results in Chapter III and tend to support the hypothesis that industrial growth is export-led. In addition, Linder's basic hypothesis that the range of a country's manufactured exports is determined by domestic demand was not validated in the case of Singapore. We have also found that there is no "excessive" growth of consumer goods relative to the growth of intermediate and capital-goods industries. However, this "pattern" of industrial growth does not imply that resources have been optimally employed in the neo-classical sense or that the industrial growth has proceeded according to the principles of comparative advantage. We shall direct our attention to these questions in Chapter V.

CHAPTER V

COMPARATIVE ADVANTAGE AND MARKET ORIENTATION OF MANUFACTURED EXPORTS

In this chapter, we shall examine the comparative advantage of Singapore's industries and the markets for its manufactured exports. Comparative advantage following the Heckscher-Ohlin theory will be determined by a Leontief-type test. Keesing's (1966, 1968) extension of the comparative advantage theory to incorporate human and skill content into trade flows will also be examined. The tests will determine which approach provides a better explanation of Singapore's trade patterns. Our empirical findings will also indicate whether Singapore's industrial resources are efficiently allocated.

5.1 Comparative Advantage of Manufacturing Industries in Singapore

According to the neo-classical Heckscher-Ohlin trade theory, the basis of international trade is international price differences which, in turn, are the results of international differences in the relative abundance of the factors of production, labor and capital. Countries may be expected to have a comparative advantage in the production of goods that use relatively more of the factors with which they are favorably endowed. Thus, LDCs would be expected to specialize in the production and export of labor-intensive goods and import capital-intensive goods from industrial countries. Before assessing the comparative advantage of Singapore's industries, we shall undertake one test to determine whether, using Singapore's data, value added per employee *á la* Lary (1968) is an effective measure of factor intensity.

(a) Measurements of Factor-Intensity

The conventional method of measuring factor-intensity of industry is the capital-labor ratio, i.e.

$$(5.1) \quad \frac{K}{L} = \frac{\text{value of fixed assets}}{\text{number of employees}}$$

Lary (1968) argued for the use of value-added per employee as an indicator of capital-intensity:

$$(5.2) \quad \frac{V}{L} = \frac{\text{value added}}{\text{number of employees}}$$

Lary's method is based on the assumption that value-added per employee, in relation to the industrial average, reflects the degree of capital intensity of the branch in question fairly well and at the same time allows a unified treatment of physical and human capital endowment. In Lary's analysis of manufacturing industries, value added per employee was separated into two components: (i) salaries and wages, and (ii) non-wages. Lary found that a strong positive relationship exists between wage value-added and the proportion of skilled workers in total employment (human capital). In the U.S. the correlation coefficient between the logarithms of the two variables varies between 0.76 and 0.85 and is significant at the 0.01 level of confidence. The implication of this finding is that industries paying higher wage rates employ a higher proportion of skilled workers. Lary also found a strong positive relationship between the non-wage component of the value added per employee and fixed assets per employee (physical capital). The correlation coefficient was 0.80 for U.S. data and 0.78 for India which are both significant at the 0.01 level of confidence. Value-added per employee seems, therefore, to be a good composite index of the use of human and physical capital per unit of employment.

The relationship between (5.1) and (5.2) can be established by writing (5.2) as

$$(5.3)\quad \underset{(5.2)}{\frac{V}{L}} = \underset{(5.1)}{\frac{V}{K} \cdot \frac{K}{L}}$$

The two measures will rank equally if capital productivity (V/K) is assumed to be constant over time. The ratio of value-added to capital can therefore be considered as a scale factor. The data provided in the Census of Industrial Production (CIP) in Singapore for 1974 show that the logarithms of V/L and K/L for 28 industry groups were positively correlated with a correlation coefficient of 0.926 which is significant at the 0.01 level of confidence (derived from Appendix Table A-5.1).[1] The CIP data also indicate that value-added per employee can be taken as an effective indicator of capital-intensity of Singapore according to the Lary-type test. The following equations were obtained by regressing wages and salaries[2] per employee (W/E_m) on the proportion of skilled labor in total employment (SL/L) in 1974 (estimated from Table 5.1 and Appendix Table A-5.1):

For twenty-nine industry groups (n = 29) including petroleum:

$$(5.4)\quad \log W/E_m = 6.832 + \underset{\substack{\text{s.e. } (0.112) \\ \text{t-ratio } (5.408)}}{0.605 \log SL/L} \qquad R^2 = 0.576$$

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[1] The extreme case "petroleum refinery and coal products" was excluded. When this is included, R^2 was 0.68 which is still significant at the 0.01 level.

[2] Including Central Provident Funds, pensions and other benefits.

For twenty-eight industry groups (n = 28) excluding petroleum:

$$(5.4)' \quad \log W/E_m = \underset{\substack{\text{s.e.} \\ \text{t-ratio}}}{2.375} + \underset{\substack{(0.228) \\ (9.234)}}{2.106} \log SL/L \qquad R^2 = 0.772$$

In the above analysis, skilled labor has been defined to include (1) professional, technical and related workers, (2) administrative and managerial workers, (3) clerical and related workers, (4) sales workers and (5) service workers as obtained from 1970 Census of Population in Singapore.[3] Equation (5.4) shows that there is a positive relationship between the logarithms of W/E_m and SL/L. The value of the t-ratio (5.408) indicates that the coefficient of correlation ($R^2 = 0.576$) is statistically significant at the 0.01 level of confidence. When the extreme case of "petroleum refinery and coal products" is excluded, the relationship of the two variables has an R^2 of 0.722 which is significant at the 0.01 level of confidence.

The relationship between the logarithms of non-wage value added per employee (W_n/E_m) and net fixed-assets per employee (NFA/E_m) in 1974 are obtained as follows (estimated from Table 5.1 and Appendix Table A-5.1):

For twenty-nine industry groups (n = 29) including petroleum:

$$(5.5) \quad \log W_n/E_m = 0.841 + \underset{\substack{\text{s.e. } (0.132) \\ \text{t-ratio } (6.672)}}{0.882} \log NFA/E_m \qquad R^2 = 0.635$$

For twenty-eight industry groups (n = 28) excluding petroleum:

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3 These were the latest data available. The proportion of skilled labor in total employment is unlikely to have changed much by 1974.

$$(5.5)' \quad \log W_n/E_m = 0.235 \bullet \underset{\substack{\text{s.e.} \ (0.064) \\ \text{t-ratio} \ (14.841)}}{0.945} \log NFA/E_m \qquad R^2 = 0.892$$

Equations (5.5) and (5.5)' indicate that there is a positive relationship between the logarithms of the two variables. For twenty-nine industry groups, R^2 was 0.635 and rose to 0.892 when the extreme case "petroleum refinery and coal products" was excluded. Both are significant at the 0.01 level of confidence.

Table 5.1 gives the total value added per employee, the wage and salary value added per employee and the non-wage value added per employee for 29 industry groups in Singapore in 1974. Value added per employee as a percentage of the average for all industries is also shown. By Lary's criteria, an index of 100 or more indicates that the industries are capital-intensive whereas industries which rank below 100 are relatively more labor-intensive. It is interesting to note that the Spearman rank correlation between total value added per employee and its non-wage component is higher than between total value added and its wage component, the coefficients being 0.973 for the former and 0.887 for the latter. This suggests that, in the case of Singapore, the total value added per employee measures physical better than human capital intensity.

Table 5.1 shows that a number of industries, tobacco, petroleum and coal products, industrial chemicals, other chemicals, cement and concrete products, non-metallic mineral products n.e.s., iron and steel basic industries, non-ferrous metal basic industries, non-electrical machinery and transport equipment are capital-intensive. Others such as textile, wearing apparels, leather and leather products, footwear, wood and cork

Table 5.1

Total Value Added, Wages Value Added and Non-wage Value Added Per Employee for Major Industry Groups, 1974

Industrial Groups	Value Added Per Employee (S$)			Value Added Per Employee (% of national average)		
	Total	Salaries & Wages	Non-wages	Total	Salaries & wages	Non-wages
Food	16,413	5,041	11,372	96	96	95
Beverages	17,161	6,991	10,107	99	133	85
Tobacco	37,100	7,710	29,390	215	146	245
Textiles	7,068	3,954	3,114	41	75	26
Clothing	4,327	2,775	1,552	25	53	13
Leather and Leather Products	9,011	3,855	5,156	52	73	43
Footwear	7,411	3,676	3,735	43	70	31
Wood and Cork Products	8,227	4,312	3,915	48	82	33
Furniture and Fixtures	7,415	4,614	2,801	43	88	23
Paper and Paper Products	11,206	3,729	7,477	65	75	62
Printing and Publishing	14,962	5,685	9,277	87	108	77
Industrial Chemicals	33,918	8,424	25,494	196	160	212
Other Chemicals	34,942	6,542	28,460	202	124	236
Petroleum and Coal Products	278,639	19,530	259,109	1,612	371	21,564
Natural Rubber and Gums	9,853	5,055	4,798	57	96	40
Rubber Products	14,738	5,390	9,348	86	102	78
Plastic Products	10,159	3,976	6,183	59	75	52
Pottery and China	7,129	3,556	3,573	41	68	30
Glass and Glass Products	14,785	7,419	7,366	86	141	61
Structural Clay Products	15,720	5,377	10,343	91	102	86
Cement and Concrete Products	35,023	6,398	28,625	203	121	238
Non-metallic Mineral, n.e.s.	20,418	5,962	19,456	118	113	162
Iron and Steel	65,835	7,759	58,076	381	147	483
Non-ferrous Metals	22,982	6,497	16,485	133	123	137
Fabricated Metal Products	13,779	5,630	8,149	80	107	68
Non-electrical Machinery	23,079	6,021	17,058	134	114	142
Electrical Machinery and Components	10,263	4,057	6,206	59	77	52
Transport Equipment	18,863	7,967	10,896	109	151	91
Instruments, Watches, Clocks and Optical Goods						
Other Manufacturing	8,629	3,765	4,864	50	71	41
Total Manufacturing	17,287	5,271	12,016	100	100	100

Sources: Calculated from Singapore, Report on the Census of Industrial Production, 1974.

products, furniture and fixtures, paper and paper products, printing and publishing, natural gums, rubber products, plastic products, pottery and china, tiles and structural clays, fabricated metal products, electrical machinery and components are labor-intensive. Food appears to be labor-intensive in Singapore relative to the national average. This is consistent with Lary's findings that:[4]

> ....items more closely tied to the origin of material inputs — chiefly certain canned or preserved food — may also be counted as labor-intensive on the basis that..... the material inputs themselves as well as the processing of the materials are labor-intensive.

In general, the factor-intensities of the major industry groups in Singapore matched well with Lary's findings for other countries. When the major industry groups are broken down into the ISIC 5-digit aggregation level, it was found that some industries which are capital-intensive fell into the labor-intensive group. These are "refined edible oil" and "prepared animal feed" in the "food" industry. On the other hand, "transport equipment" which is capital-intensive group in Table 5.1 includes some labor-intensive items such as "barges, lighters and boats". The factor-intensities of the detailed ISIC 5-digit industries are shown in Table A-5.2. We shall use V/E_m as a measure of factor intensity in our analysis below.

(b) Comparative Advantage of Industries in Singapore: A Leontief-type Test

We have shown in sub-section (a) that value added per employee can

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[4] Lary (1968), pp. 14-15.

be taken as an effective measure of the factor intensity of industries in Singapore. To test the comparative advantage of industries, we shall first examine a critical assumption of the orthodox Heckscher-Ohlin model that no factor-intensity reversals take place. Should factor-intensity reversals occur, the Heckscher-Ohlin hypothesis will not be able to offer any guidelines.

Lary (1968) found that no factor-reversals took place in his studies of selected developed and developing countries. Two tests were carried out by him. In the first test, three groups of industries were selected (Groups I, II and III) on the basis of U.S. data, ranging from relatively labor-intensive to relatively capital-intensive. It was discovered that value-added per employee increased from Group I to Group II to Group III for all countries except Argentina and Columbia in a sample of 20 nations.[5] In another test, detailed bilateral comparisons in the value added per industrial employee were made between the U.S. and the U.K., the U.S. and Japan and the U.S. and India. It was found that a similarity in the pattern of value-added per employee in different industries exists between these countries.[6]

Table 5.2 compares the ranking of 19 major industry groups in Singapore (1974 CIP data) with that in the U.S. (1965 Census data). The rankings of the industries based on Lary's method are similar with a Spearman rank correlation coefficient of 0.873 which is significant at

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[5] Argentina and Colombia are two of the developing countries vigorously pursuing import substitution policy.

[6] Lary (1968), p. 75.

Table 5.2

Industry Rankings by Value Added Per Employee, United States & Singapore

Industry Groups	United States (1965)	Singapore (1974) *
Petroleum and Coal Products	1	1
Chemicals and Chemical Products	2	4
Tobacco	3	3
Beverages	4	8
Transport Equipment	5	7
Basic Metals	6	2
Food	7	9
Paper and Paper Products	8	13
Non-electrical Machinery	9	5
Non-metallic Mineral Products	10	6
Electrical Machinery and Appliances	11	14
Printing and Publishing	12	10
Rubber Products	13	11
Metal Products	14	12
Furniture and Fixtures	15	17
Textiles	16	18
Wood and Cork Products	17	16
Leather and Leather Products	18	15
Footwear and Wearing Apparels	19	19

* Spearman rank correlation coefficient (r_s) equals 0.873 which is statistically significant at 0.01 level of confidence.

Sources: Industry rankings of U.S. are calculated from H.B. Lary, Imports of Manufacturers from Less Developed Countries, (New York: 1968), Table 2, pp. 24-29; rankings of Singapore's industries are obtained from Appendix Table A-5.2.

the 0.01 level of confidence. Further bilateral comparisons of the value-added per employee of the main industry groups between the U.S. and Singapore, Japan and Singapore, and India and Singapore are shown in Table 5.3.

Table 5.3 shows that the values of the correlation coefficients obtained are significant at the 0.01 level of confidence. It is interesting

Table 5.3

Spearman Rank Correlation Coefficient (r_s) Between Value Added Per Employee of Major Industries in U.S., U.K., Japan, India and Singapore

Countries Compared & Years of Comparison	No. of Major Industry Groups[1]	r_s *
U.S. (1965) and Singapore (1974)	19	0.873
U.K. (1958) and Singapore (1974)	17	0.892
Japan (1962) and Singapore (1974)	19	0.876
India (1961) and Singapore (1974)	20	0.781

Notes: [1] Due to different industrial classification systems in the countries compared, only those industries in the sub-industry groups which correspond to Singapore's industrial classification were chosen. We then took their average values of value-added per employee to be the values of each major industry groups. Data on U.S., U.K., Japan and India are given in Lary (1968), Appendix Table B-1.

* All correlation coefficients are statistically significant at 0.01 level of confidence.

Sources: Table 5.1 and Lary (1968), pp. 161-187.

to note that the values of Spearman rank correlation coefficients between the industrial countries and Singapore are higher than between India and Singapore. This may be due to the differences in time-periods compared. The empirical results support the strong-factor intensity assumption that there are very limited factor-reversals among the trading countries.

We shall now follow the method initiated by Leontief[7] in testing the Heckscher-Ohlin theory. In Leontief's test, the direct and indirect

[7] Leontief (1953).

capital and labor requirements of exports and imports are computed using input-output data. Singapore lacks detailed industry input-output data. However, since the strong factor-intensity assumption is validated, U.S. (1951) input-output data will be used to calculate the relative factor intensity of Singapore's imports and exports. We have limited our test to manufacturing industries only. Leontief assumed that "imports of commodities which can be and are, at least in part, actually produced by domestic industries (in the United States)."[8] This assumption does not seem to be unrealistic for Singapore.

Total capital and labor requirements of Singapore's exports and imports are presented in Table 5.4. We have excluded "petroleum refinery and coal products" from the calculations since this is a highly capital-intensive industry which accounted for over 27 percent of the total manufactured exports for Singapore in 1973 (Appendix Table A-5.3). Inclusion of this industry would have distorted the comparative advantage analysis of Singapore's industries. It should be noted that the factor requirements computed are not the actual requirements but only reflect the relative factor intensity of the two categories of manufactured goods.

The principal findings in Table 5.4 are summarized in Table 5.5.

The ratio of capital to labor for exports $(\frac{K}{L})_x$ is 9,764.967 whereas for import replacements the corresponding ratio $(K/L)_m$ is 10,489.458. The $(K/L)_x/(K/L)_m$ ratio is 0.93, indicating that Singapore's participation in international trade labor is based on its specialization

[8] Leontief (1966), p. 75.

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Table 5.4

Total Capital and Labor Requirements for Singapore's Exports and Imports (1973) Based on US Input-Output Data

Industrial Sectors	Direct and Indirect Requirements Per US$ million of Final Output		Exports Per Million of US$ of Total Exports, S'pore 1973	Imports Per Mill. of US$ of Total Imp. S'pore 73
	Capital (US$ million)	Labor (man-years)		
(1)	(2)	(3)	(4)	(5)
Food	3.3023	173.206	0.067510	0.054892
Beverages	3.2923	169.712	0.005241	0.008363
Tobacco	3.2887	173.472	0.002529	0.002757
Wood and Cork Products	1.4618	233.490	0.118971	0.031890
Furniture and Fixtures	1.6821	233.687	0.002748	0.001413
Paper and Paper Products	1.7523	163.172	0.008754	0.022901
Printing and Publishing	1.3216	196.579	0.010483	0.005951
Textiles	2.2884	192.913	0.076324	0.122714
Footwear	1.6574	262.612	0.003848	0.001618
Clothing	1.8706	214.935	0.068967	0.010643
Leather and Leather Products	1.6648	227.199	0.002430	0.005209
Rubber Products	1.8140	197.038	0.004655	0.004858
Chemicals and Chemical Products	2.3424	166.399	0.085207	0.086173
Pottery and China	1.3682	261.934	0.002154	0.007818
Glass and Glass Products	1.9293	199.932	0.003508	0.006654
Structural Clay Products	1.7718	271.334	0.000840	0.003695
Cement and Concrete Products	2.4944	167.940	0.001293	0.007817
Non-metallic Mineral Products, n.e.s.	1.8850	169.212	0.000540	0.003197
Basic Metal Products	2.4127	167.211	0.027216	0.079729
Fabricated Metal Products	1.9867	201.150	0.021962	0.031698
Non-electrical Machinery	1.9087	197.046	0.144935	0.169704
Electrical Machinery and Components	1.7478	218.635	0.206410	0.142472
Transport Equipment	1.8402	193.262	0.073128	0.102831
Instruments, Watches, Clocks and Optical Goods	1.8443	261.539	0.032931	0.042753
Miscellaneous Manufacturing	1.4382	186.429	0.027429	0.042165
Total Manufacturing			1.000000	1.000000

Table 5.4 (Cont'd)

Total Capital and Labor Requirements for Singapore's Exports and Imports (1973) Based on US Input-Output Data

Industrial Sectors	Direct and Indirect Requirements Per Million Dollars of Exports		Direct and Indirect Requirements Per Million $ of Imports	
	Capital (US$)	Labor (man-years)	Capital (US dollar)	Labor (man-years)
(1)	(6)=(2)x(4)	(7)=(3)x(4)	(8)=(2)x(5)	(9)=(3)x(5)
Food	222,938	11.693	181,270	9.508
Beverages	17,255	0.890	27,534	1.419
Tobacco	8,317	0.439	9,067	0.478
Wood and Cork Products	173,912	26.589	46,617	7.127
Furniture and Fixtures	4,622	0.642	2,377	0.330
Paper and Paper Products	15,340	1.428	40,129	3.373
Printing and Publishing	13,854	2.061	7,865	1.170
Textiles	174,660	14.724	280,819	23.673
Footwear	6,378	1.011	2,682	0.425
Clothing	129,009	14.823	19,909	2.288
Leather and Leather Products	4,046	0.552	8,672	1.183
Rubber Products	8,444	0.917	8,812	0.957
Chemicals and Chemical Products	199,589	14.178	201,852	14.339
Pottery and China	2,947	0.564	10,697	2.048
Glass and Glass Products	6,768	0.701	12,838	0.701
Structural Clay Products	1,488	0.228	6,547	1.003
Cement and Concrete Products	3,225	0.217	19,499	1.313
Non-metallic Mineral Products, n.e.s.	1,018	0.091	6,026	0.541
Basic Metal Products	65,664	4.551	192,362	13.332
Fabricated Metal Products	43,632	4.418	62,974	6.376
Non-electrical Machinery	276,637	28.559	323,914	33.440
Electrical Machinery and Components	360,763	45.129	249,013	31.149
Transport Equipment	134,570	14.133	189,230	19.873
Instruments, Watches, Clocks and Optical Goods	60,735	8.613	78,849	11.182
Miscellaneous Manufacturing	39,300	5.114	60,642	7.861
Total Manufacturing	1,975,111	202.265	2,050,196	195.453

Table 5.4 (Cont'd)

Total Capital and Labor Requirements for Singapore's Exports and Imports (1973) Based on US Input-Output Data

Notes: (a) The total value of exports f.o.b. (excluding petroleum) in 1973 was US$1,878.843 million; the actual value of exports of each industry can be obtained by multiplying each item in column (4) by US$1,878.843 million.

(b) The total value of imports c.i.f. (excluding petroleum) in 1973 was US$3,415.630 million; column (5) times US$3,415.360 million gives the actual value of each type of competitive imports.

Sources: Column (2) and (3) capital and labor requirements are based on US input-output data, Leontief (1960); exports and imports figures for Singapore in 1973 are based on United Nations, *Commodity Trade Statistics*.

Table 5.5

Total Capital and Labor Requirements Per Million Dollars of Exports and Competitive Import Replacements of Manufacturing Industries in Singapore, 1973 (Excluding "Petroleum")

	Exports (X)	Import Replacements (M)
Capital ($)	1,975,111	2,050,196
Labor (man-years)	202.265	195.453

Source: Table 5.4.

in relatively labor-intensive line of production.[9] It should be noted that the computed $(\frac{K}{L})_x/(\frac{K}{L})_m$ is less than but not significantly different from unity. This implies that Singapore's comparative advantage may lie towards labor-intensive techniques of production.[10]

5.2 Factor-Intensities and Market Orientation of Manufactured Exports

In this section we shall attempt to examine the export patterns of manufactured goods according to factor-proportions. We have verified in section 5.1 (b) that Singapore tends to have a slight comparative advantage in

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[9] According to Leontief's test, if $(K/L)_x/(K/L)_m$ is greater (less) than unity for a capital abundant (scarce) country, then the Heckscher-Ohlin hypothesis is confirmed.

[10] When "petroleum refinery and coal products" is included in our calculation of the comparative advantage of Singapore's manufacturing industries, the calculated $(\frac{K}{L})'_x/(\frac{K}{L})'_m$ is 1.17 (derived from Appendix Table A-5.3), indicating the comparative of Singapore's industries lies towards the capital-intensive rather than the labor-intensive lines of production.

labor-intensive goods excluding the extreme case of "petroleum refinery and coal products". According to the factor-proportion theorem we would expect exports of manufactured goods to developed countries to be labor-intensive goods, whereas exports to LDCs would be mainly capital-intensive goods, since compared with LDCs, capital is relatively abundant in Singapore.

Table 5.6 (Column 1) shows the percentage shares by industry groups in total manufactured exports for 1966 and 1974. In 1974, capital-intensive industries accounted for 64 percent of total industrial exports (1966: 45 percent) whereas labor-intensive industries supplied 38 percent (1966: 55 percent). The figures are somewhat misleading because of the quadruple increase of crude oil price in the last quarter of 1973[11] and the large share of the petroleum refining industry in the manufacturing sector. This group accounted for 49 percent of total industrial exports in 1974 as compared to 21 percent in 1966. This industry group has been excluded from both 1966 and 1974 figures to maintain comparability and the percentage shares of industrial exports recalculated in column (2). The shares of capital-intensive and labor-intensive industries in total industrial exports for 1966 and 1974 remained relatively unchanged, but there are marked increases in the shares of "non-electrical machinery", "textiles," "plastic products," "electrical machinery and appliances" and "instruments, watches, clocks and optical goods".

The export participation of most industries is high as shown by

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[11] In December 1974 OPEC charged an average price of US$10.12 per barrel, inclusive of tax and royalty, as compared to about U.S.$2.00 per barrel before October 1973.

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Table 5.6

Export Patterns According to Factor Proportions: Shares in Total Industrial Exports and Shares of Exports in Gross Output by Major Industry Groups, 1966 & 1974

Industrial Sectors	Percentage Shares in Total Industrial Exports (incl. petr.) 1966	1974	Change
Relatively Capital-Intensive Industries:		(1)	
Chemicals and Chemical Products	8.69	1.90	-
Petroleum and Coal Products	20.47	48.71	+
Basic Metal Products	3.15	0.54	-
Non-electrical Machinery	1.42	5.10	+
Transport Equipment	8.62	7.04	-
Cement and Concrete Products	0.03	0.17	+
Tobacco	1.03	0.13	-
Non-metallic Mineral Products, n.e.s.	1.76	0.40	-
Sub-Total	45.17	63.98	+
Relatively Labor-Intensive Industries:			
Food	10.04	4.82	-
Beverages	3.65	0.27	-
Wood and Cork Products	9.37	2.70	-
Furniture and Fixtures	0.61	0.18	-
Paper and Paper Products	0.91	0.19	-
Printing and Publishing	2.49	0.58	-
Textiles	0.52	2.27	-
Footwear	0.44	0.15	-
Clothing	6.54	2.53	-
Leather and Leather Products	2.12	0.24	-
Rubber Products	2.79	0.67	-
Natural Rubber and Gums	-	0.28	*
Plastic Products	0.18	1.85	+
Pottery and China	-	0.03	*
Glass and Glass Products	-	0.13	*
Structural Clay Products	0.03	0.01	-
Metal Products	6.20	1.38	-
Electrical Machinery & Components	4.41	17.80	+
Instruments, Watches, Clocks and Optical Goods } Miscellaneous Manufacturing	0.55	1.30	+
Miscellaneous Manufacturing		0.56	+
Sub-Total	54.85	37.94	-

Table 5.6 (Cont'd)

Export Patterns According to Factor Proportions: Shares in Total Industrial Exports and Shares of Exports in Gross Output by Major Industry Groups, 1966 & 1974

Industrial Sectors	Percentage Shares in Total Industrial Exports (excl. petr.)		
	1966	1974	Change
Relatively Capital-Intensive Industries:		(2)	
Chemicals and Chemical Products	10.93	3.71	-
Petroleum and Coal Products	*	*	*
Basic Metal Products	3.96	1.05	-
Non-electrical Machinery	1.78	9.94	+
Transport Equipment	10.84	13.72	+
Cement and Concrete Products	0.04	0.32	+
Tobacco	1.30	0.25	-
Non-metallic Mineral Products, n.e.s.	2.21	0.77	-
Sub-Total	31.06	29.76	-
Relatively Labor-Intensive Industries:			
Food	17.65	9.40	-
Beverages	4.59	0.53	-
Wood and Cork Products	11.78	5.25	-
Furniture and Fixtures	0.77	0.35	-
Paper and Paper Products	1.14	0.37	-
Printing and Publishing	3.13	1.14	-
Textiles	0.65	4.42	+
Footwear	0.55	0.29	-
Clothing	8.22	4.93	-
Leather and Leather Products	2.66	0.47	-
Rubber Products	3.51	0.37	-
Natural Rubber and Gums	-	0.32	+
Plastic Products	0.23	1.13	+
Pottery and China	-	0.01	+
Glass and Glass Products	-	0.24	+
Structural Clay Products	0.04	0.01	-
Metal Products	7.80	2.69	-
Electrical Machinery & Components	5.54	34.70	+
Instruments, Watches, Clocks and Optical Goods	} 0.70	2.54	+
Miscellaneous Manufacturing		1.08	+
Sub-Total	68.96	70.28	-

Table 5.6 (Cont'd)

Export Patterns According to Factor Proportions: Shares in Total Industrial Exports and Shares of Exports in Gross Output by Major Industry Groups, 1966 & 1974

Industrial Sectors	Percentage Shares of Exports in Gross Output		
	1966	1974	Change
Relatively Capital-Intensive Industries:		(3)	
Chemicals and Chemical Products	37.67	37.84	unchanged
Petroleum and Coal Products	31.47	66.70	+
Basic Metal Products	28.22	18.71	-
Non-electrical Machinery	22.38	72.08	+
Transport Equipment	43.96	48.11	+
Cement and Concrete Products	1.94	7.96	+
Tobacco	5.08	7.01	+
Non-metallic Mineral Products, n.e.s.	14.63	39.21	+
Relatively Labor-Intensive Industries:			
Food	31.48	40.48	+
Beverages	26.08	21.65	-
Wood and Cork Products	45.02	58.92	+
Furniture and Fixtures	17.79	31.40	+
Paper and Paper Products	25.80	14.34	-
Printing and Publishing	15.36	20.56	+
Textiles	39.22	40.15	+
Footwear	40.96	42.85	+
Clothing	70.73	73.39	+
Leather and Leather Products	67.49	65.09	-
Rubber Products	40.38	27.09	-
Natural Rubber and Gums	-	57.05	+
Plastic Products	13.43	30.85	+
Pottery and China	-	14.60	+
Glass and Glass Products	-	34.76	+
Structural Clay Products	2.16	1.41	-
Metal Products	26.79	25.05	-
Electrical Machinery & Components	53.40	86.92	+
Instruments, Watches, Clocks and Optical Goods	5.65	87.64	+

Sources: Calculated from Singapore, Report on the Census of Industrial Production, 1966 and 1974.

the percentage shares of exports to gross output. In six out of eight capital-intensive industries, the share of exports in gross output increased between 1966 and 1974. There were marked increases in export shares for "petroleum and coal products" and "non-electrical machinery." The proportion of exports to gross output in "chemical and chemical products" remained unchanged and only "basic metal products" showed a decline. The decline was due to the increase of domestic demand. In the labor-intensive industries, fourteen out of twenty-one increased their export participation between 1966 and 1974. "Food," "wood and cork products," "furniture and fixtures," "printing and publishing," "plastic products," "non-metallic mineral products," "electrical machinery and appliances," instruments, watches, clocks and optical goods," and "miscellaneous industries" have increased their shares considerably.

Table 5.7 and Table 5.8 show the percentage shares of exports to developed and developing countries by major industry groups. For some industries the results appear to support the factor-proportion hypothesis. The data for others were somewhat paradoxical. A large part (over 50 percent) of the exports of capital-intensive goods went to LDCs during 1965-1973. Singapore may have exploited the comparative advantage of these products as she is favorably endowed with capital relative to the LDCs. On the other hand, we also find that 81 percent of the labor-intensive products went to LDCs in 1965 (1968: 67%, 1973: 41%) (Table 5.8). Factor-proportion theory does not seem to be capable of explaining this. This may reflect temporary differences in producers' abilities and technology rather than factor or material cost advantage. Furthermore, the extension of the Heckscher-Ohlin model incorporating the skill-intensity of industries

Table 5.7

Export Patterns According to Factor Proportions: Share of Exports to Developed Countries by Major Industry Groups, 1965, 1968, 1973

Industry Groups	Percentage Shares of Developed Countries in Commodity Groups 1965	1968	1973	Change (1965-1968, 1968-73)	Compound Annual Growth Rate, 1965-73
Relatively Capital Intensive Industries:					
Chemicals and Chemical Prod.	6.30%	10.38%	24.27%	+ , +	49.59%
Petroleum & Coal Products	38.83	33.95	42.62	- , +	21.73
Basic Metal Products	12.65	18.90	12.39	+ , -	12.80
Non-electrical Machinery	0.59	1.27	59.00	+ , +	158.64
Transport Equipment	2.70	5.20	30.40	+ , +	62.56
Cement and Concrete Products	0.03	0.62	9.18	+ , +	82,56*
Tobacco	0.04	0.08	0.97	+ , +	47.71
Total of K-intensive Goods	24.44	26.40	41.13	+ , +	31.13
Relatively Labor Intensive Industries:					
Food	29.52	30.44	26.56	+ , -	7.18
Beverages	0.38	0.69	3.40	+ , +	43.25
Wood and Cork Products	69.64	73.91	77.70	+ , +	42.79
Furniture and Fixtures	1.96	5.86	43.83	+ , +	88.24
Paper and Paper Products	0.03	0.21	1.04	+ , +	88.63
Printing and Publishing	3.16	3.74	32.45	+ , +	56.10
Textiles	10.53	14.69	31.40	+ , +	37.44
Footwear	2.71	15.57	32.83	+ , +	60.14
Clothing	32.96	53.94	88.95	+ , +	54.70
Leather Products	4.64	6.54	19.69	+ , +	39.83
Rubber Products	1.93	4.39	9.57	+ , +	37.78
Plastic Products	0.58	2.90	43.27	+ , +	136.16
Pottery and China	0.64	1.74	4.97	+ , +	43.55
Glass and Glass Products	1.55	0.69	5.22	+ , +	19.73
Structural Clay Products	3.25	9.12	19.77	+ , +	48.08
Metal Products	0.60	1.30	16.83	+ , +	80.55
Electrical Machinery and Components	1.34	4.71	71.95	+ , +	176.69
Instruments, Watches, Clocks and Optical Goods	2.70	7.31	66.36	+ , +	129.03
Miscellaneous Manufacturing	4.96	26.16	64.06	+ , +	85.23
Total of L-intensive Goods	19.28	33.22	59.45	+ , +	48.32

Notes: * compound annual growth growth rate for 1968-1973.

Sources: Computed from Appendix Table A-5.5 - A-5.8.

Table 5.8

Export Patterns According to Factor Proportions:
Share of Exports to Developing Countries by
Major Industry Groups, 1965, 1968, 1973

Industry Groups	Percentage Shares of LDCs in Commodity Groups 1965	1968	1973	Change (1965-68, 1968-73)	Compound Annual Growth Rate, 1965-73
Relatively Capital Intensive Industries:					
Chemicals and Chemical Prod.	93.72%	89.62%	75.73%	- , -	19.65%
Petroleum and Coal Products	61.17	66.15	57.38	+ , -	14.08
Basic Metal Products	87.35	81.11	87.62	- , +	13.19
Non-electrical Machinery	99.41	98.73	41.00	- , -	17.98
Transport Equipment	97.30	94.80	69.60	- , -	9.67
Cement and Concrete Prod.	99.77	99.38	90.82	- , -	- 5.20
Tobacco	99.96	99.92	99.03	unchanged	- 6.10
Total of K-intensive Goods	76.56	73.60	58.87	- , -	16.55
Relatively Labor-Intensive Industries:					
Food	70.48	69.56	73.44	- , +	9.45
Beverages	99.62	99.31	96.60	- , -	4.45
Wood and Cork Products	30.36	26.09	22.30	- , -	34.52
Furniture and Fixtures	98.04	94.14	56.17	- , -	6.64
Paper and Paper Products	99.97	99.79	98.96	- , -	14.55
Printing and Publishing	96.84	96.26	67.55	- , -	6.32
Textiles	89.47	85.31	68.60	- , -	13.19
Footwear	97.83	84.43	67.17	- , -	6.32
Clothing	67.04	46.06	11.05	- , -	3.78
Leather and Leather Products	95.36	93.46	80.31	- , -	10.99
Rubber Products	98.07	95.61	90.43	- , -	[illegible].90
Plastic Products	99.42	97.10	56.73	- , -	20.37
Pottery and China	99.56	98.26	95.03	+ , -	6.49
Glass and Glass Products	98.45	99.31	94.78	- , -	0.09
Structural Clay Products	96.75	90.88	80.23	- , -	11.40
Metal Products	99.40	98.70	83.17	- , -	9.32
Electrical Machinery and Components	98.66	95.29	28.05	- , -	30.92
Instruments, Watches, Clocks and Optical Goods	97.30	92.67	33.64	- , -	19.26
Miscellaneous Manufacturing	95.04	73.84	35.97	- , -	11.84
Total of L-intensive Goods	80.72	66.78	40.55	- , -	14.47

Sources: Computed from Appendix Table A-5.5 to A-5.8.

(Section 5.3) appears to more adequately explain the trade pattern of Singapore.

As shown in Table 5.7, there has been an increase in the share of exports of labor-intensive goods to developed countries. In 1973, the share of total labor-intensive goods to developed countries was 60 percent (1965: 19%, 1968: 33%). It appears that Singapore has exploited her comparative advantage in labor-intensive lines of production.

A similar export pattern can be observed in the case of capital-intensive industries. Exports of capital-intensive products to developed countries have become increasingly important and accounted for 41 percent of total exports of capital-intensive goods in 1973 (1965: 24%, 1968: 26%). This indicates that Singapore's manufactured exports have embodied greater human and physical capital in the 1970s. This is also shown by the increasing export/output ratios of all capital-intensive industries and the relatively important weights of these industries in the manufacturing sector (Table 5.6).

Coupled with the relative importance of exports of both capital-intensive and labor-intensive products to developed countries during 1965-1973, the annual rates of growth of exports to industrial countries for all major industry groups except "basic metal products" were significantly higher than that to developing countries. Although annual rates of growth to LDCs during 1965-1973 were positive and impressive in most industry groups, their shares have declined relatively. Only two cases recorded negative rates of growth, i.e. "cement and concrete products," and "tobacco". The former was mainly due to the increased activity of the domestic construction industry and hence increased domestic demand, whereas the latter was traditionally manufactured for domestic consumption (Table 5.8).

The importance of LDC markets declined in the late 1960's and early 1970's. The possible explanations are as follows: first, some of the developing countries succeeded in reducing their imports of labor-intensive goods from Singapore due to import substitution policies, particularly for "textiles," "footwear," "clothing," "leather products," "electrical machinery and appliances," "plastic products," "furniture and fixtures," and "printing and publishing." Malaysia is a case in point (see Appendix Table A-2.13).

Second, there was a surge in demand for both capital-intensive and labor-intensive products by industrial countries. Government policies and multinational corporations may have played a major role as discussed in Chapter III.

However, the trade patterns do not suggest that Singapore's comparative advantage of manufactured exports to developed (developing) countries lies in the labor-intensive (capital-intensive) lines of production. A non-parametric test suggests that there is no relationship between factor-intensity as measured by value-added per employee and manufactured exports to developed and developing countries. This is shown in Table 5.9.

The rank correlation coefficients obtained are low and not statistically significant. Factor intensities did not appear to adequately explain the patterns of manufactured exports of Singapore. For example, many industries (i.e. food, beverage, furniture and fixtures, paper and paper products, printing and publishing, textiles, footwear, leather

Table 5.9

Spearman Rank Correlation Coefficient (r_s) between Factor Intensities and Manufactured Exports to Developed and Developing Countries, 1973

Relationship Between $VA/E_{m,i}$ and:	No. of Industry Groups	r_s
(a) $X_{i,DC}/X$	26	0.003
(b) $X_{i,LDC}/X$	26	0.153

Notations: (1) $VA/E_{m,i}$ denotes value added per employee of industry i;

(2) $X_{i,DC}$ denotes exports of industry i to developed countries;

(3) $X_{i,LDC}$ denotes exports of industry i to LDCs;

(4) $X = \sum X_{i,DC} + \sum X_{i,LDC}$

Source: Derived from Appendix Tables A-5.2 and A-5.8.

products, rubber products, plastic products, pottery and china, glass and glass products, structural clay products, metal products) predominantly exported to LDCs are labor rather than capital-intensive. This together with declining export shares to LDCs, can be partly explained by the "technological gap model" formulated by Posner and Hufbauer.[12] According to this model,[13]

[12] The essential components of the "technological gap" model was first proposed by Posner (1961) but it was not widely known before Hufbauer (1966) applied the model to trade in synthetics in 1966.

[13] Hufbauer (1966), p. 94.

> The innovating country initially exports large quantities of the new products. Later, when the imitating country undertakes manufactures, the innovator's exports diminish. The same pattern applies to trade between early and late imitators: the early imitator exports to the late imitator until the latter country erects its own facilities and develops comparable advantage.

The technological gap based on "imitation lead" appears to be relevant in explaining Singapore's labor-intensive exports to developing countries. In many cases, manufactured exports to LDCs reflect essentially the temporary differences in producers' ability rather than factor or material cost advantage. In general, Singapore has an imitation lead in many labor-intensive industries and hence labor-intensive products are exported to developing countries. On the other hand, the gap between Singapore's "imitation lead" and other developing countries' "imitation lag" appears to be narrowing. This may explain the declining share of exports of labor-intensive products by Singapore to other developing countries.

5.3 Labor Skills and Trade in Manufactures

Orthodox Heckscher-Ohlin theory does not appear to provide an adequate explanation of trade flows among countries. Ohlin, in a recent article, states "... in my opinion simple models in basic (Heckscher-Ohlin) theory — although leading to formally precise conclusions — can contribute to nothing more than a vague knowledge about the nature of international trade."[14] He argues that attention should be placed more on "the influence on cost accounts and trade of other cost elements than the

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[14] Ohlin (1970), p. 12.

payments to the various factors of production."[15]

A number of new trade models have been suggested to explain international trade patterns. These "new theories" include (1) human skills, (2) technological gap, (3) product-cycle and (4) product similarity. For example, the "product similarity" theory suggests that free international trade will result in a situation where each country simultaneously produces, exports and imports products that are close substitutes for each other. A case in point is intra EEC trade. This intra-industry specialization thesis has been presented by Grubel and Lloyd.[16]

The product-cycle theory of Vernon-Hirsch[17] suggests that the LDCs may expect to have a comparative advantage in mature products. As an invention passess from early and growth phases to a mature stage, the production process becomes more standardized and readily transmittable, requiring less of management talents and scientific inputs and making more use of unskilled and semi-skilled labor. In the standardized phase, capital-intensity is high due to a large quantity of specialized equipment. On well-organized and price-sensitive markets, these products require neither expensive marketing methods nor special adaptation to foreign tastes and conditions. As a result, they tend to have easily accessible foreign markets. Provided differences in productivity are not large, the low labor costs of LDCs would contribute significantly to their competitive position. A wide range of standardized electrical products and electronic

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[15] Ohlin (1970), p. 13.

[16] Grubel (1967) and Grubel and Lloyd (1975).

[17] Vernon (1966) and Hirsch (1967).

components are the strongest examples.

The technological gap model has been briefly outlined in the previous section in explaining Singapore's export of manufactured goods to LDCs. In this section we shall analyze the skill contents of Singapore's trade in manufactures as it appears to offer a better explanation of Singapore's trade flows than does the orthodox factor-proportion theory.

(a) Extension of Heckscher-Ohlin Theory á la Keesing, et al.

An important criticism of the Heckscher-Ohlin theory is found in a study done by Leontief[18] which showed that the United States, generally regarded as the most capital-abundant country in the world, exported labor-intensive goods and imported capital-intensive ones. It was found that:[19]

> an average million dollar's worth of (US) exports embodies considerably less capital and somewhat more labor than would be required to replace from domestic production an equivalent amount of (US) competitive imports. America's participation in the international division of labor is based on its specialization on labor rather than capital-intensive lines of production. In other words, (US) resorts to foreign trade in order to economize its capital and dispose of its surplus labor, rather than vice versa.

The above result is in contradiction to that of the Heckscher-Ohlin hypothesis and is referred to as the "Leontief-Paradox." This has aroused a number of tests and extensions of the Heckscher-Ohlin theory. One of the important extensions incorporates human capital and skills into the

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18 Leontief (1953), reprinted in Leontief (1966).

19 Leontief (1966), p. 86.

analytical framework. The human capital approach, suggested by Ellsworth (1954), Kravis (1956) and Kenen (1965), has been employed to resolve the Leontief-Paradox. Kenen pointed out that the American export industries employ relatively more non-agricultural labor and that such labor is more educated and better trained than agricultural labor. Kravis also found that American export industries pay a higher wage rate than the import-competing ones which suggests that they use relatively more skilled labor. If the human capital that is embodied in this labor were to be incorporated in the capital employed in measuring factor-intensity, it is quite possible that Leontief's paradox would be resolved.

Keesing[20] adopts a different approach and examines the labor skill content embodied in American trade in manufactures. The Heckscher-Ohlin theorem was extended to include labor skills among the factor determinants on the supply side of international trade. In fact, Keesing suggests that the relative abundance of skilled and unskilled labor is the principal determinant of international trade patterns. The rationale for postulating skills as a major determinant of trade in manufactures is based on a number of observations: (i) labor is the most important factor of production as reflected by factor-income shares; (ii) unlike man-made material resources, human resources change slowly for most skills are difficult to acquire in terms of time, money and other resources; (iii) labor is less mobile than physical capital and moves at relatively high cost. Hence labor exerts a greater influence on location of industries than capital.

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[20] Keesing (1965, 1966, 1968).

In Keesing's three major works on the subject, he measured the skill content of U.S. trade as well as the trade of selected trading partners using U.S. skill input-coefficients. He then calculated the skills required to produce the several nations' exports and imports, "on the assumption that every country use the same direct labor skill combinations to produce each product that was used by United States."[21] On the basis of this calculation, Keesing ranked the fourteen countries according to skill-intensity. His results show that the skill intensities of a country's exports and imports are inversely related: countries with the most skill-intensive exports are those with the least skill-intensive imports. The American exports are most skill-intensive while its imports are least skill-intensive. For two developing Asian countries, India and Hong Kong, exports were the least skill-intensive while their imports were most skill-intensive. Therefore, the comparative advantage of this "new theory" will predict an outflows of skills through trade from industrial countries to developing countries which are poor in skilled labor. Hence, the relative endowments of labor skills are considered important in determining a country's comparative advantage. Keesing's empirical results, together with that of Yahr (1965), indicate the persuasiveness of the labor skills approach.

(b) Estimates of Labor Skill Coefficients in Singapore:

Keesing classified labor in the industrial sector into eight occupational groups as follows:

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[21] Keesing (1966), p. 249. The basic assumption that the same industries are skill-intensive relative to other industries in all countries is substantiated by Keesing in his test using the West German skill mix.

I. Scientists and Engineers
II. Technicians and Draftsmen
III. Other Professionals
IV. Managers
V. Mechanics, Electricians, Toolmakers
VI. Other Skilled Manual Workers
VII. Clerical, Sales, Services Workers
VIII. Semi-skilled and Unskilled Workers

Keesing then constructed a skill index from the above classifications as follow:

$$S_k = \frac{2(\mathrm{I} + \mathrm{II} + \mathrm{III}) + \mathrm{V}}{\mathrm{VIII}}$$

In Singapore's annual Census of Industrial Production (CIP), persons engaged in industrial activities are classified into four major groups: (1) workmen - which includes all skilled, semi-skilled or unskilled workmen but excludes "other employees," "working proprietors" and "unpaid family workers"; (2) other employees — which includes working directors, managers, supervisors, engineers, technicians and clerical staff but excludes working proprietors, partners and unpaid family workers; (3) working proprietors — which include proprietors and business partners who are actively engaged in the operation of the establishment, and (4) unpaid family workers. These data do not separate "skilled workers" from "semi-skilled and unskilled workers". We therefore have to rely on the 1970 Census of Population data. The following major occupational groups are listed in Singapore's Classification of Occupations:

I. Professional, Technical and Related Workers
II. Administrative and Managerial Workers
III. Clerical and Related Workers
IV. Sales Workers
V. Service Workers
VI. Agricultural Animal Husbandry and Forestry Workers, Fishermen and Hunters
VII. Production and Related Workers, Transport Equipment Operators and Laborers.

Singapore's occupational Groups I and II correspond to Keesing's occupational groups I, II, III and IV and the former's group VII is somewhat equivalent to the Keesing's group VIII. The percentage of workers in the seven occupational groups for 30 industries in Singapore are presented in Appendix Table A-5.10. Various forms of the index were computed but there was no significant difference in the rank ordering of the 30 industries. We have decided to use the following index which was adapted from Keesing's formulae:

$$S = \frac{I + II}{VII}$$

The resultant skill coefficients, along with the factor-intensity index, for 30 manufacturing industries are shown in Table 5.10. Except for a few cases the rank orderings between the two measures are somewhat similar. The Spearman rank correlation coefficient (r_s) is 0.60 which is statistically significant at 0.01 level of confidence.

(c) Hypotheses and Results of Statistical Tests:

The following hypotheses concerning the skill levels of Singapore's trade patterns are advanced:

Hypothesis (I): its manufactured imports are more skill-intensive than its manufactured exports;

Hypothesis (II): its manufactured import composition is positively correlated with the respective skill requirements of the industries. This is a reflection of its international comparative disadvantage;

Hypothesis (III): its manufactured export composition is negatively correlated with the respective industrial skill

Table 5.10

Skill Coefficients and Factor Intensities for
30 Industry Groups and Their Relative
Rank Orderings, 1970

Industry Groups	VA/E_m (S$)	Index	Ranks	Skill Coefficient (%)	Ranks
Food	8,795	95	13	12.79	17
Beverages	14,952	162	5	8.70	24
Tobacco	23,765	257	2	14.39	11
Textiles	3,348	36	27	11.06	21
Clothing	2,453	27	30	1.71	30
Leather and Leather Prod.	3,812	41	25	9.43	22
Footwear	3,270	35	28	4.94	28
Wood and Cork Products	6,746	73	19	6.58	26
Furniture and Fixtures	6,121	66	20	3.98	29
Paper and Paper Products	5,034	55	23	11.53	19
Printing and Publishing	7,526	82	17	39.57	4
Industrial Chemicals	19,670	213	3	41.96	3
Other Chemicals	11,093	120	8	32.76	5
Petroleum & Coal Products	95,629	1035	1	82.49	1
Natural Rubber & Gums	6,808	74	18	5.44	27
Rubber Products	11,781	128	7	14.30	13
Plastic Products	5,427	59	21	14.94	10
Pottery, China & Earthenware	2,460	27	29	9.28	23
Glass and Glass Products	8,806	95	12	12.78	18
Structural Clay Products	5,089	55	22	10.56	20
Cement and Concrete Prod.	11,040	120	9	22.81	8
Non-metallic Mineral, n.e.s.	7,566	82	16	13.62	15
Iron and Steel	16,221	176	4	13.69	14
Non-ferrous Metals	12,201	132	6	13.15	16
Fabricated Metal Products	8,414	91	14	14.37	12
Non-electrical Machinery	7,636	83	15	25.26	7
Electrical Machinery & Components	9,395	102	11	18.69	9
Transport Equipment	9,882	107	10	63.11	2
Instruments, Watches, Clocks & Optical Goods	3,994	43	24	28.82	6
Miscellaneous Manufacturing	3,643	39	26	6.76	25
Total Manufacturing	9,236	100			

Sources: Computed from Singapore, Report on the Census of Industrial Production, 1970 and Appendix Table A-5.10.

requirements. This is a reflection of its comparative advantage;

Hypothesis (IV): its manufactured exports to Southeast Asian developing nations and to all LDCs are more skill-intensive than to developed countries since Singapore is better endowed with labor skills relative to developing countries.

In order to test Hypothesis (I), we employed the skill coefficients calculated from Singapore's 1970 Population Census data for 28 manufacturing industries. Each of the industries was weighted by the sectoral composition of Singapore's manufactured imports and exports in 1970 and 1973 respectively. The rationale of employing the 1970 skill coefficients for two different time periods is that we believe the skill-intensities of industries are not likely to have changed significantly between 1970 and 1973. Singapore's weighted skill coefficient for manufactured imports was calculated to be 23.12 in 1973 (1970: 20.49) while the comparable figure for industrial exports was 20.45 (1970: 17.44) (Table 5.11). This result is consistent with Chow's recent findings[22] that Singapore's import and export index were 0.1557 and 0.1358 respectively employing a different approach in the comparison of skill requirements for selected developed and developing countries in 1971. Although empirical evidence tends to "support" Hypothesis (I), the <u>difference</u> between the weighted skill coefficients for industrial imports and for exports did not appear to be significant. A second test looking at the rank correlation between

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[22] Chow (1975).

Table 5.11

Skill Coefficients and Distribution of Singapore's Imports and Exports by Sectors, 1970, 1973

(Excluding "Petroleum")*

Industrial Sectors	M_i/M 1970	M_i/M 1973	X_i/X 1970	X_i/X 1973	Skill Coefficients
Food	6.94%	5.49%	21.07%	6.75%	12.79%
Beverages	7.05	0.84	1.30	0.53	8.70
Tobacco	1.00	0.28	1.68	0.25	14.39
Textiles	15.96	12.27	9.39	7.63	11.06
Clothing	1.40	1.07	11.93	6.90	1.71
Leather and Leather Prod.	0.41	0.52	0.44	0.24	9.43
Footwear	0.17	0.16	0.65	0.38	0.49
Wood and Cork Products	3.04	3.19	8.07	11.90	6.58
Furniture and Fixtures	0.14	0.14	0.29	0.28	3.98
Paper and Paper Products	2.18	2.29	1.07	0.88	11.53
Printing and Publishing	0.80	0.60	1.24	1.05	39.57
Industrial Chemicals	3.08	3.23	2.26	2.51	41.96
Other Chemicals	2.72	5.39	2.64	6.01	32.76
Rubber Products	0.75	0.49	0.91	0.45	14.30
Plastic Products	0.20	0.35	0.19	0.31	14.94
Pottery and China	0.74	0.78	0.75	0.22	9.28
Glass and Glass Products	0.53	0.67	0.57	0.35	12.78
Structural Clay Products	0.30	0.37	0.10	0.08	10.56
Cement and Concrete Products	0.62	0.78	0.29	0.13	22.81
Non-metallic Minerals, n.e.s.	0.29	0.32	0.10	0.05	13.62
Iron and Steel	6.15	6.59	1.88	2.01	13.69
Non-ferrous Metals	1.34	1.38	0.55	0.71	13.15
Fabricated Metal Products	3.16	3.17	3.06	2.20	14.37
Non-electrical Machinery	16.61	16.97	9.13	14.49	25.26
Electrical Machinery & Components	9.67	14.25	9.15	20.64	18.69
Transport Equipment	7.57	10.28	6.80	7.31	63.11
Instruments, Watches Clocks & Optical Goods	3.77	4.28	1.49	3.29	28.82
Mis. Manufacturing	[illegible]	4.22	3.02	2.74	6.76
*Weighted Average Index for all Sectors	20.49	23.12	17.44	20.45	

Notes: * "natural rubber and gums" was also excluded.

Sources: Calculated from Appendix Table A-5.2 and Appendix Table A-5.8.

$M_i/\sum M_i - X_i/\sum X_i$ and skill coefficients (S_i) revealed that the correlation coefficient (r_s), though positive in both years (r_s: 1970 = 0.108, 1973 = 0.280, Line 4, Table 5.12), was not statistically significant.

Hypothesis (II) is supported by a positive Spearman rank correlation between the sectoral shares of imports of 29 manufacturing industries ($M_i/\sum M_i$, i = 1, 2,...., 29) and the skill coefficients (Line 1, Table 5.12). The rank correlation coefficient was 0.389 in 1973 (1970: r_s = 0.345) which was statistically significant at 0.05 level of confidence.

The negative rank correlation coefficient as predicted in Hypothesis (III) is not displayed in line (2) (Table 5.12). Instead, we obtained positive correlation coefficients for both 1970 (r_s = 0.192) and 1973 (r_s = 0.389). The r_s for 1970 was statistically insignificant. A different set of export data based on Singapore's Census of Industrial Production (CIP) was also used for both 1970 and 1974. We failed again to accept Hypothesis (III). The r_s for 1970 was 0.166 which is statistically insifnificant. In 1974 a positive rank correlation coefficient (r_s = 0.408) was obtained which is significant at the 0.05 level of confidence.

The r_s between the skill index and the sectoral export-output (X_i/Q_i) ratio was negative in 1970 (r_s = -0.260) but was positive in 1974 (r_s = 0.086). However, both r_s's are statistically insignificant. Lines (2) and (3) indicate that Singapore's industrial exports have increasingly embodied higher levels of skill resources. Despite this, Singapore's net manufactured import composition is still more skill-intensive than manufactured export composition as indicated by a positive correlation of ($M_i/\sum M_i - X_i/\sum X_i$) and S_i (Line 4), though this is not statistically significant.

Table 5.12

Spearman Rank Correlation Coefficients (r_s) between
Skill Coefficients (S_i) and Trade Composition
in Manufactures, 1970, 1973/74
(Cross-Section Analysis)

Between Skill Coefficients (S_i) and:		n	r_s
(1) $M_i / \sum M_i$	1970	29	0.345(*)
	1973	29	0.389***
(2) $X_i / \sum X_i$ (based on trade data):	1970	29	0.192
	1973	29	0.389***
$X_i / \sum X_i$ (based on CIP data):	1970	30	0.166
	1974	30	0.408***
(3) X_i / Q_i (CIP data):	1970	22	-0.260
	1974	26	0.086
(4) $M_i/\sum M_i - X_i/\sum X_i$:	1970	28	0.108
	1973	28	0.280
(5) $X_i/\sum X_i$ (to DC):	1970	29	0.108
	1973	29	0.113
(6) $X_i/\sum X_i$ (to LDCs):	1970	29	0.302
	1973	29	0.395***
(7) $X_i/\sum X_i$ (to S.E.A.):[a]	1970 (Malaysia only)	30	0.440**
	1974	30	0.668*

Test of significance of r_s:
* significant at 0.01 level;
** significant at 0.02 level;
*** significant at 0.05 level;
(*) significant at 0.10 level.

Notes: (1) S_i based on 1970 Population Census data across manufacturing industries;
(2) n = number of industry groups (including "petroleum refinery and petroleum products");

[a] S.E.A. = Southeast Asia, based on CIP data; n including "natural rubber and gums."

Sources: Derived from Table 5.10 and Appendix Tables A-5.4 and A-5.9.

One of the reasons for our failure to accept Hypothesis (III) may be that in Singapore the relatively more skill and capital intensive industries are more efficient than those industries with lesser skills and higher labor intensities.[23] In this case, there would be a relatively high skill intensity embodied in Singapore's exports of manufactures.

We turn to Hypothesis (IV) concerning the destination of Singapore's manufactured exports. Malaysia and other Southeast Asian developing countries are Singapore's major trading partners. In 1974, Singapore's direct manufactured exports to Malaysia and other Southeast Asian countries accounted for 32 percent of the total industrial exports (based on CIP data).[24] This figure is subject to downward bias because part of the sales of domestic wholesalers are finally exported (see chapter III).

In general, our non-parametric tests have accepted Hypothesis (IV) that Singapore's manufactured exports to Southeast Asian developing countries and to all LDCs are more skill-intensive than to industrial countries. In 1974 the rank correlation coefficient between sectoral shares of manufactured exports to all Southeast Asian countries ($X_i/\sum X_i$ (to S.E.A.), $i = 1, 2, \ldots, 30$) and skill coefficients was 0.668 which is statistically significant at the 0.01 level of confidence (1970: r_s between $X_i/\sum X_i$ (to Malaysia only) and S_i was 0.440 which is also significant at the

[23] In a study of the productivity performance of manufacturing industries in Singapore during 1968-1970, Goh and Chew (1973) found that firms with higher productivity tend to have higher capital intensities (measured by K/L ratio) and a higher degree of export orientation (measured by ratio of direct exports to total sales). See R. Goh and S. B. Chew, A Study of the Productivity Performance of Manufacturing Industries under Different Capital Ownership, 1968-1970, (mimeo.) Singapore, National Productivity Board, (August 1973).

[24] Singapore, Report on the Census of Industrial Production, 1974.

0.02 level). When manufactured exports to all LDCs are taken together, the Spearman correlation coefficient obtained was also positive at 0.395 which is significant at the 0.05 level (1970: $r_s = 0.302$ which is statistically insignificant). On the other hand, rank correlation coefficients between manufactured exports to industrial countries and skill intensity are low (1970: $r_s = 0.108$, 1973: $r_s = 0.113$) and not statistically significant.

An average weighted index of skilled labor in Singapore's industrial exports to developed and developing countries were also calculated and is presented in Table 5.13. The skill index of exports to developing countries was 41.43 which is higher than that to developed countries. Skills embodied in Singapore's exports to Southeast Asian countries are shown separately and are also higher than in exports to developed countries. A recent study by Chow (1975) also supports our hypothesis. Chow found out that the skill index in 1971 for Singapore is 0.1358 which is <u>lower</u> than that of the U.S., West Germany, the U.K., Australia, Netherlands, France and Japan but <u>higher</u> than Spain, Italy, Brazil, Israel, Egypt, West Malaysia, Taiwan, South Korea and Hong Kong (all countries ranked in descending order) using the assumption of fixed skill input-coefficients <u>á la</u> Keesing.[25] It is believed that the skill index for Singapore is upward biased due to the inclusion of the petroleum sector. This may explain why its export intensity is higher than that of Spain and Italy. On balance, our tests leads us to accept Hypothesis (IV).

Our empirical tests in this chapter have suffered from the basic limitation that official trade data include extrepôt figures. The results

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[25] Chow (1975), Table 4, p. 82.

Table 5.13

Percentage Distribution of Industrial Exports and Weighted Average Skill Coefficients by Areas, 1973/74

Industrial Sectors	Developed Countries	Developing Countries	Southeast Asia Nations
Food	2.62 %	7.24 %	6.88 %
Beverages	0.03	0.74	0.80
Tobacco	0.01	0.37	0.56
Textiles	3.49	7.63	2.73
Clothing	9.00	1.12	0.25
Leather and Leather Products	0.07	0.28	0.05
Footwear	0.18	0.38	0.02
Wood and Cork Products	13.57	3.90	0.46
Furniture and Fixtures	0.18	0.23	0.20
Paper and Paper Products	0.01	1.26	0.56
Printing and Publishing	0.50	1.04	0.81
Industrial Chemicals	1.65	2.54	0.97
Other Chemicals	1.35	5.82	2.17
Petroleum and Coal Products	23.10	31.14	60.63
Rubber Products	0.06	0.62	0.42
Plastic Products	0.19	0.25	1.19
Pottery and China	0.02	0.30	0.01
Glass and Glass Products	0.01	0.26	0.23
Structural Clay Products	0.02	0.10	0.02
Cement and Concrete Products	0.02	0.17	0.75
Non-metallic Mineral Products, n.e.s.	-	0.08	0.91
Iron and Steel	0.05	2.90	1.05
Non-ferrous Metal Basic Industries	0.04	0.60	0.81
Fabricated Metal Products	0.54	2.68	3.43
Non-electrical Machinery	12.51	8.70	2.68
Electrical Machinery & Components	21.73	8.48	8.11
Transport Equipment	3.18	7.28	2.52
Instruments, Watches, Clocks and Optical Goods	3.21	1.63	0.55
Miscellaneous Manufacturing	2.28	1.28	0.23
* Average Weighted Skills Intensity for Industrial Exports by Areas	32.67	41.43	58.12

Note: For developed and developing countries, the export data are based on UN trade statistics (1973). For Southeast Asian nations, exports are direct domestic exports based on production census (CIP) data (1974).

Sources: Computed from Appendix Table A-5.6 and Singapore, Report on the Census of Industrial Production, 1974.

may have been improved if trade figures excluding entrepôt activities were available.

Summary

In this chapter, we have shown that Singapore's comparative advantage lies in labor-intensive lines of production (excluding "petroleum refinery and petroleum products") by a Leontief-type test. The trade patterns do not indicate that Singapore's manufactured exports to developed (developing) countries are based on labor-intensive (capital-intensive) lines of production as predicted by the orthodox Heckscher-Ohlin theory. A non-parametric test suggests that there is no relationship between factor-intensity as measured by value added per employee and manufactured exports to developed and developing countries in 1973.

On the other hand, the extension of Heckscher-Ohlin theory *á la* Keesing appears to offer a better explanation of the trade patterns. Our empirical tests did not lead us to accept Hypothesis (I). On the other hand, we accepted Hypotheses (II) and (IV) which indicate that industrial resources in Singapore do not appear to be misallocated. The allocative implication of our failure to confirm Hypothesis (III) should not be exaggerated because the composition of manufactured exports has undergone important structural changes (Table 5.6). Capital and skill-intensive industries have grown more rapidly than labor-intensive industries. To the extent that the former industries are more efficient than those industries with lesser skill and capital intensities, we would expect industrial exports embodying higher levels of skill resources. In a dynamic context, this could indicate that there have been some beneficial effects on the allocation of industrial resources since Singapore has improved its development of human resources (see Appendix B).

So far, we have not examined the supply and demand factors responsible for the rapid growth of industrial exports. This is our main task in Chapter VI.

CHAPTER VI

THE BASIS AND SCOPE OF INDUSTRIAL EXPORTS

In this chapter, we shall focus our attention on the factors responsible for manufactured export expansion. Two analytical tools will be employed. The first approach is to test the strength of both supply and demand factors affecting the growth of manufactured exports by means of time-series regression analysis. We shall concentrate on a few elements which are quantitatively measurable and appear to be important in manufactured export expansion.

A second somewhat different statistical approach, i.e. a Constant-Market-Share model á la Tyszynski, et al.[1] will be employed to explain manufactured export performance by looking at the portions of export growth that can be attributed to: (i) world trade, (ii) commodity composition, (iii) market distribution, and (iv) "competitiveness". The "competitiveness" effect in this model represents a host of factors operating on the supply side which tend to increase or reduce export capacity. We shall attempt to analyse the competitiveness of industry by looking at technological change and scale economies, industrial relations policy and wage rate-productivity. Finally, we shall assess the scope and prospects for manufactured exports from Singapore.

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[1] The Constant-Market-Share model was first suggested in an article by Tyszynski (1951). It has since been further developed and utilized in a number of studies, among which may be mentioned: Baldwin (1958), Spiegelglas (1959), Narvekar (1960), Romanis (1961) and Wells (1964).

6.1 A Regression Analysis of the Determinants of Manufactured Exports

On *a priori* grounds, many factors could influence industrial exports. These include the supply elasticity of exportables, the level and composition of internal demand, differential rates of increase in selling prices, the efficiency of marketing, changes in producers' ability and attitudes towards exports, the availability of specific skills, endowment with natural resources and the import policy of potential customers. Many of these factors cannot be quantified. In the following analysis, we shall concentrate on a few elements which are quantitatively measurable and appeared to be important in manufactured export expansion.

(a) Hypotheses and Regression Model:

World Export Trade in Manufactured Products (W_{mx}): The hypothesis is that Singapore's manufactured exports depend positively on world trade in manufactures. During the period 1959-1974, world trade in manufactures increased rapidly (Appendix Table A-6.4). It is expected that this had a positive effect on Singapore's industrial exports. In other words, the world demand for manufactured products has contributed to the growth of Singapore's manufactured exports.

World export trade volume of manufactured goods may be considered a proxy for world income. We would expect that world demand for manufactured goods would grow in line with the increase of world income, particularly that demand for manufactured products is income elastic. Polak[2] has argued that the volume of world trade is actually preferred to world income as an

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[2] Polak (1953), pp. 50-51.

explanatory variable in the analysis of trade relations between one country and the rest of the world. His arguments are based on two grounds: first, the use of world income makes no allowance for inter-country differences in the marginal propensity to import, and second, the world income variable may be affected by any general shift in the relation between income and imports in other countries. While this may be true, we usually assume that a country's exports are dependent on income changes in other countries. For LDCs, changes in foreign exchange reserves could be the dominant factor affecting their imports. For our purposes, world export trade captures both changes in world income levels and the availability of foreign exchange in LDCs. World export trade volume is narrowly defined to include SITC commodity groups 5 to 8. The market value of world manufactured exports is deflated by the unit value index for world manufactured exports at 1964 prices (Appendix Table A-6.4).

Real Exchange Rates (R): A change in foreign exchange rates can have an effect on both the demand for and supply of exportables. A rise in foreign exchange rates reduces the foreign currency price of exports and hence shifts upward the world demand curve (demand side). On the other hand, it improves the receipts of domestic exporters in terms of local currency, thus inducing them to export more.

Unlike many other LDCs, Singapore did not have an elaborate exchange rate system to induce manufactured exports. From 1959 to 1970, the exchange rate of the Singapore dollar was stable and pegged at S$3.06 per US dollar (Appendix Table A-2.2). During the international monetary crisis of December 1971, the Singapore dollar was revalued to S$2.82 per US dollar. Since June 1973, it has been floating. Although it is likely that a revaluation of the Singapore dollar will have some initial negative effects on the expansion of manufactured exports, we hypothesize that there is no significant effect of exchange rate variation on manufactured exports. To allow for disparities in the price movements between Singapore and the rest of the world, the real exchange rates for 1959-1974 were computed. The nominal exchange rates for 1959-1974 was first inflated by the US consumer price index and then deflated by the corresponding Singapore consumer price index (Appendix Table A-6.1).

<u>Rate of Capacity Utilization (U)</u>: The rate of capacity utilization will likely have an effect on the volume of manufactured exports. The underlying hypothesis is that when domestic demand is high and home sales are profitable, firms will operate at full capacity to satisfy domestic orders and export little. On the other hand, when domestic demand is sluggish and capacity utilization low (i.e. excess capacity), firms will attempt to increase export sales. Hence, the rate of capacity utilization and export expansion will be inversely related. This is the so-called "recession-boom effect."[3] Since there is no existing measure of capacity utilization available in Singapore, this may be roughly measured by the deviation from the exponential growth trend of industrial production in period t.[4] This procedure is also followed by Tyler[5] and has a close

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[3] Donges (1972) and Tyler (1973).

[4] The fitted trend for total manufacturing including petroleum industries in Singapore was $\hat{Q}_m = 114.08\ (1 + 0.2303)^t$. For total manufacturing industries excluding petroleum refinery and petroleum products, the fitted trend was $\hat{Q}_m = 122.70\ (1 + 0.1840)^t$. Rate of capacity utilization is greater if $(\hat{Q}_m - Q_m)$ is positive and large. Since the deviation $(\hat{Q}_m - Q_m)$ contained negative values, they are put into index form by adding a constant, i.e. $\hat{U}_t = (\hat{Q}_m - Q_m + \text{constant})$. The constant in our case is 200. The results are given in Appendix Table A-6.5.

[5] Tyler (1973).

affinity to the Wharton-School method of estimating the rate of capacity utilization.[6]

Labor Productivity (L_p): Due to the small domestic market, many industries in Singapore have no alternative but to export. Improvements in the efficiency of industries can enhance their competitiveness in overseas markets and shift the supply curve rightward. We shall use labor productivity (L_p) measured by value added per worker as a proxy variable for the efficiency of industries. Labor productivity of manufacturing industries has increased during the period 1959-1974 (Appendix Table A-6.6). We hypothesize that there is a positive relationship between manufactured exports and the increase in labor productivity.

Commodity Concentration of Manufactured Exports (C_{jx}): It is generally hypothesized that changes in the commodity concentration of manufactured exports will have some direct effect on the volume of export trade. Some evidence suggests that the more diversified a country's exports, the higher its export growth rate (see Table 2.9, chapter II). Tinbergen[7] found that the volume of exports between pairs of countries is positively related to the diversification of commodity groups, that is, negatively to commodity concentration. A similar result is obtained by Rahman[8] in a cross-country analysis of manufactured exports from LDCs to developed countries, but the explanatory power of commodity concentration is low in a simple log-linear equation (r = 0.49). We shall test this relationship for Singapore by using time-series annual data. The commodity concentration of manufactured

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[6] Klein and Summers (1966).

[7] Tinbergen (1962).

[8] Rahman (1973), p. 99.

exports is measured by the Gini-Hirschman index as discussed in Section 2.4(b), Chapter II.

Geographical Concentration of Manufactured Exports (G_{jx}): It is generally believed that there is a negative relationship between the market concentration of exports and export expansion: the smaller its market concentration, the larger its export expansion. We shall test this relationship in the case of Singapore using annual data on geographical concentration. Market concentration is measured by the Gini-Hirschman index as defined in section 2.4, Chapter II. Since Singapore's domestic exports are predominantly manufactured products, we shall use the coefficient of geographical concentration for total exports as a proxy variable for manufactured exports.[9] The values for 1959-1974 are shown in Table 2.10. Both commodity and geographical concentration of manufactured exports may partly reflect factors operating on the demand side, but we may also consider them as supply phenomena since they demonstrate the country's willingness and ability to diversify its commodity composition of exports and to penetrate into foreign markets.

The industrial export function can be expressed as follows:

(6.1) $$X_{s,t} = f\,(W_{mx,t},\ R_t,\ U_t,\ L_{p,t},\ C_{x,t},\ G_{x,t})$$

where $X_{s,t}$ = Singapore's manufactured exports in period t;

$W_{mx,t}$ = value of world export trade in manufactures in period t;

R_t = real exchange rate in period t;

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[9] The Census of Industrial Production showed only two market orientations of manufactured products, i.e. direct exports to Malaysia, and "overseas" collectively. Although trade statistics show the market orientation of exports, exports includes re-export figures.

U_t = rate of capacity utilization as measured by the deviation from the exponential trend of the type Log Q_m = a + bt;

$L_{p,t}$ = labor productivity as measured by value-added per worker in period t;

$C_{x,t}$ = commodity concentration of manufactured exports as measured by the Gini-Hirschman coefficient in period t;

$G_{x,t}$ = geographical or market concentration of manufactured exports as measured by the Gini-Hirschman index in period t.

This model is neither a demand nor supply function since it includes elements of both. It is an aggregated industrial export function. In the model, changes in the variables W_{mx} and R_t can be viewed as shifts in the export demand curves. On the other hand, changes in variables U_t, $L_{p,t}$, $C_{x,t}$ and $G_{x,t}$ and to some degree R_t are seen as shifts in supply curves. The values of $X_{s,t}$ and $W_{mx,t}$ are expressed at constant prices in US dollars.[10] Values of $L_{p,t}$ are shown in the form of an index (Appendix Table A-6.6). The annual values of $X_{s,t}$ were then regressed on the six independent variables.

In our study, we shall mainly focus on the supply side of export behavior. The foreign demand for Singapore's industrial exports is assumed to be perfectly elastic or nearly so, implying that Singapore will be able

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[10] To find a suitable price index for Singapore posed some problems. Ideally, Singapore's manufactured exports (X_s) should be deflated by an industrial price index, but no such price index is available. It is solved by using GDE and GDP price deflators (see Appendix Table A-1.2) as an approximation. W_{mx} is deflated by the world export price index for manufactures (Appendix Table A-6.4).

to sell all its industrial exports at internationally competitive prices. This does not appear to be an unrealistic assumption for Singapore since its share of industrial exports in world trade is negligible or minute. Demand factors are later incorporated into the supply function to form an aggregate function. It is assumed that the relationships take the log-linear form for both the supply and aggregate functions since it provides a better "fit" to our data.

(a) Empirical Results:

The estimated supply functions using time-series regression analysis for 1959-1974 are presented below:

$$(6.2)\quad \log X_s = \underset{}{-5.646} + \underset{(5.286)^{*}}{3.573} \log L_p + \underset{(1.809)^{**}}{0.609} \log U + \underset{(1.165)}{0.988} \log R - \underset{(1.838)^{**}}{2.000} \log C_x + \underset{(-1.224)}{1.307} \log G_x$$

$$\bar{R}^2 = 0.935 \qquad D\text{-}W = 1.916 \qquad F\text{-ratio} = 44.118$$

$$(6.3)\quad \log X'_s = -5.931 + \underset{(3.105)^{*}}{1.942} \log L_p + \underset{(3.633)^{*}}{1.153} \log U' + \underset{(2.251)}{1.740} \log R - \underset{(-2.966)^{**}}{2.463} \log C_x + \underset{(0.525)}{0.412} \log G_x$$

$$\bar{R}^2 = 0.941 \qquad D\text{-}W = 1.771 \qquad F\text{-ratio} = 48.960$$

$$(6.4)\quad \log X_{s,\mathrm{SITC}\ 5\text{-}8} = -12.327 + \underset{(5.686)^{*}}{2.105} \log L_p + \underset{(3.144)^{*}}{0.589} \log U + \underset{(1.867)}{0.825} \log R + \underset{(0.804)}{0.391} \log C_x + \underset{(1.565)}{0.733} \log G_x$$

$$\bar{R}^2 = 0.956 \qquad D\text{-}W = 2.701 \qquad F\text{-ratio} = 66.164$$

(Note: * signifies significant at 0.01 level;
** significant at 0.05 level)

where X'_s, U' denote X_s and U less "petroleum refinery and petroleum products," $X_{s,\ \mathrm{SITC}\ 5\text{-}8}$ refers to the narrower definition of manufactured exports, i.e.

SITC 5-8. The figure within the parentheses is the t-ratio, $\bar{R}^2$ is the coefficient of determination corrected for degrees of freedom and D-W is the Durbin-Watson statistic. The explanatory power of the estimated equations (with or without "petroleum refinery and petroleum products") is high as indicated by a high $\bar{R}^2$'s. The regression coefficients for L_p are significant in all three equations and have the expected positive signs. Furthermore, the Durbin-Watson statistic indicates that there is no serial correlation detected. Hence, it tends to support our hypothesis that manufactured exports are affected by the increase of labor productivity which implies lower unit costs and greater competitiveness. The results also show that the regression coefficients of commodity concentration (C_x) of equations (6.2) and (6.3) have the expected negative signs and are statistically significant at 0.05 level. In equation (6.4) it has the wrong sign. Although evidence is inconclusive, it appears that diversification of manufactured exports may have some effect on the volume of export trade.

On the other hand, the results show that there are no effects of capacity utilization (U), exchange rate (R) or geographical concentration (G_x) on the expansion of manufactured exports during 1959-1974 as viewed from the supply side.

Multiple regression results from inclusion of supply and demand variables in our aggregated industrial export function (6.1) are shown below:

$$(6.5)\quad \log X_s = -29.101 + \underset{(11.212)^*}{2.680} \log W_{mx} + \underset{(0.684)}{0.239} \log L_p + \underset{(1.698)}{0.169} \log U$$

$$+ \underset{(1.127)}{0.270} \log R + \underset{(3.295)}{1.398} \log C_x - \underset{(-4.102)^*}{1.195} \log G_x$$

$$\bar{R}^2 = 0.995 \quad D\text{-}W = 2.240 \quad F\text{-ratio} = 516.151$$

$$(6.6)\quad \log X'_s = -24.016 + \underset{(10.012)^\bullet}{1.957} \log W_{mx} - \underset{(-0.118)}{0.033} \log L_p + \underset{(6.016)}{0.660} \log U$$

$$+ \underset{(2.788)}{0.688} \log R + \underset{(0.877)}{0.328} \log C_x + \underset{(1.075)}{0.216} \log G_x$$

$$\bar{R}^2 = 0.995 \quad D\text{-}W = 2.034 \quad F\text{-ratio} = 612.937$$

$$(6.7)\quad \log X_{s,\ SITC\ 5\text{-}8} = -20.630 + \underset{(3.587)^*}{0.916} \log W_{mx} + \underset{(3.250)^*}{1.173} \log L_p$$

$$+ \underset{(2.416)}{0.346} \log U + \underset{(0.915)}{0.303} \log R + \underset{(3.454)}{1.688} \log C_x + \underset{(2.708)}{0.660} \log G_x$$

$$\bar{R}^2 = 0.980 \quad D\text{-}W = 2.750 \quad F\text{-ratio} = 122.70$$

(Note : • denotes significant at 0.01 level)

The results show that there is a strong positive relationship between the dollar value of Singapore's manufactured exports and the expansion of world exports of manufactures. A positive labor productivity effect was obtained in equation (6.5) as predicted but was non-existent or had the "wrong" sign in equations (6.5) and (6.6). A market concentration effect was observed in equation (6.5). On the other hand, there was no "recession-boom effect" for Singapore's industries since estimated values for U have the "wrong" signs.

In general, the influence of world trade expansion is strong on the demand side. On the supply side, labor productivity and commodity concentration have some positive effects on the expansion of manufactured exports. There was no capacity utilization effect which may be explained by the limited domestic market. Many industries have no alternative but to export their products to foreign markets. In addition, there were no exchange rate or geographical concentration effect as shown by our time-series regression analysis.

The above analysis encountered several statistical problems. First, the observation period ($n = 16$) is short. This poses the degrees of freedom problem which is particularly acute in multiple regression analysis involving many independent variables. One consequence is that the standard errors of regression coefficients increase which in turn results in low t-ratios ($t = \hat{\beta}$/standard error of $\hat{\beta}$ where $\hat{\beta}$ is the estimated regression coefficient). Furthermore, it would have been much more conclusive to confine our analysis to the late 1960s and early 1970s in which a real upward surge of industrial exports took place, if half-yearly or quarterly figures were available.

6.2 Constant-Market-Share Analysis of Export Performance

We shall now look at the portions of export growth that can be attributed to factors operating on the demand and supply side by means of the Constant-Market-Share analysis.

(a) Theoretical Framework:

A country's exports could grow as rapidly as the average of world exports for the following reasons: (a) exports did not concentrate on commodities for which demand was growing slowly; (b) exports did not go primarily to relatively stagnant areas; or (c) the country was able and willingly to compete effectively with other sources of supply. The method which separates these effects is the Constant-Market-Share Analysis (hereafter CMS model) pioneered by Tyszynski.[11] The basic assumption of this model is that a country's share in world markets remains unchanged over time. The CMS model can be formulated as follows:[12]

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[11] Tyszynski (1951). See Footnote (1), this chapter.

[12] See Leamer and Stern (1970), Chapter 7.

Notations and Definitions:

X_i = value of Singapore's exports of Commodity i in Period 1.

X_i' = value of Singapore's exports of Commodity i in Period 2.

X_j = value of Singapore's exports to Country j (or Area j) in Period 1.

X_j' = value of Singapore's exports to Country j (or Area j) in Period 2.

X_{ij} = value of Singapore's exports of Commodity i to Country j (or Area j) in Period 1.

r = percentage increase in total world exports from Period 1 to Period 2.

r_i = percentage increase in world exports of Commodity i from Period 1 to Period 2.

r_{ij} = percentage increase in world exports of Commodity i to Country j (or Area j) from Period 1 to Period 2.

From the above definitions it follows that for Period 1,

$$(6.8) \quad \sum_j X_{ij} = X_i \; ; \quad \sum_i X_{ij} = X_j$$

and similarly for Period 2. The value of Singapore's exports in Period 1 is given by

$$(6.9) \quad \sum_i \sum_j X_{ij} = \sum_i X_i = \sum_j X_j = X$$

First, assume that exports are completely undifferentiated as to commodity market distribution, i.e. exports are viewed as a single good destined for a single market. If Singapore maintained its share in this market (constant-share norm), the exports would increase by rX and the following identity holds:

$$(6.10) \quad X' - X = rX + (X' - X - rX)$$

Identity (6.10) is referred to as "one-level" analysis. It separates the growth of Singapore's exports into (1) the general increase in world exports and (2) an unexplained residual, the competitiveness effect.

Exports are in fact a diverse set of commodities. For the ith commodity, the identity is

$$(6.11) \qquad X_i' - X_i = r_i X_i + (X_i' - X_i - r_i X_i)$$

which may be aggregated to

$$(6.12) \qquad X' - X = \sum_i r_i X_i + \sum_i (X_i' - X_i - r_i X_i)$$
$$= rX + \sum_i (r_i - r)\, X_i + \sum_i (X_i' - X_i - r_i X_i)^{13}$$

Identity (6.12) is a "two-level" analysis where the growth of Singapore's exports may be attributed to (1) the general increase in world exports, (2) the commodity composition of Singapore's exports in Period 1 and (3) a residual indicating the difference between Singapore's actual export increase and the hypothetical increase if Singapore had maintained its share of the exports of each commodity group.

"Three-level" analysis takes into account the differentiation of market destination as well as export commodity groups. Allowance should be made that some countries have easy access to rapidly growing regions while others are surrounded by relatively slow-growing neighbors. The appropriate norm in this case is a constant share of the exports of a particular commodity class to a particular region. The identity similar to (6.10) and (6.11) is

$$(6.13) \qquad X_{ij}' - X_{ij} = r_{ij} X_{ij} + (X_{ij}' - X_{ij}\ r_{ij} X_{ij})$$

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13 Because $\sum_i r_i X_i = rX + \sum_i r_i X_i - \sum_i rX_i$ where $rX = \sum_i rX_i$.

When aggregated, it becomes

$$(6.14)\quad X' - X = \sum_i \sum_j r_{ij}X_{ij} + \sum_i \sum_j (X'_{ij} - X_{ij} - r_{ij}X_{ij})$$

$$= \underset{(1)}{rX} + \underset{(2)}{\sum_i (r_i - r)X_i} + \underset{(3)}{\sum_i \sum_j (r_{ij} - r_i)X_{ij}}$$

$$+ \underset{(4)}{\sum_i \sum_j (X'_{ij} - X_{ij} - r_{ij}X_{ij})}\ ^{14}$$

Identity (6.14) states that the increase in Singapore's exports is due to (1) the general rise in world exports, (2) the commodity composition effect, (3) the market distribution effect and (4) the residual which represents "competitiveness", i.e. the difference between actual export growth and the growth which would have occured if Singapore had maintained its share of exports of each commodity to each market.

The commodity-composition effect, defined by $\sum_i r_iX_i - \sum_i rX_i = \sum_i (r_i - r)X_i$, is positive if Singapore's exports are concentrated in commodity classes with growth rates more favorable than the world average. Similarly, the market distribution effect, defined by $\sum_i \sum_j (r_{ij} - r_i)X_{ij} = \sum_i \sum_j r_{ij}X_{ij} - \sum_i \sum_j r_iX_{ij}$, is positive if Singapore had concentrated its exports in markets that were experiencing relatively rapid growth.

If one allows first for the market distribution effect and then the commodity distribution effect, identity (6.14) may be written as

$$(6.15)\quad X' - X = \underset{(1)}{rX} + \underset{(2)}{\sum_j (r_j - r)X_j} + \underset{(3)}{\sum_i \sum_j (r_{ij} - r_j)X_{ij}}$$

$$+ \underset{(4)}{\sum_i \sum_j (X'_{ij} - X_{ij} - r_{ij}X_{ij})}$$

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[14] Because $\sum_{ij}\sum r_{ij}X_{ij} = rX + \sum_i r_iX_i - \sum_i rX_i + \sum_i \sum_j r_{ij}X_{ij} - \sum_i \sum_j r_iX_{ij}$ where $rX = \sum_i rX_i$ and $\sum_i r_iX_i = \sum_i \sum_j r_iX_{ij}$.

where term (2) is the "market structure" effect and term (3) the "commodity composition" effect. Although the sum of terms (2) and (3) are identical to the two center terms in identity (6.14), their respective values are different. In algebraric form,

$$\text{Commodity Effect: } \sum_i (r_i - r)X_i = \sum_i \sum_j (r_{ij} - r_j)X_{ij}$$

$$\text{Market Effect : } \sum_i \sum_j (r_{ij} - r_j)X_{ij} = \sum_j (r_j - r)X_j$$

The first three factors in (6.14) and (6.15) are mainly demand phenomena which reflect (1) the changes in world demand as measured by the total value of world trade; (2) changes in the commodity composition of import demand in a given foreign market due to changes in the level and distribution of real income, taste, technology, commercial policy, etc., and (3) changes in the market distribution pattern of the different national or regional markets for similar reasons. On the other hand, the "competitiveness effect" represents a host of factors operating on the supply side which tend to increase or reduce the export capacity of the home industry, i.e. changes in relative export prices, the quality of exportables, the development of new products, the efficiency of export marketing, the financing of export goods and delivery, the growth rates of available productive resources and the productivity level of export industries vis-â-vis its foreign competitors abroad.[15]

[15] Strictly speaking, the competitiveness residual is an interaction of demand and supply factors. Factors such as changes in relative export prices, quality improvement, marketing efficiency, financing and delivery, bear upon the saleability of a country's exports. Thus they are meant to describe demand phenomena. On the other hand, variables such as differential rates of monetary inflation, the differential rates of growth of factors, and the differential rates of productivity increase may have an effect on a country's export-supply prices vis-â-vis its competitors in world trade. The factors interact with each other. See Leamer and Stern (1970).

(b) Application to Singapore and the Empirical Results:

When applying the CMS model to Singapore, the following major commodity groups (i) and market areas (j) are selected:

Commodity Groups (i):

Food, Beverages, and Toabcco (SITC 0 and 1);
Crude Materials, Oils and Fats (SITC 2 and 4);
Mineral Fuels and Related Materials (SITC 3);
Chemicals (SITC 5);
Machinery and Transport Equipment (SITC 7);
Other Manufactured Goods (SITC 6 and 8);
All Other Goods (SITC 9).

Market Areas (j):

United States; Canada; Latin America; Western Europe; Japan; Developing Asia; Australia and New Zealand; Developing Africa; Rest of World.

Although our major concern is on manufactured exports (defined as SITC commodity groups 5-8), we shall also briefly examine the sources of change in Singapore's total exports (SITC 0-9). The results of the CMS estimates for Singapore's total exports and manufactured exports during 1960-1973 are summarized in Table 6.1 and Table 6.2. All the data are in current prices. Selection of the base periods for the sub-periods was arbitrary.

Table 6.1 reveals that the increase in Singapore's total exports was predominantly due to the increase in world trade throughout the periods under study. Commodity composition and market structure explained little of the increase of total exports. Market distribution was in fact negative during the period 1960-1973. The negative change due to market structure implied that world demand grew less than proportionately in

Table 6.1

Analysis of Changes in Singapore's Exports: All Goods

(Current Prices, US$ m)

	1960-1967	1967-1969	1969-1971	1971-1973	1960-1973
Changes in Total Exports	$ 46.75	$ 410.10	$ 204.25	$ 1897.00	$ 2558.10
1. Due to increase in world trade	720.13	306.60	575.17	938.75	3749.58
2. Due to commodity composition	(a)-255.24	83.98	139.95	-63.24	521.08
	(b)-298.30	202.75	-178.58	52.00	375.01
3. Due to market distribution	(a) -60.66	81.37	-254.11	291.03	-230.56
	(b) -17.60	-37.40	64.42	175.79	-84.49
4. Due to increased "competitiveness"	-357.50	-61.85	-256.76	730.46	-1482.00
Percentage Distribution of Change in Total Exports	100%	100%	100%	100%	100%
1. Due to increase in world trade	1540.38	74.76	281.60	49.49	146.58
2. Due to commodity composition	(a)-545.97	20.48	68.52	-3.33	20.37
	(b)-638.08	49.44	-87.43	2.74	14.66
3. Due to market distribution	(a)-129.75	19.84	-124.41	15.34	-9.01
	(b)- 37.65	-9.10	31.54	9.27	-3.30
4. Due to increase "competitiveness"	-764.71	-15.08	-125.71	38.51	-57.93

Notes: (a) refers to Identity (6.14); (b) refers to Identity (6.15).

Sources: Derived from Appendix Table A-6.8 and Appendix A-6.9.

Table 6.2

Analysis of Changes in Singapore's Exports: Manufactured Goods

(Current Prices, US$ m)

		1960-1967	1967-1969	1969-1971	1971-1973	1960-1973
Changes in Total Manufactured Exports		$ 74.23	$ 69.05	$ 232.95	$ 1064.05	$ 1431.98
1. Due to increase in world trade		193.02	101.42	115.09	335.16	927.51
2. Due to commodity composition	(a)	-4.05	-1.71	-8.11	-4.25	-18.40
	(b)	-4.87	-5.93	6.02	30.73	-20.56
3. Due to market distribution	(a)	-33.64	-23.18	-13.68	33.10	-141.41
	(b)	-32.82	-18.96	-18.81	6.62	-139.25
4. Due to increased "competitiveness"		-81.10	-7.48	130.65	691.54	664.28
Percentage Distribution of Change in Total Manufactured Exports		100%	100%	100%	100%	100%
1. Due to increase in world trade		260.03	146.88	49.41	31.50	64.77
2. Due to commodity composition	(a)	-5.46	-2.48	-3.48	0.40	-1.29
	(b)	-6.56	-8.59	2.58	2.89	-1.44
3. Due to market distribution	(a)	-45.32	-33.57	-5.87	3.11	-9.88
	(b)	-44.21	-27.46	-8.08	0.62	-9.72
4. Due to increased "competitiveness"		-109.26	-10.83	56.09	64.99	46.39

Notes: 1/ (a) refers to Identity (6.14); (b) refers to Identity (6.15);
2/ figures are rounded up and may not add to 100 percent.

Sources: Derived from Appendix Table A-6.8 and Appendix A-6.9.

those markets where Singapore's exports were concentrated in the initial year. Similarly, if world trade expanded less than proportionately for those commodities in which Singapore was specialized in the beginning year, the changes due to commodity composition will be negative. The commodity composition effect was negative from 1960-1967. These two effects, together with the competitiveness effect, improved considerably during 1971-1973.

In the case of manufactured exports (Table 6.2), the increase in world trade was again substantial. It represents about 65 percent of the increase for the entire period 1960-1973. Commodity and market concentration appeared to have little effect on the increase of Singapore's manufactured exports. The share of the increases of Singapore's manufactured exports going to each of nine regions during 1960-1973 are presented in Table 6.3. Exports to developed countries (particularly the United States, Western Europe and Japan) have gained in importance whereas the share of exports to LDCs has declined relatively. The residual portion measuring the competitiveness of manufactured exports was favorable. In the first two sub-periods the effects were negative, but became positive in the last two sub-periods. Its value was quite substantial: 56% for 1969-1971 and 65% for 1971-1973. The percentage for the entire period 1960-1973 was 46 percent.

Singapore's CMS estimates of manufactured exports compares favorably with those of LDCs in a study made by Banerji.[16] The latter study revealed that for 1955-1962 and 1962-1970 exports from LDCs grew more slowly than world trade and their commodity composition effects were negative. The

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[16] Banerji (1974).

Table 6.3

Share of Increase of Singapore's Manufactured Exports
to Nine Regions of Distribution, 1960-1973
(Percentage)

Countries/Areas	1960-1967	1967-1969	1969-1971	1971-1973	1960-1973
Developed Countries:	26.96%	59.39%	49.25%	67.57%	62.17%
United States	13.12	33.19	29.04	35.31	33.07
Canada	0.76	5.20	0.44	0.95	1.06
Western Europe	5.95	17.05	12.05	21.32	18.86
Japan	2.62	0.74	3.16	5.26	4.57
Australia and New Zealand	4.41	3.21	4.56	4.73	4.61
Less-Developed Countries:	74.57	38.69	49.69	31.78	37.12
Latin America	0.31	-0.59	1.50	0.30	0.44
Developing Asia[1]	67.06	34.41	44.03	29.32	33.82
Developing Africa	7.20	4.87	4.16	2.16	2.86
Others (Rest of World):[2]	-1.44	1.92	1.07	0.68	0.69
Total	100.0	100.0	100.0	100.0	100.0

Notes: 1/ including China (Mainland) and other Asian Socialist States;
2/ chiefly U.S.S.R. and other Eastern European countries.
* figures may not add to 100 due to rounding.

Sources: Derived from Appendix Tables A-6.8 and 6.9.

competitiveness residual was negative but very small in the 1960s. This suggests that Singapore has performed better than the LDCs as a whole as far as the expansion of manufactured exports is concerned.

Table 6.4 contains an analysis of Singapore's manufactured exports for the period 1960-1973 using the major SITC commodity classes. The increase in the exports of "chemicals," "machinery and transport equipment" and "other manufactures" from 1960-1967 and from 1967-1969 were mainly due to factors on the demand side. Most important of all was the growth of world trade. While market structure had virtually no impact, the commodity composition effect for "chemicals" and "machinery and transport equipment" for 1960-1967 proved to be slightly favorable to Singapore. Data for later sub-periods indicate that this contribution was not continuous.

As to supply factors, export competitiveness was unfavorable for Singapore in the first two sub-periods. But in 1969-1971 and 1971-1973, a very substantial part of export growth is attributable to the increased competitiveness of Singapore's export industry, particularly "machinery and transport equipment" and "other manufactures." Singapore also gained considerably from this factor during the entire period under review. The results also show that the contribution of world trade on the demand side was a continuous one. This is consistent with our regression analysis in Section 6.1. As a whole, it appears that growth of world trade on the demand side and increased competitiveness on the supply side predominated over other elements.

(c) <u>Limitations of CMS Estimates:</u>

In interpretating the foregoing empirical results, one must be cognizant of the limitations inherent in its calculations. First, it has been

Table 6.4

Analysis of Changes in Singapore's Manufactured Exports by Commodity Classes, 1960-1973

	Chemicals (SITC 5)	Machinery & Transport Equipment (SITC 7)	Other Manufactures (SITC 6+8)
Exports (US$ million):			
1960	27.13	27.27	122.40
1967	37.68	88.57	169.78
1969	45.56	144.21	205.31
1971	60.62	241.89	286.52
1973	160.09	839.38	654.31
Percentage Distribution of Sources	100%	100%	100%
(I) 1960-1967			
(1) Due to world trade	223.79	385.89	224.80
(2) Due to commodity composition	28.53	72.64	-39.93
(3) Due to market distribution	-39.98	-68.65	-46.47
(4) Due to increased Competitiveness	-148.32	-28[illegible]	-38.40
(II) 1967-1969			
(1) Due to world trade	163.79	118.34	163.74
(2) Due to commodity composition	-22.58	9.28	-6.50
(3) Due to market distribution	-44.40	-0.98	-54.69
(4) Due to increased competitiveness	3.20	-26.64	-2.55
(III) 1969-1971			
(1) Due to world trade	95.35	28.20	79.70
(2) Due to commodity composition	-17.93	8.73	-20.38
(3) Due to market distribution	-19.45	-11.65	5.07
(4) Due to increased competitiveness	41.74	74.73	36.69

(Cont'd)

Table 6.4

Analysis of Changes in Singapore's Manufactured Exports by Commodity Classes, 1960-1973

	Chemicals (SITC 5)	Machinery & Transport Equipment (SITC 7)	Other Manufactures (SITC 6+8)
Percentage Distribution of Sources			
(IV) 1971-1973			
(1) Due to world trade	34.67	23.04	44.33
(2) Due to commodity composition	5.13	-2.68	4.12
(3) Due to market distribution	6.68	3.77	1.08
(4) Due to increased competitiveness	53.53	75.87	50.48
(V) 1960-1973			
(1) Due to world trade	85.31	39.40	101.98
(2) Due to commodity composition	2.99	6.91	-15.02
(3) Due to market distribution	-6.02	-5.77	-17.75
(4) Due to increased competitiveness	17.73	59.46	30.79

Note: Figures may not add to 100 due to rounding.

Sources: Derived from Appendix Table A-6.8 and Appendix A-6.9.

assumed that the various factors specified in the model are independent and additive and can be fully isolated. Furthermore, the model has no stochastic base and is useless for projection purposes. The interpretation is further complicated by the arbitrary selection of the base period and the level of disaggregation of commodity and market groups.[17] Hence, there is an index number problem because the base year export values are used throughout. Finally, the CMS model implies a judgement that retaining a constant share of world market is the relevant criterion in judging a country's export performance. There are cases where this may not be so.[18] Despite these limitations, the CMS model is useful in "explaining" the export performance of a country provided that the calculated values are not overemphasized. In any case, the results obtained demonstrate clearly the predominant role of world trade and increased competitiveness in the remarkable increase of manufactured exports during 1960-1973.

6.3 Competitive Capacity of the Industry

The "competitiveness" effect in the CMS model represents a host of

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[17] Richardson's (1971) calculations suggest that quite different results may emerge when final rather than the initial year weights are used and when disaggregation of both markets and commodities is introduced.

[18] To be "competitive" is desirable. But there are cases where this may not be true. For example, "a small country might be exporting commodities to regions with very fast-growing demands and might not have the domestic capacity to maintain its market shares. Accordingly, the country ought to raise its asking price and be subjected to a reduction in its market share. Another country exporting to more stagnant regions would have little trouble maintaining its share and may have positive competitiveness. Clearly, the first country is not less competitive than the second under the ordinary definition of the word. However, in terms of the CMS analysis, the country would be designated less competitive." Leamer and Stern (1970), p. 172 (footnote 20). Therefore to identify the determinants of the "competitiveness" effect is important.

factors operating on the supply side which affect the export capacity of the home industry. It reflects not only price competitiveness, but also the introduction of new exportables, the influence of policy measures and improvement in the quality of goods exported (see also section 6.3 (a)). We have empirically verified that labor productivity has a positive effect on the expansion of manufactured exports (section 6.2). However, statistical identification of other components has not been undertaken due to lack of relevant data. It is possible that a part of the competitiveness effect could be credited to various export promotion schemes adopted by the government authorities as described in Appendices B and C. In this section, we shall assess the competitive capacity of industry by looking at (a) technological change and scale economies of the industries; (b) the effects of industrial relations policies; and (c) wage levels.

(a) Technological Change and Scale Economies of the Industry: In a study of the manufacturing sector in Singapore conducted by the National Productivity Board, it was found that using a simple Cobb-Douglas production function of the type $V = AK^{\alpha}L^{\beta}$,[19] increasing returns to scale were operating in the manufacturing sector for the four-year period from 1968-1970.[20] Such scale effects would increase the competitive position of the industry

[19] In the simple Cobb-Douglas production of the type $V = AK^{\alpha}L^{\beta}$, V denotes value added, K = capital input, L = labor input, α = capital share or elasticity of value added with respect to K, β = labor share or elasticity of value added with respect to L and A = "residual" or index of technological change.

[20] Chew (1973), Table 1.

in foreign markets.

In the same study, the estimated "residual" or technological parameter was favorable for Singapore.[21] This "residual" is the growth of value added not attributable to increases in capital or labor and consists of a number of possible factors, such as (i) changes in the quality of labor; (ii) changes in the quality of capital; and (iii) pure entrepreneurial innovations. Casual observations suggest that the quality of the labor force in Singapore ranks among the best in Asia. Singapore is highly urbanized with one of the highest literacy rates in Asia. The educational system was restructured in the late 1960s to favor technical and vocational education at the secondary and post-secondary level. Manpower training schemes were also established (see Appendix C).

Another important factor which operates on the quality of labor is general state of health. Health programs increase the productivity of man over his working life. Inadequate nutrition and disease will lower energy and receptivity to new ideas. As Pepelasis-Mears-Adelman point out, this energy and receptivity to new ideas are crucial for economic growth.[22] Nutrition and health conditions have improved in Singapore in the 1960s and 1970s.[23] Taking the above considerations together, the quality of the labor force appears to have improved. Furthermore,

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[21] Chew, op. cit. The "residual" or technical change ($\hat{A}$) parameter was positive from 1968-1971.

[22] It is argued that although improved health programs may accentuate the population problem for LDCs, the disadvantage must be accepted if development is to proceed. Pepelasis, Mears and Adelman (1961), pp. 69-70.

[23] See Geiger and Geiger (1973), p. 213.

entrepreneurship does not appear to be lacking in view of the fact that Singapore has long been a commercial center in the region with entrepreneurs looking for opportunities.[24]

(b) Effects of Industrial Relations Policy on Competitive Capacity: Since 1963, labor unions have been under the tight control of government. Under the Employment Act of 1968, standard hours for white collar and industrial employees were increased from 39 to 44 hours per week. Fringe benefits were curtailed or restricted. Businessmen acclaimed the labor laws passed in 1968 as "an industrialist's dream."[25] Furthermore, trade union powers are limited under the Industrial Relations Act of 1970 (see Appendix B). As a result of these labor laws and the co-operation of union leaders, the number of strikes/work stoppages and the man-days lost have fallen drastically (see Appendix Table 6.10). In view of the restrained wage policy in Singapore, the competitiveness of Singapore's manufactured exports in the foreign markets has been enhanced.

(c) Wage levels and Competitiveness: In Singapore, wages are regulated or under control through labor laws and the National Wage Council (NWC). (The evolution of wage policy in Singapore is briefly summarized in Appendix B). The major competitors of Singapore's manufactured exports are South Korea, Taiwan and Hong Kong. The wage levels

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[24] Singapore is similar to Hong Kong in many respects and the existence of entrepreneurship is considered a key factor in the success of the two city states. See Geiger and Geiger (1973).

[25] Bocock (1970), reported that "one businessman described Singapore's new labor laws, adopted in 1968 ..., as 'an industrialist's dream."

of the manufacturing sector in six selected countries[26] during 1963-1974 are shown in Table 6.5. Of the six, the U.S. has the highest wage levels with Japan second. The overall skill level and productivity of labor in

Table 6.5

Wages in Manufacturing Sector in Selected Six Countries, 1963-1974

(US$ Per Day)

Year	U.S.	Japan	Singapore	South Korea	Hong Kong	Taiwan
1963	19.68	2.78	2.41	-	-	1.08
1964	20.24	3.09	2.45	0.51	1.49	1.10
1965	20.88	3.34	2.46	0.57	1.67	1.20
1966	21.76	3.73	2.36	0.67	1.77	1.27
1967	22.64	4.20	2.74	0.81	1.80	1.44
1968	24.08	4.91	2.49	1.00	1.87	1.60
1969	25.52	5.75	2.38	1.24	2.09	1.65
1970	26.88	6.66	2.33	1.49	2.43	n.a.
1971	28.56	8.58	2.54	1.55	3.04	n.a.
1972	30.48	10.33	2.78	1.68	3.39	n.a.
1973	32.56	13.84	3.47	1.87	4.20	n.a.
1974	35.20	16.22	4.36	2.08	4.56	n.a.

Notes: * Wage rates are converted into U.S. currency at the official exchange rates;
n.a. = not available

Source: Calculated from International Labor Office, Yearbook of Labor Statistics, 1975, pp. 573-581.

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26 Singapore, South Korea, Taiwan and Hong Kong have close trade links with the United States and Japan.

these two countries are higher than that of the LDCs, including South Korea, Taiwan, Hong Kong and Singapore.[27] The latter four countries are at a similar stage of economic development. Of these four, Singapore had the highest wage levels before 1969. Although the wage levels in the four countries have risen, South Korea had the highest rates of increase with Hong Kong second (Appendix Table A-6.11). Singapore's wage levels remained relatively stable until 1973. Since 1970, its wage levels have been below that of Hong Kong. The wage gap between Japan and Singapore has widened during 1963-1974 in favor of the latter. The gap between the U.S. and Singapore has also broadened during 1963-1972, but narrowed somewhat in 1973 and 1974 (see Appendix Table A-6.12).

Indices of labor productivity in the manufacturing sectors of four selected countries are shown in Table 6.6. The labor productivity of Japan, South Korea and Singapore has improved considerably, particularly in Japan and South Korea. In view of the fairly stable wage rates of Singapore vis-á-vis other countries and improved labor productivity, the competitive position of her manufactured exports has undoubtedly improved.

6.4 The Scope and Prospects of Industrial Exports

Comparative cost considerations based on present factor or skill intensities are an important but not the only criterion for assessing the future development of manufacturing industries. Factor endowments will not remain unchanged over time. In a growing world economy, one has to take into account the dynamic characteristics of the activities under

[27] Leontief pointed out that U.S.'s labor is much more productive than foreign labor because of better education and training, more efficient management, etc. See Leontief (1966).

Table 6.6

Index of Labor Productivity in Manufacturing
Sector of Selected Countries,

(1970 = 100)

Year	U.S.	Japan	Singapore*	South Korea
1965	94	53	70	48
1966	95 (+1)	60 (+7)	75 (+5)	50 (+2)
1967	94 (-1)	70 (+10)	80 (+5)	59 (+9)
1968	99 (+5)	80 (+10)	87 (+7)	70 (+11)
1969	101 (+2)	91 (+11)	94 (+7)	89 (+19)
1970	100 (-1)	100 (+9)	100 (+6)	100 (+11)
1971	107 (+7)	104 (+4)	106 (+6)	110 (+10)
1972	114 (+7)	116 (+12)	115 (+9)	120 (+10)
1973	121 (+7)	139 (+26)	118 (+3)	130 (+10)
1974	120 (-1)	140 (+1)	123 (+5)	144 (+14)

Notes: * for national economy;

Figures in brackets indicate changes relative to preceeding year.

Sources: International Labor Office, <u>Yearbook of Labor Statistics</u>, <u>1975</u>.

consideration. To quote Hirsch:[28]

> Failure to recognize the dynamic nature of comparative advantage may lead policy-makers concerned with the enhancement of a country's export potential to adopt policies which go counter to its long-run interest. Such policies may lock up capital, labor, and other scarce resources in enterprises which should long have been abandoned, and may lead to the neglect of advantageous export opportunities.

In view of the relatively high labor cost vis-á-vis other LDCs including Taiwan and South Korea (see section 6.4) and the relative abundance of skill resources, Singapore's long-run comparative advantage appears to lie in the production of relatively skill-intensive products, such as a wide range of metal products, precision instruments, petroleum products, chemical products, plastic products, machinery, sophisticated electrical and electronic products, and rubber products. These products usually have high income elasticities of demand. This is also compatible with our findings in Chapter V that labor skills are among the major determinants of Singapore's trade patterns. Although Singapore will probably not be able to compete for some years to come with the exports of industrial countries in some skill-intensive products, it has an edge on product prices due to its lower wage rates.

To the extent that labor skills are among the major determinants of trade, a skill bottleneck could hinder industrial growth. When industrialization gathered momentum in the late 1960's, Singapore experienced a serious scarcity of skilled human resources. Immigration regulations were relaxed to permit skilled labors and management personnel from other countries to enter Singapore. This problem was also reflected in the

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[28] Hirsch (1967), p. 129.

excess capacity of "pioneer industries" during 1967-1968 as shown in Appendix Table A-6.13. Many industries suffered an appreciable amount of unutilized productive capacity. The capacity-utilization rate for total "pioneer industries" was only 50 percent in 1968. Although recent data on capacity utilization have not been published, it is believed that many industries still have considerable amounts of unutilized capacity. This excess capacity may be traced to many factors such as technological indivisibilities, over-optimistic assessment of demand, errors in investment planning, instability of supply of raw materials, and the lack of export credits. But there is scope for industrial exports from Singapore if the skill endowments are improved.

Linkage effects are also important for long-run comparative advantage if a broad industrial base is to be created. Singapore has been quite successful in this regard. For example, the expansion of petroleum refining has enabled Singapore to supply the world market with a wide range of petroleum products including naphtha feedstock for petro-chemical production. Due to the availability of low-cost naphtha, a major petro-chemical industry complex has been initiated in Singapore to supply the local and regional markets.[29] Furthermore, the expansion of metal-working industries, including precision engineering, has widened the technological base and facilitated the growth of a wide range of metal products. The

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[29] An agreement has been signed between the Singapore Government and Sumitomo Chemical, a Japanese chemical firm, for the long-planned US$800 million chemical complex. The latter has won the backing of five other Japanese ethylene manufacturers. The project is expected to start in 1977. See Far Eastern Economic Review, Vol. 96, No. 15, April 15, 1977, pp. 36-37.

electronic industry, which started with semi-conductor devices in 1967, has diversified into instrumentation and other sophisticated electrical and electronic products. Heavy investment in the ship-repairing industry has led to the development of the manufacture of ship machinery.

The foregoing analyses has focused on the supply side. On the demand side, it is important for Singapore to export manufactures which have a high income elasticity. Successful export promotion depends not only on the strengthening of the competitive position, but also on the willingness of importing countries to purchase a growing volume of the commodities which may directly compete with their own industries.

As far as exports to developed countries are concerned, strongly labor-intensive manufacture such as cotton textiles are subject to quantitative or quota restrictions in addition to the fact that the effective level of protection for finished products is considerably higher than the nominal level.[30] Maintenance of low price and good quality is necessary in order to sustain a high rate of growth of exports. Although Singapore's share of textiles and garments exports to developed countries is small as compared to that of Hong Kong and South Korea, the existing markets have already been tight and competition keen. On the other hand, exports to LDCs are vulnerable to import-substitution policies of these countries. There is less scope, therefore, for future export expansion of these products to LDCs. Lary's (1968) empirical findings suggest that greater opportunities for the future expansion of manufacture to LDCs lie in the marginally labor-intensive miscellaneous light manufactures as measured by their relatively high value added per employee. These products

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[30] See Balassa (1965).

include: footwear and other leather products; rubber and plastic goods; glassware, china and pottery; furniture; books and printed matter; games, toys and sporting goods and musical instrument; jewelry and silverware; optical goods, cameras, watches and instruments; cutlery, hardware and other metal products; and electrical apparatus and appliances. Many of these products are mature and standardized products and have long entered the mass production stage. These products in general have high income elasticities of demand.[31]

Many of the products mentioned in the preceding paragraph were initially developed in Singapore to serve the domestic market but increased production of these products is now aimed at overseas markets. Although increased competitiveness of these products depends on continued improvement of product quality and design, industrial exports can be expected to expand further if the leading developed countries will scale down the effective tariff rates and remove quantitative restrictions.

The present schemes of preferential trade in manufactures are embodied in the UNCTAD October 1970 agreement on the Generalized System of Preference (GSP).[32] Under this agreement, perferential tariff treatment is given to the imports by developed countries of manufactured and semi-manufactured products originating in the LDCs. However, several countries have excluded the most common manufactured products from LDCs for preferential treatment, i.e. textiles, footwear and leather products. It was pointed out that about 122 manufactured products of export interest

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[31] See Lary (1968), p. 114.

[32] For a discussion of the GSP schemes, see Bhattacharya (1976), Chapter 6.

to LDCs are subject to quantitative and related restrictions in the markets of developed markets and the main beneficiaries of the GSP schemes are those countries with an advanced manufacturing potential including Yugoslavia, Iran, South Korea, Brazil and Mexico.[33] Singapore also benefits as its manufactured exports have become more skill-intensive in recent years. Further trade liberalization leading to wider market access in developed countries and less quantitative restrictions would be more beneficial to Singapore than the existing preferential schemes.

The future of manufactured exports from LDCs is still largely dependent on the demand conditions in developed countries. Recession in developed countries in 1974 had had a major effect on exports of manufactures from LDCs including Singapore.[34] More diversification of manufactured products and market areas could lessen the impact of economic fluctuations in the industrial countries.

At the present time, the expansion of manufactured exports to Southeast Asian countries is hindered by trade barriers as these countries seek to protect their own industries. Establishment of some form of regional economic integration among these countries could stimulate exports. A logical place to look at this form of economic co-operation is the present Association of Southeast Asian Nations (ASEAN).[35] In view

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[33] Bhattacharya (1976), pp. 41-42.

[34] Manufactured exports originating from Hong Kong, Singapore Taiwan, South Korea and Latin America are the most seriously affected. See World Bank Annual Report, 1975, pp. 6-7.

[35] The Association of Southeast Asian Nations (ASEAN), established in 1967, of which Singapore is a member (other members include Malaysia, Thailand, Indonesia and the Philippines), is a loose-form of regional cooperation among the member nations. The Association has decided that

of the formidable non-economic problems, a complete customs union among member countries would be extremely ambitious. Singapore has been proposing a free trade area in this region for some years.[36] The recent Bali summit meeting in Indonesia has taken the first important step toward a free trade area.[37] A further positive development has been the agreement between Singapore, the Philippines and Thailand to reduce tariff rates by 10 percent across-the-board on mutual trade in early 1977.[38]

Summary

In this chapter, we have first analysed the determinants of Singapore's manufactured exports. Our time-series multiple regression analysis indicated that Singapore's manufactured export expansion was positively related to world trade in manufactures. This demand factor was found to be strong. On the supply side, there was a positive effect of labor productivity on the expansion of manufactured exports. There also appeared to be a rather weak effect of commodity concentration.

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member countries should co-operate in the fields of food production and supply, tourism, telecommunication and transport, promotion of exports and trade liberalization. Some achievements have been made in the fields of tourism, telecommunication and transport since its establishment , but progress of co-operation in trade liberalization is painfully slow.

[36] Singapore is the most ardent supporter of a free trade area among ASEAN nations, in which she is the most developed country and therefore stands to gain from a larger market.

[37] See Far Eastern Economic Review, Vol. 90, NO. 47, November 21, 1975.

[38] See South China Morning Post, March 14, 1977, p. 12.

On the other hand, geographical concentration and the exchange rate had no effect on manufactured export expansion. The "recession-boom effect" was also found to be non-existent. This may be due to the limited domestic market in which industries have no alternatives but to export their products to overseas markets.

The Constant-Market-Share (CMS) model was further employed to analyse export growth. Four sub-periods were arbitrarily selected: 1960-1967, 1967-1969, 1969-1971 and 1971-1973. The empirical results show that the contribution of world trade on the demand side was continuous. Commodity composition and market distribution appeared to have little effect on the increase of manufactured exports. These findings are in general consistent with that of the regression analysis. The competitiveness effects were negative in the first two sub-periods but became positive in the last two periods. For the entire period 1960-1973, "increased competitiveness" contributed 46 percent of the total increase of industrial exports.

Manufactured exports were further broken down by major commodity classes. The empirical results showed that the increases in the exports of "chemicals," "machinery and transport equipment" and "other manufacturers" were mainly due to world trade and competitiveness effects. The effects of commodity composition and market distribution were either small or unfavorable in different sub-periods. The "competitiveness effect" was unfavorable in the first two sub-periods. But in 1969-1971 and 1971-1973, a very substantial part of export growth was attributable to increased competitiveness particularly for "machinery and transport equipment" and "other manufacturers." As a whole, the growth of world trade on the demand side and increased competitiveness on the supply side predominated over other elements. Our CMS estimates showed that Singapore became internationally competitive in skill-intensive "chemicals" and "machinery and transport equipment" in the later sub-periods.

The "competitiveness effect" in the CMS model includes a host of factors. Our assessment of technological change, economies of scale, effects of industrial relations policy and the relative increase of labor productivity appear to indicate that those elements contributed to competitive strength. Finally, the scope and prospects for Singapore's industrial exports were briefly assessed.

CHAPTER VII

SUMMARY AND CONCLUSIONS

7.1 Summary of Findings

Singapore is a small open economy. It has no natural endowment except a strategic geographical location. Although prospects for economic development may appear bleak, it has been able to offset the disadvantage of size through the expansion of manufactured exports.

When Singapore obtained internal self-rule status in 1959, the dominant view was that it was not economically viable as an independent nation. A merger with Malaya (now Malaysia) was considered essential in order to provide a sufficiently large domestic market to support industrialization. Tax concessions and other incentives were provided to "pioneer firms" and protective tariffs imposed to stimulate local and foreign investment in manufacturing. However, Singapore was "forced" to adopt an export-oriented industrialization strategy following its separation from Malaysia in September 1965.

During the import-substitution stage, most industrial ventures were undertaken by existing or new local and British firms. However, in view of the rising unemployment rate, large multinational corporations were actively encouraged to invest in the city-state. These efforts have paid off and investment in manufacturing has grown rapidly. Initially, investment was concentrated in labor-intensive industries. When near full employment was reached in the early 1970s, a new development strategy was announced to promote skill-intensive industries and incentives to labor-intensive industries were no longer granted. Singapore's industrialization strategy experienced only a brief period of import-substitution and did not encounter the "difficult phase" faced by such countries as the Philippines and Thailand. Protective tariffs were gradually removed without inhibiting industrial growth.

The primary objective of this study was to examine the role of exports and manufactured exports in the development process from 1959 to 1974. Specifically, we analysed the relationship between the expansion of industrial exports and the growth of manufacturing industries.

Our major findings can be summarized as follows:

(1) The growth elasticity of output (value added) for the manufacturing sector as measured by the Chenery-Taylor technique was 1.83; that is, the value added of total manufacturing increased 1.83 percent for every one percent increase in per capita income. Growth elasticities of 17 major industry groups except "beverage" were significantly larger than one.

(2) Industrial growth has brought about significant structural changes in relative shares and the sectoral contribution of industrial groups to the increase of total value added (or industrial exports). In general, the importance of traditional products such as "food," "wood and cork products," "furniture and fixtures," "footwear and leather products," "rubber products," "non-metallic mineral products" and "fabricated metal products" have declined relatively, whereas non-traditional products such as "textiles, " "chemicals and chemical products," "petroleum products," "non-electrical machinery," "electrical machinery and appliances," "transport

equipment," "plastic products," and "photographic and optical goods" have become increasingly important.

(3) In our time-series regression analysis of the behavior of manufacturing output, we found that manufacturing growth could be partially "explained" by the expansion of manufactured exports which tends to support our hypothesis that manufacturing growth was export-induced. In addition, we found positive consumption effects as indicated by positive population coefficients for the majority of industry groups. Empirical results also showed that foreign firms contributed significantly to total manufacturing activity in terms of gross output, value added and direct exports. They also performed better than joint ventures and local firms in terms of value added per worker.

(4) The Shift-Share-Analysis <u>á la</u> Chenery-Lewis-Soligo showed that in the early phase of the industrialization process (1960-1965), the growth of gross output and value added could be attributed mainly to import substitution and the expansion of domestic demand. Although industrial growth attributable to export expansion was relatively less important during the early phase, domestic production of products like "food," "textiles, clothing and footwear," "printing and publishing," "rubber products, " "chemicals, chemical and petroleum products," "metal products," "non-electrical machinery" and "transport equipment" benefited from the tapping of export markets. Export expansion became increasingly important in its contribution to gross output and value-added growth after 1965. The increase in intermediate-goods and capital-goods industries has been particularly marked. The empirical results supplement the regression results and tend to support the hypothesis that industrial

growth was export-led.

(5) Our empirical result does not support Linder's hypothesis that the range of a country's manufactured exportables is determined by domestic demand. Cross-industry analysis showed that the Spearman rank correlation between growth of domestic demand and the growth of exports, though positive, was not statistically significant. In addition, we also found that there was no "excessive" growth of consumer-goods relative to the growth of intermediate- and capital-goods industries. The share of value added of consumer goods in total manufacturing fell from a high of 52 percent in 1960 to just over 13 percent in 1974. The ratio of consumer-goods to capital-goods has continually declined throughout the period. This "pattern" of industrial growth conforms to the pattern of long-term industrial growth observed by Hoffmann (1958). The rate of change in Singapore's industrial structure has been rapid.

(6) We found that value added per employee was an effective measure of factor-intensity (Keesing's method) using Singapore's data. Furthermore, the ranking of 19 major industry groups in Singapore and in the United States revealed a strong positive correlation. Hence, the strong factor-intensity assumption of the Heckscher-Ohlin model was supported.

(7) We verified empirically that Singapore's comparative advantage tends to lie in labor-intensive lines of production, excluding "petroleum refinery and petroleum products", with a Leontief-type test. The factor-proportions hypothesis was confirmed only weakly by observing the patterns and market orientation of manufactured exports. Over fifty percent of capital-intensive goods exports went to LDCs during 1965-1973. Singapore may have exploited its comparative advantage as she is favorably endowed with

capital relative to other LDCs. On the other hand, we observed that 81 percent of total labor-intensive products went to LDCs in 1965 (1968: 67 percent, 1973: 41 percent). The factor-proportion theory does not seem capable of explaining this. This may essentially reflect temporary differences in producer's ability and technology rather than factor or material cost advantages. In general, trade patterns do not explicitly indicate that Singapore's manufactured exports to developed (developing) countries are based on the labor-intensive (capital-intensive) lines of production as predicted by the orthodox Heckscher-Ohlin theory. A non-parametric test suggests that there is no relationship between factor-intensity and manufactured exports to developed and developing countries.

(8) Our empirical results showed that an extension of the orthodox comparative theory <u>à la</u> Keesing incorporating human and skill contents offered a better explanation of Singapore's trade patterns in manufactures. The empirical results showed that the weighted skill index for all industrial imports was larger than that for exports, but the <u>difference</u> between the two did not seemed to be significant. Hence, it did not conclusively support our hypothesis that Singapore's manufactured imports are more skill-intensive than its manufactured exports. On the other hand, the empirical tests supported the following hypotheses: (1) Singapore's manufactured import composition is positively correlated with the respective skill requirements of manufacturing industries. This is a reflection of its international comparative disadvantages; (2) Singapore's manufactured exports to Southeast Asian developing countries and to all LDCs are more skill-intensive than to developed countries. Since Singapore is relatively better (less) endowed with labor skills as compared with other

developing (developed) countries, it implies that industrial resources in Singapore do not appear to be misallocated.

We failed to confirm the hypothesis that Singapore's manufactured export composition is negatively correlated with industrial skill requirements. The resources-allocation implication of this test should not be exaggerated because the composition of manufactured exports has undergone significant changes in recent years. There has been a relatively rapid growth of capital and skill-intensive industries. To the extent that these industries are more efficient than industries with lesser skill and capital intensities, we would expect that industrial exports would embody higher levels of skill resources. In a dynamic context, this could indicate that there had been some beneficial effects on the allocation of industrial resources because skill levels had improved in Singapore.

(9) Multiple regression analysis showed that Singapore's manufactured export expansion was positively related to world trade in manufactures. This demand factor was found to be strong. On the supply side, there was a positive effect of labor productivity on the expansion of manufactured exports. There also appeared to be positive but weak effect of commodity concentration as measured by the Gini-Hirschman coefficient. On the other hand, geographical concentration and the exchange rate had no apparent effect on manufactured export expansion. The "recession-boom effect" was also found to be non-existent.

(10) The Constant-Market-Share (CMS) analysis indicated that the contribution of world trade to the growth of industrial exports was significant over the 1960-73 period and contributed 65 percent to export growth. Commodity composition and market distribution appeared to have little

effect on the growth of manufactured exports. These findings are in general consistent with the regression analysis findings. The competitiveness effects were negative in sub-periods 1960-1967 and 1967-1969 but became positive in the last two periods 1969-1971 and 1971-1973. For the entire period 1960-1973, "increased competitiveness" contributed 46 percent of the total increase of industrial exports. The "competitiveness effect" in the CMS model includes a host of factors. Our assessment of technological change, economies of scale, the industrial relations policy and increase of labor productivity relative to wage levels indicate that these elements contributed to the competitiveness effect.

7.2 Policy Implications and Conclusions

The performance of the Singapore economy indicates that export-based industrialization is a viable development strategy for small developing economies. Resource limitations and size constraints can be overcome by the adoption of appropriate economic policies. Small countries will have to specialize in products in which they have a comparative advantage. It is important for policy makers to recognize the dynamic nature of comparative advantage. As Singapore's relative endowment has shifted from one of labor surplus to labor shortage, her comparative advantage has likewise changed. This is reflected in the composition of manufactured exports in recent years.

In view of her relatively high labor costs vis-à-vis other LDCs, Singapore's long-run comparative advantage appears to lie in the production of relatively skill-intensive products which have high income elasticities. Incentives should be given to industries that are likely to achieve this objective. To the extent that labor skills are among the major determinants of trade patterns, a skill bottleneck could hinder industrial growth. Building an adequate pool of skilled human resources is conducive to sustained industrial growth.

To assess whether certain industries are viable for development, we should determine whether the industries can make a significant contributions to skill development and have a strong potential for technological advancement. The linkage effects of industries are also important if a broad industrial base is to be created.

Singapore's manufactured exports are limited to a few developed and developing countries. It should open additional foreign outlets and diversify its commodity composition further to alleviate the adverse effects of recessions abroad. Furthermore, the ability to produce quality products for export at international prices is a necessary condition if the recent rapid rate of export growth is to be sustained. Improved labor and capital productivity could further increase the competitive capacity of the manufacturing industries.

Successful export promotion depends not only on an enhanced competitive position, but also on the willingness of importing countries to purchase a growing volume of commodities which directly compete with their own industries. Singapore would benefit from the relaxation of protectionism by both developed and developing countries. Regional economic co-operation among ASEAN countries should be encouraged.

Singapore's successful industrialization was achieved through active management of the economy while at the same time relying on decentralized private (both local and foreign) initiatives. Economic pragmatism has been the guiding principle of the policy makers of Singapore. It is unlikely that the Singapore "model" can be copied by other developing economies, but much can be learned from its experience.

APPENDIX A

INDUSTRIAL CLASSIFICATION IN SINGAPORE

Singapore's census of industrial production was first conducted by the Department of Statistics in August 1960 to collect industrial data for the preceding year 1959. The Report on the Census of Industrial Production 1959 was published by the department in 1963 and the census was subsequently conducted annually. Industries were classified in accordance with the "Industrial Classification of All Economic Activities, Singapore" which was adapted from the United Nation's "The International Standard Industrial Classification of All Economic Activities" (ISIC). Industries were classified into two industry major groups: two-digit and four-digit level industries. The 2-digit level industries will be shown later. The definitions and concepts used in the industrial census were basically in accordance with the United Nations' "Industrial Recommendations in Basic Industrial Statistics".

The classification scheme was revised in 1966 in accordance with "Industrial Classification of All Economic Activities in Singapore" (Revised 1966) which was adapted from the "International Standard Industrial Classification (ISIS)." The use of the revised classification scheme in 1966 has necessitated the transfer of some establishments from one major group under which they were classified in 1965 to another under the revised classification. According to the Department of Statistics, "Establishments in Major Groups 29, 34, 35, 36 and 37 have been partly affected by this reclassification and thus for these groups it has not been possible to maintain strict comparability with previous years. The aggregate data for total manufacturing and for most other groups, however, have not been affected in any significant way." (See Report on the Census of Industrial Production, 1966, p. 1.)

In 1970, the classification was based on the "Singapore Standard Classification of All Economic Activities, (Revised 1969)" (hereafter SSIC, 1969) which was adapted from the "International Standard Industrial Classification of All Economic Activities (1968)" of the United Nations. This system is commonly refered to as ISIC, 1968. Under the 1970 classification scheme, the grouping of industrial activities was raised to a five-digit level instead of the four-digit level used in earlier classifications. The scheme was presented by industry major groups (3-digit level) and industries (5-digit level). Two groups, namely (1) repair and servicing of motor vehicles and other household goods and equipment, and (2) carpentry and joinery work, formerly included in the manufacturing sector under Wood and Cork (major group 25), were excluded from the 1970 census of industrial production. It was noted by the Department of Statistics that the contribution of the above two activities to the manufacturing sector was relatively small and their exclusion would not significantly affect the comparability of data with earlier periods.

The data before 1970 and after 1970 (1970-1974)[1] were regrouped as follows for the sake of continuity and analysis:

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[1] In view of the changes in industrial and economic structure, Singapore has attempted to make a revision of the "Singapore Standard Industrial Classification of All Economic Activities, 1969)." See Singapore Standard Industrial Classification 1973, Singapore, National Statistical Commission, 1974.

Industry Major Group	1959-1969 ISIC (SIC)	1970-1974 ISIC, 1968 (SSIC, 69)
Food	20	311+312
Beverage	21	313
Tobacco	22	314
Textile	23	321
Footwear, Wearing Apparel and Made-up Textile Goods	24	322+324
Wood and Cork Products	25	331
Furniture and Fixtures	26	332
Paper and Paper Products	27	341
Printing, Publishing and Allied Products	28	342
Leather and Leather Products	29	323
Rubber Products (including footwear but excluding rubber processing)	30	355+356
Chemicals and Chemical Products	31	351+352
Petroleum Refinery, Petroleum and Coal Products	32	353+354
Non-metallic Mineral Products	33	361+362+363+364 +365+369
Basic Metal Products	34	371+372
Metal Products (except machinery and transport equipment)	35	381
Non-electrical Machinery	36	382
Electrical Machinery	37	383
Transport Equipment	38	384
Miscellaneous Manufacturing Industries	39	385+390
(a) Plastic Products	3995	357
(b) Precision Equipments, Photographic and Optical Goods	39	385

Note: a/ Plastic Products (major industry group 357) was not shown in the detailed list of industries before 1970 and it was decided to be classified as petroleum products to maintain comparability for the previous periods.

Sources: Singapore, Department of Statistics, Report on the Census of Industrial Production, 1959-1974.

APPENDIX B

POLICY MEASURES AND ECONOMIC INCENTIVES

(A) Major Policy Framework to Promote Industrial Growth

(1) General Policy on Investment:

Singapore welcomes private foreign investment. This attitude is supported by Government's announced policy of encouraging private industrial development and fostering trade with all nations. Investment incentive measures are offered to both new and existing industries (see Section B). In principle, no distinction is made by the Government between local and foreign capital. Legislation offering incentives for private industrial development is open to both sources equally. There are no restrictions against foreign ownership of business entities in Singapore and completely foreign-owned businesses may operate. However, there is a tendency, although not reflected in written legislation, to encourage joint ventures emphasizing foreign know-how and the participation of local capital.

The spheres of development by foreign private investment is not limited by legislation. Furthermore, foreign investors may bring any amount of capital to Singapore. There is no restriction on remittance of profits and repatriation of capital in the currency of the original investment. Investment Guaranty Agreements have been signed with the United States, United Kingdom, Japan and other foreign countries. Under the Agreement, foreign investors are protected against loss due to specific political risks of currency inconvertibility, expropriation, war, revolution or insurrection.

(2) Industrial Relations Policy:

Several crucial steps have been taken in Singapore since 1959. An Industrial Arbitration Court was established in 1960 under the provision of the Industrial Relations Ordinance. Trade disputes are referred to the court at the joint request of the parties to the dispute or by the Minister of Labor. The court has the status of a supreme court and comprises a President who is the only permanent member of the court and two other members, one from the Employees' Panel and the other from the Employers' Panel. Member of the panels are appointed by the Minister of Labor from nominations made by the Employers' Organizations and the National Trade Union Council (NTUC) which is under the control of government.

In May 1968, a new Employment Act was introduced. Under this Act, standard hours of work for white collar and industrial employees were increased from 39 to 44 hours per week and public holidays reduced from 15 to 11 per year. Annual paid leave, retirement benefits and overtime work were also restricted or limited. Furthermore, bonus payments are negotiable only up to one month's salary. Any bonus or ex-gratia payment over and above one month's salary is tied to productivity. This regulation is a form of wage control because prior to 1968, "practically all workers in the private sector have been receiving annual bonuses ranging from 2 week's wages to 23 month's wages and these bonuses were regarded by workers as part of their wages rather than as an incentive payment for higher productivity."[1] Pioneer industries which began operations on or after

[1] C. H. Ow and C. M. Goh, "Wages, Productivity and Prices," in Inflation and Growth, V. V. V. B. Rao (ed.), Stamford College Press Ltd., Singapore, p. 208. See also section (3).

January 1[illegible] must comply wholly with all the terms and conditions of employment as detailed in the Employment Act for a period of five years from the date of commencement of operations in Singapore.

In the same year, the Industrial Relations Ordinance was amended. The Amendment Act was replaced by the Industrial Relations Act of 1970. The main components in the two Acts remained unchanged. Under the Industrial Relations Act, collective agreements could not include more favorable employment conditions than those stipulated by the Employment Act. In addition, management functions which are clearly delineated from trade union functions are not subject to negotiations as part of a collective agreement. These management functions are: promotion, internal transfers, recruitment, retrenchment, dismissal or re-instatement and assignment or allocation of duties or specific tasks.

Theoretically, unions bargain for wages and working conditions as representative of the workers. But "the government regulation on collective bargaining has severely reduced the role that unions can play."[2] For example, "job security measures are one of the most important parts of collective bargaining, but the amendments (1968) have put the Government and the employers, not the trade unions, as the protectors of working security. ... if a worker feels that he was discharged unfairly, he may file an application for reinstatement to the Minister of Labor. The grievance procedure is not involved because bargaining about such a matter is forbidden."[3] Thus it seems little is left for the trade union leaders

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[2] D.H. Clark, "Labor Market and Industrial Relations," in <u>The Singapore Economy</u>, You and Lim, (ed.) Singapore: Eastern Universities Press, 1971, p. 322.

[3] Clark <u>op. cit.</u>, p. 327.

to do as representative of the workers. However, most union leaders appear to be willing to live with the current laws in the name of national interest.[4]

(3) Wages Policy:

Prior to 1968, there was no formalized wage policy in Singapore. The Employment Act of 1968 embodies some elements of wage control (see section 2). In 1972, National Wage Council (NWC) was established to make recommendations on periodic adjustments in the wage structure with a view to "secure an orderly and steady increase in wages as part of the overall policy to maintain and consolidate the high rate of economic advance in recent years."[5] The National Wage Council is a body of nine members with equal representation from labor, management and the Government. The Council sits throughout the year to consider the overall wage structure of the Republic. The chief criterion for the NWC's recommendation is changes in productivity level. Other factors include cost of living and the price competitiveness of Singapore's products. In general, the recommendations cover all industries and corporations. It is a normal practice for the Government to accept the recommendations for the public sector in full, but the recommendations are not binding in the private sector. They are considered as "guidelines" and are implemented to the full extent only if

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[4] Clark op. cit., p. 327.

[5] NWC Chairman's letter to the Prime Minister on April 1974. Quoted in Ow and Goh op. cit., p. 209.

companies can afford to do so.[6]

Since 1972, the NWC had made the following recommendations for wage increases: (1) 8% annual wage increase and an additional one month payment in 1972; (2) 9% annual wage increase in 1973; (3) S$40 plus 6% increase for those earning less than S$1,000 per month and others 6% in 1974; (4) 2% annual increase in 1975.

(B) Economic Incentives

(1) Incentive Legislation on Pioneer Industries:[7]

The Pioneer Industries (Relief from Income Tax) Ordinance 1959 and the Industrial Expansion (Relief from Income Tax) Ordinance 1959 were the first to introduce tax incentives to investors. The former provided for pioneer status to be awarded to firms in selected industries, entitling them to a tax holiday of up to five years. Under the latter Act, tax concessions were granted to firms on the expansion of capital stock.

In 1967 the Economic Expansion Incentives (Relief from Income Tax) Act was passed and the two ordinances of 1959 repealed. Its aim was to amend and to consolidate the existing laws providing incentives for the establishment of pioneer industries and the expansion of established

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[6] Since the NWC made its first recommendation in 1972, how many companies implemented the guidelines to the fullest extent was not known. It is believed that many firms simply ignored the recommendations.

[7] The materials for sub-sections (1), (2), (3) and (4) are consolidated from the following sources: (a) Republic of Singapore, Economic Expansion Incentive (Relief from Income Tax) Act, 1967; (b) Republic of Singapore, Economic Incentives (Relief from Income Tax) (Amendment) Act 1970, Government Gazette Acts Supplement 7th August 1970; (c) U.S. Department of Commerce, Overseas Business Reports (OBR 75-08), March 1975.

industries and to introduce new inducements to encourage export production and the application of science and technology to industrial operations. In 1970 the Act was no longer considered appropriate. Parliament therefore passed the Economic Expansion Incentives (Relief from Income Tax) (Amendment) Act 1970. The main changes made in tax incentives were to tighten up the criterion for granting pioneer status.

Under the Economic Expansion Incentive Act 1967, an industry may be declared a "pioneer industry" and its products "pioneer products " if the industry is one which "is not being carried out in Singapore on a scale adequate to the economic needs of Singapore" and for which there appear to be favorable prospects for development. The following benefits may be gained from pioneer status: (i) a tax relief period varying with the size of its investment in fixed assets. A company with a fixed capital expenditure of S$1 million or more can claim a tax relief period of 5 years; companies with fixed capital investment of less than S$1 million can claim a tax relief period from 2 to 4 years. However, in 1970 Amendment Act a company must have a fixed capital expenditure of at least S$1 million to qualify for pioneer status; (ii) tax exemption on dividends paid during the 5-year period; (iii) loss carryover for tax purposes even beyond the tax relief period; (iv) a pioneer company is allowed to exclude capital cost allowances in the computation of its tax relief income. Such allowance can instead be carried forward to the first year of the post relief period.

The Amendment Act 1970 stipulates that deduction of capital cost allowance commences on the day following termination of the tax relief period (instead of commencing on the day the capital expenditure is actually incurred). This timing will allow an increase in the tax-exempt profits during the tax relief period and reduces profits subject to tax subsequent to the period. In order to qualify for this benefit, it must have been officially decided that the pioneer enterprise will promote or enhance the economic or technological development of Singapore, and that the enterprise either (a) has a fixed capital expenditure of at least S$1 billion or (b) incurs a fixed capital expenditure of at least S$150 million, with 50 percent paid-up capital held by permanent residents of Singapore.

The Government has made some changes with respect to pioneer status criteria recently. Some labor-intensive industries which had previously obtained pioneer status are no longer eligible. Their products include preserved food, chewing gums, printing ink, industrial bags, toilet soap and household textile goods.

Under the current policy, pioneer status will not be granted to companies producing exclusively for the local market. Industries with a high degree of technology are particulary welcome. The reasons are two-fold: (a) these industries are more productive and can generate greater output, and (b) they can stimulate other industries through "linkage effects." Among the new industries and products declared eligible are aircraft components and accessories, compressors, transformers, diesel and petrol engines, electrical and portable tools, telephone exchange equipment, microwave equipment, magnets and magnetic materials, typewriters, cameras, watches and clocks, miniature lamps and a range of plastic raw materials. Many of these products are already in production in Singapore.

(2) <u>Expansion of Established Industries:</u>

Under the Economic Expansion Incentives (Amendment) Act 1970, a manufacturing firm which plans to incur at least S$10 million worth of additional capital expenditure may be granted tax exemption for a maximum period of 5 years as determined by the Ministry of Finance. The income which will be eligible for exemption from tax will be the portion of the difference between the income after expansion and the income before expansion. Dividends received by shareholders on any amounts exempted from tax during the tax relief period will likewise be tax exempt.

(3) Incentives of Production for Exports:

In order to qualify for incentives for export production, an enterprise must have f.o.b. export sales of at least S$100,000 in the operating year in which the incentives commence. These sales must be at least 20 percent of the value of the enterprise's total sales. The period of tax relief of an export enterprise which is not pioneer enterprise is five years. In the case where the export enterprise is also a pioneer firm, the combined tax relief is a total of 8 years. However, the tax relief period for both pioneer and non-pioneer export exterprises may be extended to a maximum of 15 years, provided (a) the enterprise incurs a fixed capital expenditure of at least S$1 billion, or the enterprise incurs a fixed capital expenditure of at least S$150 million, with 50 percent of its paid-up capital held by permanent residents of Singapore, and (b) the Ministry of Finance decides that the enterprise will help promote or enhance economic and technological development. It is noted that if annual export sales fall below the S$100,000 level, tax relief will be terminated even before the end of the previously approved period.

The income which may be exempted from tax is (a) 90 percent of the excess of export profits on the approved product over a fixed sum equivalent to the average annual export profits on that product over the last 3 years; or (b) the product has no past history, equivalent to an amount to be determined by the Ministry of Finance. Export profits of the product are taken, however, as a maximum, in the same proportion to total profits as export sales are to the enterprise's total sales of goods and services.

(4) Other Industrial Incentives for Investors and Exporters:

(a) Foreign Loans for Productive Equipment: Under the Economic Expansion Incentive Act 1967, interest payable to foreign lenders on approved loans advanced to Singapore enterprises for the purchase of productive equipment will be exempted from tax. This is to ensure that no tax liability of the foreign lender is passed on to local enterprises through higher interest rates on loans.

(b) Royalties, Fees and Development Contribution: Under the same Act, royalties or technical assistance fees or contributions to research and development (R and D) costs payable to overseas corporations or individuals which are approved by the government are taxed at a concessionary rate of 20 percent. Complete tax exemption may be granted on such income or contributions if it is invested in the equity capital of the company.

(c) Market Development Expenditure: Under the Income Tax Act, market development expenditures such as advertising and market research expenses incurred primarily to promote the export of Singapore-made goods or the increase in consumption of Singapore-made goods within Singapore are deductible from chargeable income. Double taxation relief is also offered for export promotion expenses primarily and solely for the purpose of developing exports of Singapore-made goods approved by the Department of Trade.

(d) Accelerated Depreciation for Industries: In addition to the above incentives which are offered to pioneer, expanding, and export enterprises, there is also the incentive to non-pioneer industrial enterprises of a write-off over a 3-year period of capital expenditures for plant and equipment incurred on or after January 1, 1965. An industrial enterprise as herein defined must carry on the manufacture or processing of goods or materials with the use of plant and equipment.

(e) Duty-free Import of Equipment and Raw Materials: Equipment, machinery and raw materials needed by industrial enterprises located in Singapore are exempted from import duties. There is also no restriction on the import of such items.

(f) Lower Interest Rates for Re-discounting Export Bills: A new instrument for export promotion was introduced in 1975 by the Monetary Authority of Singapore.[8] The latter offers lower interest rates to enable companies to rediscount export and re-export bills drawn to finance their export transactions.

(g) Low Interest Rates for Industrial Loans: Before the establishment of Development Bank of Singapore (DBS), the Finance Division of Economic Development Board (EDB) acted as an industrial bank (see Appendix C, (1) and (7)). Medium and long-term loans for plant and equipment were

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[8] Monetary Authority of Singapore (MAS) is Singapore's quasi-central bank.

made available to industrial firms at interest rates comparable to but generally 0.5 to one percent lower than the prime rate of local banks. The interest rate was the same regardless of the maturity of the credit. Most maturities ranged from five to eight years; but if the loan was large, the period could be extended up to 10 years. Repayment of the credit generally begins several months after commencement of commercial production in the borrower's factory.

The EDB is prepared to lend up to 50 percent of the value of fixed assets for new industries and up to 80 percent of the expansion of existing ones provided the total EDB commitment does not exceed 50 percent of the value of the fixed assets of the expanding firm. Credits have been provided to a variety of industries. The Finance Division of the EDB was later taken over by Development Bank of Singapore.

APPENDIX C

INSTITUTIONAL ARRANGEMENTS TO PROMOTE INDUSTRIAL GROWTH AND EXPORT EXPANSION

The following is a brief outline of the institutional arrangements to promote industrial growth and export expansion in Singapore.

(1) The Economic Development Board (EDB)

The Winsemius Mission called for the establishment of the Economic Development Board of Singapore with a capital of S$100 million which was to be the instrument of government participation in industrial activity.

Another S$50 million was allotted to the development of industrial estates. The Economic Development Board Ordinance was passed in 1961 and the Board incorporated on June 9, 1961.[1] Although the EDB is a completely government-owned statutory body, its assistance, both financial and technical, has been extended only to the private sector. The Board's basic purpose is to facilitate the industrial and economic development of Singapore by helping to promote new, private industries. This is to be accomplished by developing industrial estates, preparing feasibility studies and offering a wide range of technical and consultant services including management and training, marketing services, product design, standardization and quality control. The EDB was originally organized into

[1] The EDB replaced the Singapore Industrial Promotion Board which had been established by the British colonial government in 1957 and assumed its assets and liabilities. The latter institution was small and ineffective as far as promoting industrial development was concerned.

six divisions: investment promotion, projects, technical consultant services, civil engineering, finance and industrial facilities. But as industrialization gathered momentum, the EDB found itself developing into a vast organization, deeply involved in all aspects of industrial development. It was felt that greater specialization of functions should be introduced to achieve greater efficiency. Accordingly, several organizations were set up to take over the EDB's finance, technical service, civil engineering and industrial facilities (see Sections (2) - (7)). This left the EDB to concentrate on investment promotion and project evaluation. The EDB continues to serve as a coordinating unit.

(2) Singapore Institute for Standards and Industrial Research (SISIR)

The Industrial Research Unit of the EDB was converted into SISIR in 1969. The function of the SISIR is to assist industry to overcome technological and standardization problems. Its services include (a) provision of testing services for raw material and finished manufactured products to ensure that standards are established and maintained; (b) offering research facilities to investigate raw materials, improve products and processes; (c) provision of services for the repair and calibration of a wide range of industrial and scientific equipment. SISIR is a member of the International Organization for Standardization and maintains close relationships with similar organizations in other countries.

(3) Engineering Industries Development Agency (EIDA)

The technical division of EDB had operated a number of workshops and engineering development services which were established with the assistance of various United Nations agencies. It was felt that the intensified promotion of such engineering services was vital for accelerated development. Consequently, a centralized coordinating and administrative unit known as the Engineering Industries Development Agency (EIDA) was set up in 1968 to administer these various workshops and services. The main objective of EIDA is to promote and stimulate the development of more sophisticated engineering industries, particularly metal and precision engineering, electronics, machinery and ship-building. EIDA also undertakes product research, design and development and maintains a pool of designers for continuing technological progress. Training and upgrading facilities for skilled workers, technicians and young engineers are provided.

(4) Singapore Institute of Management (SIM)

Singapore Institute of Management, established in 1964, took over the management training function of EDB. The institute obtained technical and financial support from the Ford Foundation, the business community and institutions of higher learning in Singapore.

(5) National Productivity Board (NPB)

The National Productivity Board, an autonomous statutory body, was set up in 1973 to take over the National Productivity Centre from the EDB. The Centre was set up in 1967 with the dual objectives of promoting mutual co-operation between labor and management and ensuring a higher level of industrial productivity to enable industries to compete successfully in foreign export markets. Expert personnel in industrial productivity and industrial engineering are provided to NPB through the UN Technical Assistance Programme. The NPB offers advisory and consultancy services in the fields of industrial relations and industrial engineering. It also organizes training courses on work study, production planning and control, and job evaluation for middle and lower management.

(6) Jurong Town Corporation (JTC)

The EDB embarked on the massive task of providing fully-serviced industrial estates in various locations. The largest and most comprehensive industrial complex is in Jurong Town. The provision of such industrial estates minimizes the capital outlay for industries implementing projects in Singapore. As Jurong expanded in size and complexity, the functions of the Industrial Facilities Division of EDB were transferred to a new statutory body, the Jurong Town Corporation (JTC), which was established in 1968. JTC provides facilities for the management of industrial estates and sites and the provision of amenities for the benefit of people living and working in such industrial estates. In addition to Jurong Town, the JTC also manages other small industrial estates scattered over the island. The Corporation, as with the EDB, continues to receive long-term low interest loans from the government for its development expenditures. Its chief sources of income are land leases, factory rentals, rentals from housing, and charges for services.

(7) Development Bank of Singapore (DBS)

The Development Bank of Singapore was established in 1968 as a result of a spin-off of the financial activities of the EDB. The total authorized capital of the Bank is S$200 million of which S$100 was fully subscribed and paid in 1969. The bank is quasi-governmental: 49 percent of its shares are owned by the government and 51 percent are owned by the private sector, mainly commercial banks, insurance and finance companies.

In addition to providing term loans to manufacturing industries (see Appendix B, section B. 4 (h)), DBS provides equity participation, underwrites public issue of shares by industrial firms and acts as a guarantor in the floating of loans by industries. While its main effort is directed at manufacturing industries, the service sectors can also seek financial assistance from DBS. The bank encourages equity participation in enterprises by both the government and the public but avoids any direct competition with commercial banks.

In addition to its paid-in capital, the bank also obtained a US$10 million loan from Asian Development Bank in July 1969, a US$5 million loan from the World Bank in February 1970 and a S$8 million loan from the German Credit Bank (Kreditansatalt fur Wiederaufbau) in 1970. All of these loans are guaranteed by the Singapore Government.

In the area of export finance, the Bank started to undertake short-term overdraft facilities to finance foreign-trade in 1969 and later expanded both long-term credits and guarantees to help finance Singapore's exports.

(8) <u>International Trading Company (INTRACO)</u>

It was recognized that a high standard of product design and marketing techniques was essential to establish foreign markets. Thus, the Product and Design Center was first established under the Technical Consultant Services Division of EDB. The Center also served as a base from which information could be provided and as a focal point for overseas buyers. In 1966, the Center was incorporated into the Export Promotion Center. This new Center disseminates information on tariff structures of export markets, standards and specifications, quota restrictions and other matters relevant to manufacturers seeking overseas markets. In addition, it assists in organizing sales teams to promote Singapore's manufactured goods in foreign markets. In co-operation with the Trade Division of the Ministry of Finance, manufacturers and chambers of commerce, the Center participates in meeting all foreign trade missions.

In 1968, the Export Promotion Center was absorbed into the International Trading Company Ltd. (INTRACO), a new quasi-government body, along the line of Japanese trading companies.[2] The company is jointly owned by the government, DBS and private firms with a total subscribed capital of S$20 million. The establishment of INTRACO was the first effort in international marketing, including the setting up of relationships with socialist countries where foreign trade is a state monopoly.

(9) <u>Nepture Orient Lines Ltd</u>.

The shipping practices of developed countries have long been criticized by exporters from the LDCs. The usual allegation is that the Conferences discriminate against LDCs by using their power to charge what the market will bear on lesser-used routes. Specifically, the practice discourages the export of manufacturing products from LDCs by applying the general cargo rate which is considerably higher than the rates

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[2] The objective was stated by Dr. K. S. Goh, former Finance Minister, in the following words: "We cannot depend forever on the overseas industrialist bringing his market with him. The reason is that he could well decide that he can handle his present markets more profitably or more securely from his own country .... What we need is a trading company, something like the great Japanese trading companies, which will study opportunities for our manufacturers in overseas markets and undertake their marketing operations there." Quoted in S. A. Lee, <u>Industrialization in Singapore</u>, Longman Australia Pty Ltd. 1973, p. 99.

specifically assigned to particular items.[3] In January 1969, a national shipping line, Nepture Orient Lines Ltd., was formed with the objective of expediting foreign trade and securing lower freight rates. Its fleet of seven cargo vessels service the Hong Kong-London and Singapore-Japan runs. Negotiations are continuing with the "Far East Freight Conferences" to service other runs between Japan and Europe.

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[3] Manufactured products have only recently become export items in LDCs and they pay freight tariff rates for cargo "not otherwise specified" which are considerably higher than the common rates. See L. M. S. Rajwar, "Trade and Shipping Needs of Developing Countries", International Conciliation, No. 582, March 1971, p. 15.

APPENDIX D

CLASSIFICATION OF PRODUCTION AND TRADE DATA

The statistical analysis of Chapter IV is carried out in terms of two different sets of data with different classification systems. Production data is based on the International Standard Industrial Classification (ISIC) system (See Appendix A) and trade data is based on the Standard International Trade Classification (SITC) system. The correspondence of the two classification systems by industries is shown in Table A-1 which is adapted from Hong (1966), Chenery (1960) and Lewis-Soligo (1965). Some arbitrary judgements are made, particularly for processed food products. Miscellaneous manufacturing industries are not shown because "photographic and optical goods and scientific instruments" and "plastic products," originally listed in the "Miscellaneous Manufacturing Industry" column in Singapore's Census of The Industrial Production, are taken out and reclassified as individual industries. Other miscellaneous manufacturing industries are insignificant in terms of gross output and are therefore left out of our study.

Table A-1

Classification of Production and Trade Data

Industry	UN ISIC Code	UN SITC Code
Consumer Goods:		
Food	311-2	a/
Beverages	313	111,112
Tobacco	314	122

Table A-1

(Cont'd)

Industry	UN ISIC Code	UN SITC Code
Wearing Apparels (Clothing)	322	841
Footwear	324	851
Furniture and Fixtures	332	821
Printing and Publishing	342	892
Photographic and Optical Goods	385	861-4
<u>Intermediate Goods</u>:		
Wood and Cork Products	331	63, 241-3, 251
Paper and Paper Products	341	641-2
Rubber Products	356	62
Leather and Leather Products	323	61, 831
Plastic Products	357	893
Industrial Chemicals	351	51, 521, 531-2, 571
Other Industrial Chemical Products	352	541, 533, 551-4
Petroleum Refinery and Petroleum Products	353-4	332 b/
Processing Natural Rubber and Gums	355	231-3
Pottery, China and Earthware	361	666
Glass and Glass Products	362	664-5
Structural Clay Products	363	662
Cement and Concrete Products	364-5	661
Non-metallic Mineral Products, n.e.s.	369	663
Textiles	321	651-7
<u>Capital Goods</u>:		
Iron and Steel Basic Industries	371	671-9
Non-ferrous Metal Basic Industries	372	681-9
Fabricated Metal Products	381	691-8
Non-electrical Machinery	382	71
Electrical Machinery, Appliances and Components	383	72
Transport Equipment	384	73

Table A-1

(Cont'd)

Notes: a/ The following items are classified as manufactured products of food:

013	meat in airtight containers & meat preparations
022	milk and cream: dried
032	fish in airtight containers & fish preparations
046	wheat meal and flour
048	cereal preparations
053	fruit preserved and fruit preparations
061.2	beet and cane sugar, refined
081	fodder, n.e.s.

b/ crude oil (332.4) is excluded.

Sources: W. Hong, A Study of Changes in the Structure of Manufacturing Industry and in the Trade Pattern of Manufactured Products in Korea, Taiwan and Japan (Unpublished Ph.D. Thesis, Columbia University, 1966); H. B. Chenery, "Patterns of Industrial Growth," American Economic Review, Vol. 50 (1160), September 1960, pp. 624 sqq.; and S. R. Lewis and R. Soligo, "Growth and Structural Change in Pakistan Manufacturing Industry, 1954-1966" The Pakistan Development Review, Vol. V, No. 1 (Spring 1965), pp. 94 sqq.

Singapore, Department of Statistics, Report on the Census of Industrial Production, 1970.

Appendix Table A-2.1

Population, Density and Growth Rates: 1947, 1957 and 1959-1974

Year	Population[1] ('000)	Density[2] ('000 per sq. km.)	Growth Rate (%)
1947 Census	938.2	1.60	-
1957 Census	1,445.9	2.47	4.4[3]
1959	1,579.6	2.70	-
1960	1,634.1	2.79	3.5
1961	1,687.3	2.88	3.2
1962	1,732.8	2.96	2.7
1963	1,795.0	3.06	2.5
1964	1,841.6	3.14	2.5
1965	1,886.9	3.22	2.5
1966	1,934.4	3.30	2.3
1967	1,977.6	3.38	2.0
1968	2,012.0	3.43	1.6
1969	2,042.5	3.49	1.5
1970 Census	2,074.5	3.54	1.7
1971	2,110.4	3.60	1.7
1972	2,147.4	3.67	1.8
1973	2,185.1	3.73	1.7
1974	2,219.1	3.79	1.6

Notes: 1 Population was mid-year estimates except census years;
2 Calculation of density is based on an area of 586 sq. kilometers;
3 1947-1957.

Sources: Singapore, Yearbook of Statistics, 1974/1975; and You and Lim, ed. The Economy of Singapore, Singapore: Eastern University Press, 1971, p. 45.

Appendix Table A-2.2

Gross Domestic Product (GDP), GDP Deflators, Nominal Rates of Exchange and Consumer Price Index

Year	GDP[a] (S$ million)	GDP Deflators[b] (1960 = 100)	Nominal Rates[c] of Exchange (S$ per US $)	Consumer Price Index (1963 = 100)
(1)	(2)	(3)	(4)	(5)
1959	1,968	100.0	3.06	100
1960	2,046	100.0	3.06	97
1961	2,240	99.0	3.05	97
1962	2,371	99.0	3.06	98
1963	2,684	100.0	3.06	100
1964	2,700	101.0	3.07	102
1965	3,043	102.0	3.06	102
1966	3,365	104.0	3.08	104
1967	3,692	104.0	3.07	107
1968	3,971	105.0	3.08	108
1969	4,610	107.4	3.09	109
1970	5,320	109.6	3.09	108
1971	6,279	114.7	2.90	110
1972	7,524	120.9	2.82	112
1973	9,621	138.3	2.49	136
1974	12,145	162.5	2.31	162

Notes: [a] GDP at current factor cost;
[b] GDE/GDP price deflators are converted into same base;
[c] mid-point rates.

Sources: Column (2): Singapore, Statistical Yearbook, (various years);

Column (3): W. I. Abraham and P.C.K. Tan, "A Note on the Growth and Changing Composition of Gross Domestic Expenditure in Singapore," The Malayan Economic Review, Vol. XV, No. 2 (October 1970), pp. 42-48; and Singapore, Ministry of Finance, Economic Survey of Singapore 1974;

Column (4) and Column (5): United Nations, Statistical Yearbook, (various years).

Appendix Table A-2.3

Estimates of Labor Force and Unemployment
Rates: 1965 - 1974

('000)

Year	Mid-Year Population[1]	Labor Force[2]	Persons Employed	Persons Unemployed	Unemployment Rate (%)
1965	1,005.9	557	509	48	8.7
1966	1,038.5	575	524	51	8.7
1967	1,074.7	601	552	49	8.1
1968	1,109.8	626	580	46	7.3
1969	1,147.0	654	610	44	6.7
1970	1,200.3	693	651	42	6.0
1971	1,242.3	726	691	35	4.8
1972	1,286.9	761	725	36	4.7
1973	1,330.2	818	781	37	4.5
1974	1,389.6	836	803	33	4.0

Notes: [1] Aged 15 - 64 years old;

[2] defined as all economically active population.

Sources: Singapore, Yearbook of Singapore 1974, p. 274; and Singapore, Ministry of Finance, Economic Survey of Singapore 1974, Table 1.2.

Appendix Table A-2.4

Gross National Product (GNP) of Selected Asian Countries and Rates of Growth

(At Market Prices)

Country	Per Capita GNP (US$)		Average Annual Growth Rates	
	1973	1974*	1960 - 1973	1965-1973
Japan	3,630	3,880	9.4%	9.6%
Singapore	1,830	2,120	7.1	9.4
Hong Kong	1,430	1,540	7.0	5.8
Taiwan	920[a]	-	-	-
Malaysia	570	660	3.9	3.7
South Korea	400	470	7.1	8.7
Philippines	280	310	2.3	2.6
Thailand	270	300	4.8	4.5
Indonesia	130	150	2.4	4.5
Pakistan	120	130	3.4	2.5
India	120	130	1.3	1.5
Sri Lanka	120	130	2.0	2.0
Bangladesh	80	100	-0.2	-1.6
Burma	80	90	0.7	0.7

Notes: * Preliminary; [a] 1970 figures.

Sources: International Bank for Reconstruction and Development (IBRD), <u>World Bank Atlas: Population, Per Capita Product and Growth Rates</u>, 1975 edition.

Appendix Table A-2.5

Singapore's Balance of Payments: 1968, 1971 & 1974

(S$ million)

	1968	1971	1974
A. Goods and Services (net)			
Merchandise trade (f.o.b.)			
Exports	3,589	5,075	13,435
Imports	4,759	8,090	19,167
Trade Balance	-1,170	-3,015	- 5,732
Services (net)	803	846	2,874
Freight and Insurance	- 295	- 506	- 929
Travel	128	298	661
Investment Income	69	161	- 289
Government, n.i.e.	446	358	164
Other Transportation and Services, n.i.e.	455	535	3,267
B. Transfer Payments (net)	- 41	- 35	- 83
Current Account Balance	- 408	-2,205	-2,941
C. Capital (net)	464	878	1,324
Non-monetary Sector (net)	348	482	1,744
Private	199	407	1,750
Official	149	75	- 6
Monetary Sector (net)	116	396	- 420
Commercial Banks:			
Foreign Assets[1]	- 8	- 210	- 385
Foreign Liabilities	124	606	- 35
D. Balancing Item	608	2,301	2,325
E. Overall Balance (A + B + C + D)	664	975	708
F. Reserves (net)[1]	+ 664	+ 975	+ 708
IMF Accounts	-	+ 5	-
Monetary Authorities[2]	+ 49	+ 771	+ 941
Government	+ 615	+199	- 233

Notes: [1] Increase in assets is indicated by a plus (+) sign;

[2] From 1971, figures include foreign assets of the Monetary Authority of Singapore (MAS).

Source: Singapore, The Monetary Authority of Singapore, Annual Report, (various years).

Appendix Table A-2.6

Singapore's Official Foreign Reserves

(S$ million)

	1968	1969	1970	1971	1972	1973	1974
Monetary Authority[1] (including gold tranche)	641	747	898	1,669	2,461	3,137	4,084
Government (including Statutory Authorities)	1,545	1,786	2,201	2,427	2,470	2,663	2,428
Total[2]	2,186	2,533	3,099	4,096	4,931	5,800	6,512

Notes: [1] Figures prior to the formation of The Monetary Authority of Singapore in January 1971 refer to foreign assets of the Board of Commissioners of Currency, Singapore, and up to April 1972 also include Singapore's estimated share of the foreign assets of the Board of Commissioners of Currency, Malaya and British Borneo.

[2] Valuation at cost.

Source: Singapore, The Monetary Authority of Singapore, Annual Report, (various years).

Appendix Table A-2.7

Gross Domestic Product by Industrial Origin:
1960, 1968 and 1974

(at Current Factor Cost)

(S$ million)

Economic Sector	1960	1968	1974
Gross Domestic Product	1,985.3	3,970.8	12,144.9
Agriculture and Fishing	74.9	120.0	225.4
Quarrying	6.1	14.5	29.2
Manufacturing	235.6	675.6	3,011.8
Electricity, Gas and Water Supply	49.7	116.7	248.9
Construction	71.7	250.6	961.2
Entrepot and Domestic Trade:	712.5	1,264.0	3,611.3
Entrepot Trade	450.5	561.9	n.a.
Domestic Trade	262.0	702.1	n.a.
Transport, Storage and Communication	282.8	450.4	1,271.4
Banking, Insurance and Real Estate	145.2	360.8	1,194.3
Ownership of Dwellings	79.3	168.4	539.2
Public Administration and Defense	55.4	137.0	368.5
Other Services:	305.2	484.1	927.7
Military	275.4	348.6	n.a.
Tourism	29.8	135.5	n.a.
Less: Imputed Bank Service Charge	33.1	71.3	262.0

Source: Singapore, Ministry of Finance, Economic Survey of Singapore 1974, Table 2.1.

Appendix Table A-2.8

Percentage Distribution of GDP by Industrial Origin and Rates of Growth: 1960, 1968 & 1974

Economic Sectors	Percentage Distribution (%)			Compound Annual Rate of Growth		
	1960	1968	1974	1960-1968	1968-1974	1960-1974
Agriculture and Fishing	3.77	3.02	1.86	6.07%	11.08%	8.19%
Quarrying	0.31	0.37	0.24	11.43	12.38	11.84
Manufacturing	11.87	17.01	24.80	14.08	28.29	19.96
Electricity, Gas and Water Supply	2.50	2.94	2.05	11.26	13.46	12.10
Construction	3.61	6.31	7.91	16.93	25.11	20.37
Entrepot and Domestic Trade:	35.89	31.83	29.74	7.43	19.12	12.29
Entrepot Trade	(22.69)	(14.15)	(10.30)[a]	24.67	-	-
Domestic Trade	(13.20)	(17.27)	(16.18)	13.11	-	-
Transport, Storage & Communications	14.25	11.34	10.47	5.99	18.88	11.34
Banking, Insurance and Real Estate	7.31	9.09	9.83	12.05	22.08	16.76
Ownership of Dwellings	3.99	4.24	4.44	9.87	21.41	14.67
Public Administration and Defense	2.79	3.45	3.18	11.98	19.87	14.88
Other Services:	15.37	12.19	7.64	5.94	11.45	8.27
Military	(13.87)	(8.78)	(1.70)[a]	2.99	-	-
Tourism	(1.50)	(3.41)	(5.80)	20.84	-	-
Less: Imputed Bank Services Charges	1.67	1.80	2.16	10.07	24.22	15.93
Gross Domestic Product	100	100	100	9.05	20.48	13.81

Notes: [a] Figures for 1973; * Figures may not add to 100 percent due to roundings.

Source: Derived from Appendix Table A-1.7.

Appendix Table A-2.9

GDP, Imports, Exports, Domestic Exports, Re-Exports, Manufactured Exports: 1959-1974

(at current market prices)

(Unit: S$ million)

Year	GDP[1]	Imports[2] (c.i.f.)	Exports[2] (f.o.b.)	Domestic Exports	Re-Exports	Mfg. Exports[3]
1959	1,968	3908	3440 (3309)	215*	n.a.	148.4*
1960	2,046	4078	3477 (3356)	217	3260	164.3
1961	2,240	3963	3309 (3115)	233	3076	179.1
1962	2,371	4036	3417 (3124)	244	3173	217.5
1963	2,684	4279	3474 (3214)	341	3134	223.8
1964	2,700	3479	2722	277	2495	266.4
1965	3,043	3807	3004	424	2580	349.2
1966	3,365	4066	3374	965	2409	404.9
1967	3,692	4407	3491	1111	2380	508.2
1968	3,971	5084	3891	1592	2299	598.5
1969	4,610	6244	4741	2160	2581	1265.3
1970	5,320	7534	4756	2142	2614	1523.0
1971	6,279	8655	5371	2416	2955	1954.7
1972	7,524	9538	6150	3033	3117	2641.7
1973	9,621	12513	8907	4791	4116	4269.8
1974	12,145	20405	14155	8900	5255	7811.9

Notes: [1] at current factor cost;
[2] Trade with Indonesia only up to October 1963; since then, figures for trade with that country were not available; figures in brackets indicate exports to Indonesia were excluded.
[3] manufactured exports are broadly defined (ISIC 2-3);
* estimated figure.

Sources: Singapore, _Statistical Yearbook_, various years; Dept. of Trade, _Annual Report_, various years; _Report on the Census of Industrial Production_, various years.

Appendix Table A-2.10

Manufactured Exports of Selected Southeast Asian Countries [1]

Country	Manufactured Exports[2] (US$ '000)		GNP (US$ million)		Population (million)	
	1965	1972	1965	1972	1965	1972
Singapore [3]	286,030	898,096	1,058	2,905	1.89	2.15
Malaysia	66,120	163,563	2,851	4,041	9.73	11.00
Philippines	65,830	81,023[4]	8,590	10,555[4]	31.67	37.91[4]
Thailand	52,374	131,582	3,936	7,627	31.03	38.58
Indonesia	n.a.	32,692	n.a.	15,084	n.a.	121.63
Bruma	1,373	7,825	1,768	1,975	24.73	28.87

Notes: 1 SITC 5 to 8 excluding 687.1 (tin);
2 Valued at current market prices;
3 Including re-exports;
4 1971 figures.

Sources: United Nations, Yearbook of International Trade Statistics, various years;
United Nations, Statistical Yearbook, various year.

Appendix Table A-2.11

Exports, Domestic Exports, Re-exports and Manufactured Exports: 1959-1974 (at 1960 constant prices)[1]

(S$ million)

Year	Exports	Domestic Exports	Re-exports	Mfg. Exports
1959	3,440	215	n.a.	148.4
1960	2,477	217	3,260	164.3
1961	3,342	235	3,107	180.9
1962	3,452	247	3,205	219.7
1963	3,474	341	3,134	223.8
1964	2,695	274	2,470	263.9
1965	2,945	416	2,529	342.4
1966	3,244	928	2,316	389.3
1967	3,357	1,086	2,289	488.7
1968	3,706	1,516	2,190	570.0
1969	4,414	2,011	2,403	1,178.1
1970	4,339	1,958	2,385	1,389.6
1971	4,685	2,106	2,576	1,704.2
1972	5,087	2,509	2,578	2,185.0
1973	6,436	3,462	2,974	3,085.1
1974	8.712	5,477	3,234	4,807.3

Note: [1] Deflated by GDP price deflators as given in Appendix Table A-1.2.

Source: Derived from Appendix Tables A-1.2 and A-2.1.

Appendix Table A-2.12

Singapore's Manufactured Exports (SITC 5-8): 1959 - 1974

(US $ million)

Year	At Current Prices	At 1960 Constant Prices[1]
1959	160.9	160.9
1960	177.5	177.5
1961	277.2	280.0
1962	303.5	306.6
1963	324.6	324.6
1964	287.9	285.1
1965	305.2	299.2
1966	317.0	304.8
1967	290.6	279.4
1968	306.3	291.7
1969	365.1	340.0
1970	431.4	394.3
1971	589.0	513.5
1972	898.1	742.9
1973	1,611.9	1,164.7
1974	2,335.0	1,436.9

Note: [1] Deflated by GDP price deflators (see Appendix Table A-1.2).

Sources: United Nations, Yearbook of International Trade Statistics, various years.

Appendix Table A-2.13

Major Buyers of Singapore's Exports: 1959, 1963, 1967, 1970, 1974

(percentage shares)

Country/Area	1959		1963		1967		1970		1974	
1. United States	8.49%	(5)	6.67%	(5)	6.99%	(4)	11.90%	(3)	14.83%	(3)
2. Canada	1.72	(16)	0.94	(17)	0.97	(16)	1.19	(16)	1.01	(15)
3. United Kingdom	7.95	(6)	5.84	(6)	6.06	(5)	6.82	(6)	4.05	(8)
4. EEC Countries 1/	9.93	(4)	7.98	(3)	7.24	(3)	8.30	(4)	8.19	(5)
France	2.29		1.78		1.58		2.00		1.85	
West Germany	2.59		2.03		1.53		2.86		3.02	
Itlay	2.05		2.04		1.58		1.45		1.25	
Netherlands	2.44		1.55		1.80		1.51		1.64	
Bel-Lux	0.56		0.58		0.70		0.48		0.43	
5. Other W. Europe	3.73	(9)	3.44	(9)	2.73	(12)	3.54	(8)	2.60	(11)
6. Japan	5.69	(7)	3.94	(8)	4.47	(6)	7.60	(5)	11.35	(4)
7. China (Mainland)	3.73	(12)	0.47	(18)	2.75	(11)	1.46	(15)	0.88	(17)
8. Malaysia	20.92 2/	(1)	35.27 3/	(1)	31.44	(1)	21.86	(1)	16.58	(1)
9. Indonesia	10.24	(3)	7.52	(4)	n.a.	(-)	n.a.	(-)	n.a.	(-)
10. Thailand	2.77	(13)	2.76	(10)	3.71	(7)	3.30	(11)	2.42	(12)
11. Hong Kong	1.46	(17)	2.60	(11)	3.35	(8)	4.08	(7)	6.49	(6)
12. Other Asia, n.e.s.	11.91	(2)	14.79	(2)	15.52	(2)	15.35	(2)	16.41	(2)
13. Australia	3.58	(11)	2.49	(12)	2.09	(14)	3.36	(11)	4.85	(7)
14. New Zealand	0.99	(18)	1.05	(16)	0.83	(17)	0.43	(17)	1.24	(14)
15. U.S.S.R.	4.77	(8)	4.46	(7)	2.58	(13)	3.00	(12)	1.67	(13)
16. Other E. Europe, n.e.s.	2.20	(14)	1.81	(13)	1.77	(15)	2.20	(14)	1.16	(6)
17. Latin America	3.63	(10)	1.61	(14)	3.10	(10)	2.56	(13)	2.71	(10)
18. Africa	1.74	(15)	1.28	(15)	3.18	(9)	3.52	(9)	3.45	(9)

Notes: 1/ UK joined EEC in 1973 but was excluded in our calculation; 2/ excluding Sarawak and Sabah; 3/ including Sarawak and Sabah (29.10% if excluded).
* Bracked figures indicate rank.

Sources: Derived from IMF Direction of Trade (Annual), various years; United Nations, Yearbook of International Trade Statistics, various years.

Appendix Table A-2.14

Gross Domestic Fixed Capital Formation (I) and Its Price Deflators: 1959-1974

Year	I[a] (S$ million)	Price Deflators (1968 = 100)	I at Constant Prices (S$ million)	Growth Rates (%)
1959	144	94.5	152	-
1960	205	94.5	217	42.76
1961	226	94.5	239	10.14
1962	255	95.5	267	11.72
1963	446	95.5	467	74.91
1964	547	96.5	567	21.41
1965	625	97.5	640	12.88
1966	655	99.5	658	2.81
1967	738	98.2	752	14.29
1968	997	100.0	997	32.58
1969	1,326	103.1	1,286	28.99
1970	1,886	110.3	1,710	32.97
1971	2,473	117.7	2,101	22.87
1972	3,054	126.7	2,410	14.71
1973	3,561	136.2	2,615	8.51
1974	4,620	157.9	2,926	11.89

Notes: 1/ at current market prices;
2/ converted to same base.

Sources: Abraham and Tan, "A Note on the Growth and Changing Composition of Gross Domestic Expenditure in Singapore," The Malayan Economic Review, Vol. XV, No. 2 (Oct. 1970), pp. 42-48; and Singapore, Statistical Yearbook 1974/1975.

Appendix Table A-3.1

Index Number of Manufacturing Employment by Major Industry Groups in Singapore, 1952-1959

(1958 = 100)

Industry Code ISIC	Major Industry Groups	(a) Indices: 1958 = 100						
		1952	1953	1954	1955	1956	1957	1958
2-3	Total Manufacturing	103	107	112	106	110	106	100
20-22	Food, Beverages and Tobacco	97	103	109	103	101	103	100
23	Textiles	44	102	92	136	116	111	100
24	Clothing, Footwear and Made-up Textiles	70	76	80	85	111	108	100
25-26	Wood Products and Furniture	102	113	112	105	112	103	100
27	Paper and Paper Products	60	73	95	103	112	102	100
28	Printing and Publishing	82	85	91	94	103	104	100
29	Leather and Leather Products	76	113	123	110	126	102	100
30	Rubber Products	158	143	147	135	130	120	100
31-32	Chemicals, Chemical and Petroleum Products	154	136	112	113	111	106	100
33	Non-metallic Mineral Products	94	84	103	117	122	109	100
34	Basic Metals	137	132	117	116	132	121	100
35-38	Metal Products	96	104	110	102	105	104	100
39	Miscellaneous	93	110	107	96	104	105	100

(Cont'd)

Appendix Table A-3.1

Industry Code	Major Industry Groups	(a) Indices: 1959 = 100	(b) Average Annual Rate of Change (Percentage)		
ISIC		1959	1952-1954	1954-1959	1952-1959
2-3	Total Manufacturing	92	5.8	-4.0	-1.6
20-22	Food, Beverages and Tobacco	98	6.0	-2.2	0.1
23	Textiles	98	44.6	1.3	12.1
24	Clothing, Footwear and Made-up Textiles	86	6.9	1.5	10.1
25-26	Wood Products and Furniture	84	4.8	-5.9	-2.8
27	Paper and Paper Products	87	25.8	-1.8	5.5
28	Printing and Publishing	97	5.3	1.3	2.4
29	Leather and Leather Products except Wearing Apparels	92	27.2	-6.0	2.8
30	Rubber Products	87	-3.7	-11.1	-8.9
31-32	Chemicals, Chemical and Petroleum Products	93	-17.3	-3.8	-7.5
33	Non-metallic Mineral Products	95	4.7	-1.6	0.2
34	Basic Metals	81	-8.2	-7.6	-7.8
35-38	Metal Products	93	7.1	-3.4	-0.5
39	Miscellaneous	79	7.3	-6.3	-2.4

Source: United Nations, The Growth of World Industry 1938-1961 (National Tables), New York:, 1963.

Appendix Table A-3.2

Selected Major Indicators of Manufacturing Industries in Singapore, 1959-1974

(S$ million at current prices)

Year	Col. (1) All Industries[1]					Col. (1) Index Number of	
	Output (S$ m.)	Value Added (SE m.)	Direct Exports (S$ m.)	Employment (No.)	Establishment[2] (No.)	Production 1963 = 100	Employment 1963 = 100
1959	399.8	142.8	n.a.	25,607	531	n.a.	n.a.
1960	465.6	142.1	164.2	27,416	548	n.a.	n.a.
1961	518.4	174.4	179.1	27,562	562	n.a.	n.a.
1962	660.3	201.7	217.5	28,642	605	n.a.	98
1963	843.8	252.6	223.8	36,586	858	100	100
1964	927.9	282.5	266.4	41,488	930	110	104
1965	1,086.4	348.4	349.2	47,334	1,000	129	114
1966	1,325.8	415.0	404.9	52,807	1,123	159	131
1967	1,687.2	478.6	508.2	58,347	1,200	200	130
1968	2,175.7	611.8	659.5	74,823	1,586	258	139
1969	3,213.9	865.6	1,265.3	100,758	1,714	381	150[5]
1970	3,891.0	1,093.7	1,523.0	120,507	1,747	461	173[3]
1971	4,699.3	1,366.5	1.954.7	140,552	1,813	480[3]	190
1972	5,722.2	1,782.3	2,641.7	170,352	1,931	502	217
1973	7,938.1	2,540.6	4,269.8	198,574	2,079	526	251
1974	10,258.6[4]	3,060.2[4]	5,776.4[4]	206,067	2,179	530	n.a.

Notes: [1] covered establishments with at least 10 workers only; [2] number of workers; [3] converted into same base; [4] "petroleum refinery and petroleum products" prices are adjusted; [5] my estimate (no overlapping years for 1968-1969 in UN Statistical Yearbook).

Sources: Column (1): Singapore, Report on the Census of Industrial Production (various years); Column (2): United Nations, Statistical Yearbook (various years).

Appendix Table A-3.3

Selected Major Indicators of Pioneer Firms of Singapore, 1961-1973

Year	Output (S$ m.)	Value Added (S$ m.)	Direct Exports (S$ m.)	Employment (no.)	Establishment (No.)
1961	36.3	6.9	n.a.	241	7
1962	109.8	22.7	n.a.	968	14
1963	153.2	33.5	n.a.	2,654	29
1964	220.4	50.1	n.a.	5,416	56
1965	318.2	86.4	88.0	10,495	95
1966	490.3	119.4	185.0	10,881	111
1967	649.5	163.9	261.0	16,095	159
1968	1,072.5	249.5	344.0	20,800	203
1969	1,199.8	333.5	460.0	36,071	236
1970	1,749.0	593.0	997.0	50,504	263
1971	2,403.0	636.0	1,294.0	66,124	291
1972	3,380.0	901.0	1,964.0	86,464	313
1973	4,684.0	1,410.0	2,983.0	96,018	319

Sources: Singapore, Economic Development Board, Annual Report (various years) and Singapore's Major Economic Indicators, 1960-1973/74.

Appendix Table A-3.4

Index Number of Industrial Production for Manufacturing Sectors in Selected Countries, 1964-74

(1963 = 100)

Countries	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
United States	107	118	130	132	139	146	139	138	146	157	156
Canada	109	119	128	129	135	141	143	149	156	166	169
United Kingdom	109	112	114	114	121	126	127	127	129	137	135
Japan	116	121	137	164	193	227	264	267	274	292	288
South Korea	107	126	156	200	275	335	390	407	426	477	533
Singapore	110	129	159	200	258	381	461	480	502	526	530
India	109	119	117	115	121	129	135	137	142	147	148
Philippines	108	111	121	125	137	142	142	153	163	176	173
Pakistan	111	118	130	140	155	176	187	187	196	202	200
Sri Lanka (1970=100)	..	..	..	79	91	96	100	107	112	108	n.a.
Isrdel	113	124	126	122	158	184	202	228	241	248	254
Taiwan	121	145	169	199	246	292	342	n.a.	n.a.	n.a.	n.a.
Malaysia (1970 = 100)	..	..	..	..	77	89	100	106	119	144	166

Source: United Nations, Statistical Office, Statistical Yearbook, (various years).

Appendix Table A-3.5

Value Added of Manufacturing Industries,

1959 - 1974

(S$ '000 at current price)

	1959	1960	1961	1962	1963	1964	1965
1. Food	16,615	16,700	18,062	17,518	20,372	24,373	32,106
2. Beverage	20,055	19,693	30,036	27,200	22,567	21,085	27,349
3. Tobacco	4,384	7,732	5,584	12,017	18,757	22,615	26,558
4. Wood and Cork Products	9,199	10,067	10,117	10,255	13,842	17,104	19,398
5. Furniture and Fixtures	1,619	1,353	2,425	3,185	4,830	5,137	5,063
6. Paper and Paper Products	1,496	1,890	2,347	1,913	2,077	2,492	3,890
7. Printing and Publishing	22,451	24,503	27,370	28,605	30,021	31,184	34,782
8. Textile, Footwear and Leather Products	3,703	4,434	3,884	3,560	3,022	10,730	12,905
(a) Textile	-	-	-	-			
(b) Wearing Apparels and Footwear	-	-	-	-	4,143	10,311	11,732
(c) Leather Products	-	-	-	-	901	416	1,173
9. Rubber Products	2,606	3,323	2,918	2,518	3,879	3,241	7,488
10. Chemicals, Chemical and Petroleum Products	9,378	9,718	11,223	26,085	38,827	41,662	59,619
(a) Chemicals and Chemical Products	-	-	-	-	-	-	-
(b) Petroleum Refinery & Petroleum Product	-	-	-	-	-	-	-
11. Non-metallic Mineral Products	9,521	5,465	14,839	15,613	24,687	21,581	23,609

(Cont'd)

Appendix Table A-3.5

Value Added of Manufacturing Industries:

1959 - 1974

(S$ '000 at current price)

	1959	1960	1961	1962	1963	1964	1965
12. Basic Metal Products	1,885	1,906	2,585	3,889	4,950	9,672	11,203
13. Metal Products (except machinery and transport equipment)	8,301	10,870	12,639	14,413	20,441	23,613	29,483
14. Non-electrical Machinery	7,943	6,525	8,025	8,256	7,116	6,249	8,657
15. Electrical Machinery	11,598	7,884	9,244	6,181	9,478	9,788	11,136
16. Transport Equipment	10,435	8,299	10,659	17,525	20,308	26,100	26,216
17. Plastic Products							
18. Photographic & Optical Goods							
19. Miscellaneous Manufacturing Industries	1,573	1,782	2,407	3,221	5,730	5,927	8,899
0. Total Manufacturing	142,780	142,143	174,364	201,680	252,566	282,461	348,361

Appendix Table A-3.5 (Cont'd)

Value Added of Manufacturing Industries:

1959 - 1974

(S$ '000 at current price)

	1966	1967	1968	1969	1970	1971	1972	1973	1974
1. Food	35,913	48,196	62,032	67,530	76,380	92,091	103,435	128,850	147,157
2. Beverage	30,974	29,971	29,592	32,059	34,899	35,053	33,034	38,572	45,666
3. Tobacco	26,649	31,024	22,409	24,374	24,768	24,724	25,828	30,769	41,886
4. Wood and Cork Products	24,929	27,047	42,952	52,279	60,460	66,332	78,062	140,160	97,132
5. Furniture and Fixtures	6,709	5,872	9,010	12,304	10,669	12,410	11,963	15,286	19,291
6. Paper and Paper Products	4,671	5,753	9,244	11,049	12,455	14,795	21,133	31,942	36,407
7. Printing & Publishing	37,737	38,779	37,535	43,318	51,053	62,434	83,442	92,703	120,762
8. Textile, Footwear & Leather Products	14,665	20,685	32,311	44,370	56,259	86,489	138,284	217,602	179,827
(a) Textile	1,985	3,434	6,710	13,613	23,531	40,304	64,935	121,654	85,871
(b) Wearing Apparels & Footwear	10,890	14,931	22,634	27,445	30,170	43,406	69,804	90,831	88,118
(c) Leather Product	1,790	2,320	2,967	3,312	2,558	2,779	3,545	5,117	5,848
9. Rubber Products	11,019	10,443	12,433	16,996	20,570	24,871	23,419	24,975	25,293
10. Chemicals, Chemical & Petroleum Products	82,400	101,329	139,221	202,239	259,811	339,151	355,279	499,070	1,026,663 (558,659)*
(a) Chemicals and Chemical Products	20,654	28,269	38,851	45,027	49,523	58,106	74,698	136,750	162,045
(b) Petroleum Refinery & Petroleum Products	61,746	73,062	100,370	157,212	210,288	281,045	280,581	362,320	864,618 (396,614)*

Appendix Table A-3.5 (Cont'd)

	1966	1967	1968	1969	1970	1971	1972	1973	1974
11. Non-metallic Mineral Products	28,047	26,252	28,414	29,310	33,280	44,147	49,837	83,301	106,373
12. Basic Metal Products	17,025	16,036	21,525	25,547	22,164	21,594	32,082	63,805	111,922
13. Metal Products (except machinery & transport equipment)	27,669	31,748	43,723	53,315	71,703	72,996	87,562	119,264	145,791
14. Non-electrical machinery	11,618	14,461	17,800	20,829	28,252	33,144	48,215	82,958	269,177*
15. Electrical Machinery	13,408	15,917	17,456	47,254	127,437	174,500	338,308	489,105	501,725
16. Transport Equipment	32,198	40,489	64,194	141,320	159,352	203,947	267,749	359,406	534,773
17. Plastic Products	1,810	4,105	7,390	11,159	11,582	18,743	28,051	43,512	46,567
18. Photographic & Optical Goods	n.a.	n.a.	n.a.	565	3,499	5,773	22,589	48,294	35,704
19. Miscellaneous Manufacturing Industries	8,220	10,624	14,509	21,087	32,430	39,098	54,597	79,316	36,095
0. Total Manufacturing	415,043	478,629	611,758	856,631	1,093,722	1,366,520	1,782,278	2,540,597	3,528,220 (3,060,216)*

Note: * The market value for "petroleum refinery and petroleum products" industry group in 1974 had been adjusted by using the HWWA - Index (Fuel) compiled by the Hamburg Institute for International Economics.

Sources: Singapore, Report on the Census of Industrial Production, 1959-1974.

Appendix Table A-3.6

Gross Output of Manufacturing Industries, 1959-1974

(in S$ '000 at current price)

	1959	1960	1961	1962	1963	1964	1965	1966
1. Food	69,362	75,318	79,398	86,650	116,454	122,493	155,000	180,548
2. Beverages	33,604	39,331	44,174	45,719	42,530	42,565	48,735	56,606
3. Tobacco	21,904	38,905	39,869	51,227	59,817	70,229	71,187	82,662
4. Wood and Cork Products	26,725	35,679	34,638	33,957	49,879	56,207	65,808	84,229
5. Furniture and Fixtures	3,243	3,842	4,817	5,943	8,900	10,316	10,945	13,899
6. Paper and Paper Products	4,509	5,187	6,524	6,122	6,269	7,313	10,823	14,274
7. Printing, Publishing and Allied Industries	38,142	42,672	46,206	49,359	53,307	56,592	61,777	65,542
8. Textile, Footwear & Leather Products	9,470	15,208	14,661	13,106	21,180	41,197	47,647	59,763
(a) Textile	n.a.	n.a.	n.a.	n.a.				5,324
(b) Footwear & Wearing Apparels	n.a.	n.a.	n.a.	n.a.	11,896	30,038	38,112	41,731
(c) Leather Products	n.a.	n.a.	n.a.	n.a.	9,284	11,159	9,535	12,708
9. Rubber Products	17,223	18,138	13,638	11,533	14,831	15,070	21,828	27,951
10. Chemicals, Chemical & Petroleum Products	56,050	63,626	62,308	186,892	223,127	237,741	260,984	356,790
(a) Chemicals & Chemical Products	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	93,441
(b) Petroleum Refinery & Petroleum Products	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	263,349
11. Non-metallic Mineral Products	19,561	17,310	29,905	35,590	61,621	51,073	51,091	61,082

(Cont'd)

Appendix Table A-3.6

Gross Output of Manufacturing Industries, 1959-1974
(in S$ '000 at current price)

	1959	1960	1961	1962	1963	1964	1965	1966
12. Basic Metal Products	4,964	4,926	23,365	9,313	11,012	22,602	27,450	45,210
13. Metal Products (except machinery & transport equipment	24,681	30,389	35,204	40,068	55,857	70,528	93,887	93,699
14. Non-electrical Machinery	13,491	16,805	18,595	16,257	15,752	14,651	19,953	25,662
15. Electrical Machinery	19,356	17,090	17,767	14,433	20,995	19,577	25,479	33,417
16. Transport Equipment	28,138	31,708	34,428	39,896	49,415	58,111	67,714	79,368
17 Plastic Products	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5,451
18. Photographic & Optical Goods	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
19. Miscellaneous Manufacturing Industries	8,519	9,416	12,877	14,237	32,807	31,664	38,058	39,669
0. Total Manufacturing	398,942	465,568	518,373	660,300	843,753	927,928	1,086,363	1,325,782

(Cont'd)

Appendix Table A-3.6

Gross Output of Manufacturing Industries, 1959-1974

(in S$ '000 at current price)

	1967	1968	1969	1970	1971	1972	1973	1974
1. Food	325,570	357,162	401,248	551,362	577,621	552,016	714,878	930,185
2. Beverages	54,890	58,219	59,406	66,431	70,069	73,306	80,540	97,845
3. Tobacco	92,472	87,754	90,694	97,583	94,029	102,674	129,778	142,723
4. Wood and Cork Products	91,125	128,219	160,337	186,464	199,024	260,988	466,177	357,251
5. Furniture and Fixtures	12,774	21,691	28,526	24,026	29,566	29,007	38,410	45,162
6. Paper and Paper Products	17,739	26,177	32,542	37,757	44,427	60,571	84,879	103,624
7. Printing, Publishing & Allied Industries	68,489	68,506	78,293	98,322	117,340	143,152	168,321	221,231
8. Textile, Footwear & Leather Products	75,152	121,858	163,899	203,066	288,447	442,216	654,783	614,335
(a) Textile	8,375	29,335	47,761	84,387	128,464	192,927	313,791	292,385
(b) Footwear & Wearing Apparels	51,886	75,126	97,061	103,987	146,251	232,628	313,063	296,313
(c) Leather Products	14,891	17,397	19,077	14,692	13,732	16,661	27,929	25,637
9. Rubber Products	28,667	34,824	47,020	54,144	57,166	56,307	65,556	77,133
10. Chemicals, Chemical & Petroleum Products	489,120	690,853	1,289,537	1,334,440	1,687,169	1,845,457	2,244,956	6,098,136
(a) Chemicals & Chemical Products	113,768	150,701	156,895	112,619	133,695	165,247	277,052	392,609
(b) Petroleum Refinery & Petroleum Products	365,352	540,152	1,132,642	1,221,821	1,553,474	1,680,210	1,967,904	5,705,527 (2,617,214)

(Cont'd)

Appendix Table A-3.6

Gross Output of Manufacturing Industries, 1959-1974

(in S$ '000 at current price)

	1967	1968	1969	1970	1971	1972	1973	1974
11. Non-metallic Mineral Products	59,099	74,119	77,454	89,843	113,288	133,305	195,754	291,612
12. Basic Metal Products	48,537	61,655	72,090	75,499	79,062	94,345	138,012	222,851
13. Metal Products (except machinery & transport equipment	103,179	128,528	159,064	217,967	222,549	245,371	323,711	430,199
14. Non-electrical Machinery	30,340	41,568	49,791	74,568	87,987	128,107	208,150	552,707
15. Electrical Machinery	42,206	53,218	122,734	288,018	400,897	740,819	1,253,494	1,599,564
16. Transport Equipment	93,496	135,509	259,531	329,952	429,891	553,499	768,233	1,142,310
17. Plastic Products	10,503	16,732	26,897	35,174	49,604	68,315	124,020	146,411
18. Photographic & Optical Goods	n.a.	n.a.	1,061	12,469	25,630	69,195	128,262	115,929
19. Miscellaneous Manufacturing Industries	53,817	69,076	93,778	131,402	151,160	192,700	278,421	157,706
0. Total Manufacturing	1,687,234	2,175,668	3,213,899	3,891,012	4,699,246	5,722,224	7,938,073	13,346,913 (10,258,600)

Note: For industrial classification system in Singapore, see Appendix A. Figures in brackets were adjusted (see note to Appendix Table A-3.5).

Sources: Singapore, Department of Statistics, Report on the Census of Industrial Production, 1959-1974.

Appendix Table A-3.7

Direct Exports of Manufacturing Industries, 1960-1974
(S$ '000 at current prices)

Industry Groups	1960	1961	1962	1963	1964	1965	1966	1967
Food	23,349	26,107	27,427	33,416	37,781	53,341	56,848	117,758
Beverages	18,058	19,973	22,070	11,651	13,460	14,289	14,765	13,665
Tobacco	306	755	12,288	3,396	2,148	7,977	4,199	8,987
Wood and Cork Products	17,221	16,530	16,354	20,635	23,843	30,732	37,920	35,856
Furniture and Fixtures	1,247	1,267	1,679	2,817	1,550	1,695	2,473	1,963
Paper and Paper Products	1,374	2,260	1,401	1,328	1,244	2,562	3,683	4,179
Printing and Publishing	7,199	10,512	10,887	10,696	9,071	11,071	10,065	8,305
Textiles, Clothing, Footwear								
and Leather Products	4,019	8,143	7,095	11,703	28,627	33,934	38,893	44,154
(a) Textiles	n.a.	n.a.	n.a.				2,088	3,149
(b) Clothing	n.a.	n.a.	n.a.	5,542	21,512	26,215	26,458	29,248
(c) Footwear	n.a.	n.a.	n.a.				1,770	3,138
(d) Leather Products	n.a.	n.a.	n.a.	6,161	7,115	7,719	8,577	8,619
Rubber Products	12,845	8,521	7,005	7,420	7,025	10,069	11,286	7,610
Chemicals, Chemical and								
Petroleum Products	29,075	32,148	29,442	43,556	61,343	75,402	118,068	139,328
(a) Chemicals and Chem. Prod.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	32,201	41,531
(b) Petroleum Products	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	82,867	97,797
Non-metallic Mineral Products	14,946	18,601	22,490	20,368	20,744	20,164	7,365	14,112
Basic Metal Products	2,981	318	6,473	3,637	7,622	12,015	12,756	18,862
Metal Products	12,941	13,368	14,312	18,297	19,535	25,968	25,106	31,884
Non-electrical Machinery	4,004	4,522	5,024	4,167	3,474	6,813	5,743	4,514
Electrical Machinery & Appliances	13,659	13,139	12,444	12,717	11,893	15,046	17,834	21,642
Transport Equipment	686	1,629	19,066	15,261	15,056	26,293	34,890	32,137
Plastic Products	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	733	1,309
Photographic and Optical Goods	-	-	-	-	-	-	-	-
Miscellaneous	330	1,275	2,042	740	2,011	1,797	2,243	2,434
Total Manufacturing	164,240	179,067	217,501	223,807	266,422	349,163	404,865	508,204

Appendix Table A-3.7 (Cont'd)

Industry Groups	1968	1969	1970	1971	1972	1973	1974
Food	129,758	146,075	185,674	183,406	158,484	228,598	376,526
Beverages	13,919	12,719	13,127	12,408	14,578	13,649	21,183
Tobacco	4,793	3,370	4,040	6,540	3,502	6,200	10,008
Wood and Cork Products	52,390	72,793	84,848	102,115	138,658	283,030	210,493
Furniture and Fixtures	2,974	3,113	2,456	2,483	2,599	7,347	14,182
Paper and Paper Products	4,592	6,358	5,893	6,683	11,693	11,783	14,856
Printing and Publishing	6,827	8,503	13,189	22,042	23,500	32,931	45,482
Textiles, Clothing, Footwear and Leather Products	71,905	91,861	108,671	164,365	288,728	459,512	405,234
(a) Textiles	15,962	21,650	40,831	66,370	118,444	205,950	177,393
(b) Clothing	43,325	56,053	55,459	82,753	151,092	226,732	197,494
(c) Footwear	2,445	2,701	4,078	7,396	9,423	8,228	11,654
(d) Leather Products	10,173	11,457	8,303	7,837	9,769	18,602	18,688
Rubber Products	9,731	20,782	25,635	25,237	24,715	21,851	27,657
Chemicals, Chemical and Petroleum Products	196,658	634,796	607,387	793,803	859,428	1351,972	1894,149*
(a) Chemicals and Chem. Prod.	57,678	56,614	27,314	33,659	41,383	107,647	148,542
(b) Petroleum Refinery and Petroleum Products	138,980	578,182	580,073	760,144	818,045	1244,325	1745,607*
Non-metallic Mineral Products	23,430	16,558	25,263	17,603	14,517	33,341	54,278
Basic Metal Products	23,328	18,587	15,922	12,819	8,128	15,798	41,889
Metal Products	37,645	40,660	50,979	45,291	50,904	68,787	107,762
Non-electrical Machinery	3,125	5,934	16,957	34,619	63,451	96,779	398,407
Electrical Machinery and Appliances	22,972	84,605	212,049	323,317	628,554	1132,004	1390,261
Transport Equipment	41,651	72,879	98,533	130,223	226,385	329,363	549,575
Plastic Products	2,513	5,708	10,206	15,893	23,915	34,961	45,174
Photographic and Optical Goods	..	100	5,900	15,999	62,308	104,311	125,882
Miscellaneous	11,308	25,724	36,296	39,848	37,533	37,557	43,405
Total Manufacturing	659,520	1265,286	1523,033	1954,683	2641,681	4269,774	5776,400

Note: * Figures were adjusted.

Source: Singapore, Department of Statistics, Report on the Census of Industrial Production, (various years).

Appendix Table A-3.8

Value Added Per Worker for the Manufacturing Industries,
1959-1974

(Unit: S $)

Industry Groups	1959	1960	1961	1962	1963	1964	1965	1966
Food	4,632	4,558	4,813	4,674	4,434	5,070	6,359	6,639
Beverages	11,092	11,813	19,107	16,811	12,399	10,725	14,067	15,549
Tobacco	5,080	8,012	5,915	11,922	15,882	18,659	21,297	21,561
Wood and Cork Products	3,946	4,008	4,150	4,196	4,033	4,205	4,174	4,276
Furniture and Fixtures	3,271	3,139	5,815	6,540	6,851	6,182	5,219	6,121
Paper and Paper Products	4,507	4,305	4,819	3,952	3,250	3,987	4,456	4,305
Printing and Publishing	6,363	6,034	6,743	6,899	6,558	6,742	7,501	7,864
Textiles, Leather Products and Footwear	2,951	3,406	4,093	3,466	2,794	2,908	2,102	2,029
Rubber Products	3,712	3,789	3,075	3,613	4,526	3,683	5,526	7,288
Chemical and Petroleum Products	6,600	6,763	7,931	13,853	18,968	20,443	26,509	28,123
Non-metallic Mineral Products	4,090	2,302	5,959	5,572	8,023	6,980	7,450	7,705
Basic Metals	3,325	4,047	5,809	10,261	11,327	10,289	10,412	10,977
Metal Products	5,998	6,305	6,847	6,754	6,622	6,403	6,895	6,996
Non-electrical Machinery	5,501	4,506	5,204	6,552	4,857	4,532	6,215	6,487
Electrical Machinery & Appliances	10,829	6,297	7,111	5,431	6,863	7,671	7,660	8,323
Transport Equipment	4,826	3,656	4,825	6,600	5,002	5,574	5,294	6,174
Miscellaneous	3,472	3,414	3,222	4,167	3,652	3,452	4,671	4,836
Total Manufacturing	5,576	5,185	6,326	7,041	6,903	6,808	7,360	7,860

(Cont'd)

Appendix Table A-3.8

Industry Groups	1967	1968	1969	1970	1971	1972	1973	1974
Food	7,382	8,522	8,290	8,429	9,489	10,450	13,638	15,854
Beverages	14,563	12,742	13,619	14,863	14,891	12,960	14,207	17,136
Tobacco	26,114	18,713	22,908	23,634	24,383	24,374	25,900	36,839
Wood and Cork Products	4,495	6,213	6,354	6,572	6,145	6,374	10,689	8,120
Furniture and Fixtures	4,679	5,020	5,348	5,944	6,001	5,721	6,474	7,302
Paper and Paper Products	4,964	3,677	3,943	4,860	5,484	6,904	9,370	10,920
Printing and Publishing	7,768	7,300	7,348	7,278	8,520	10,998	11,989	14,583
Textiles, Leather Products and Footwear	2,487	2,586	3,092	2,848	3,435	4,105	5,774	5,426
Rubber Products	6,299	6,813	8,234	7,911	8,897	9,301	10,321	11,295
Chemical and Petroleum Products	31,735	35,911	32,255	42,788	51,408	53,986	63,641	69,425
Non-metallic Mineral Products	8,490	8,256	7,083	6,879	10,567	11,420	13,796	21,555
Basic Metals	9,551	11,852	15,344	14,855	11,983	18,927	33,564	53,731
Metal Products	7,055	6,946	7,107	8,250	8,010	9,025	11,656	13,565
Non-electrical Machinery	7,043	6,403	6,425	7,417	7,440	9,016	10,642	22,850
Electrical Machinery and Appliances	8,576	7,569	6,903	9,380	9,307	10,746	11,009	10,258
Transport Equipment	6,732	8,183	8,308	9,829	9,976	11,876	14,115	18,806
Miscellaneous	5,317	4,369	4,733	3,621	4,260	5,331	6,599	84,141
Total Manufacturing	8,203	8,176	8,502	9,076	9,722	10,462	12,794	14,850

Sources: Calculated from Singapore, Department of Statistics, Report on the Census of Industrial Production, (various years).

Appendix Table A-3.9

Gross Output and Direct Exports of Pioneer Firms by Major Industry Groups, 1969-1973
(At Current Prices)

(S$ million)

Industries	1969 Q	1969 X	1970 Q	1970 X	1971 Q	1971 X	1972 Q	1972 X	1973 Q	1973 X
Food and Beverages	175	63	187	92	206	69	218	67	365	124
Textiles	[98	[72	[119	[73	[169	[112	134	83	180	144
Garments							104	90	139	112
Wood and Cork Products	35	34	54	44	69	63	115	91	205	197
Paper and Paper Products	6	3	8	3	11	4	16	7	21	8
Leather and Leather Prod.	28	10	29	12	32	13	30	13	34	11
Basic Industrial Chemicals	[32	[13	35	7	47	15	64	16	53[a]	16[a]
Other Chemical Products			58	15	64	22	80	32	110[a]	75[a]
Petroleum Refinery and Petroleum Products	540	131	820	455	1159	568	1608	788	1987	974
Non-metallic Mineral Prod.	24	3	34	3	33	1	44	2	47	4
Basic Metal Industries	50	7	56	7	74	9	87	6	136	23
Metal Products and Mechanical Engineering	55	19	36	11	47	11	73	34	113	50
Electrical Products	[89	[55	36	7	46	19	88	46	119	73
Electronic Products			[203[b]	[186	[304	[279	142	121	279[b]	254
Electronic Components							427[b]	411	710[b]	695
Transport Equipment	33	32	47[b]	40	62	52	76	54	97	81
Plastic Products	10	3	14	5	26	11	36	22	46	24
Photographic and Opticals	[23	[16	4[b]	3	18	16	63	60	133	103
Miscellaneous			38	31	35	29	30	22	20[a]	15[a]
Total Manufacturing	1200	460	1749	997	2403	1294	3380	1964	3684	2983

Notes: [a] decrease in the number of establishments - due to reclassification into proper industry groups; [b] "sales" figures.

Sources: Singapore, Economic Development Board, Singapore's Major Economic Indicators, 1960, 1969-1973/74, (July 1974).

Appendix Table A-3.10

Foreign Investments* in Manufacturing Industry by Country of Origin as at End of 1965, 1970, 1974

(S$ million, percentage in brackets)

Country or Origin	1965	1970	1974
United States	23 (14.6)	343 (34.5)	1,080 (35.4)
Japan	27 (17.4)	68 (6.8)	354 (11.6)
United Kingdom	45 (28.6)	199 (20.0)	424 (13.9)
Netherlands	40 (25.4)	183 (18.4)	420 (13.8)
West Germany	-	3 (0.3)	107 (3.5)
Others[1]	22 (14.0)	199 (20.0)	667 (21.8)
Total	157 (100)	995 (100)	3,054 (100)

Notes: * foreign investments in terms of gross fixed assets (excluding costs of land in most cases);

[1] including Switzerland, Sweden, France, Australia, Canada, Norway, Denmark, Italy, Hong Kong, Taiwan, Malaysia and other countries.

Source: Singapore, Economic Development Board Annual Report 1974-1975, p. 16

Appendix Table A-3.11

Foreign Investment* in Manufacturing Industry by Industry
Groups as at 1965, 1970, 1974
(S$ million, percentage in brackets)

Major Industry Groups	1965	1970	1974
Food and Beverages	9 (5.7)	31 (3.1)	113 (3.7)
Textiles and Garments	7 (4.5)	45 (4.5)	215 (7.0)
Wood and Cork Products	3 (1.9)	17 (1.7)	162 (5.3)
Paper and Paper Products		18 (1.8)	44 (1.4)
Leather and Leather Products	n.a.	26 (2.6)	27 (0.9)
Chemicals	5 (3.2)	61 (6.1)	141 (4.6)
Petroleum Products	99 (63.1)	555 (55.8)	1,336 (43.8)
Non-metallic Mineral Products	n.a.	31 (3.1)	52 (1.7)
Basic Metal Products			28 (0.9)
Metals and Engineering	19 (12.1)	104 (10.5)	258 (8.5)
Transport Equipment			168 (5.5)
Electrical Products	1 (0.6)	82 (8.3)	80 (2.6)
Electronic Products			236 (7.7)
Plastic Products	n.a.	8 (0.8)	43 (1.4)
Scientific Equipment, Photographic and Optical Goods	n.a.	17 (1.7)	116 (3.8)
Miscellaneous	14 (8.9)		35 (1.2)
Total	157 (100)	995 (100)	3,054 (100)

Note: * foreign investments in terms of gross fixed assets (excluding costs of land in most cases).

Source: Singapore, Economic Development Board Annual Report 1974-1975, p. 8.

Appendix Table A-3.12

Size Structure of Manufacturing Establishments, 1973

(Percentage in Brackets)

Size (No. of Workers)	Establishments (No.)	Employment (No.)	Output (S$'000)	Value Added (S$ '000)
Small				
5 - 9	1,248 (37.5)	8,958 (4.3)	136,153 (1.7)	46,720 (1.8)
10 - 29	1,150 (34.6)	19,036 (9.2)	638,081 (7.9)	196,176 (7.6)
Sub-total	2,398 (72.1)	17,994 (13.5)	774,234 (9.6)	242,896 (9.4)
Medium				
30 - 49	301 (9.1)	11,721 (5.7)	414,965 (5.1)	110,887 (4.3)
50 - 99	296 (8.9)	20,443 (9.9)	750,047 (9.3)	238,041 (9.2)
Sub-total	597 (17.9)	32,164 (15.5)	1167,021 (14.5)	348,928 (13.5)
Large				
100 - 299	201 (6.0)	35,614 (17.2)	1672,324 (20.7)	487,161 (18.8)
300 - over	131 (3.9)	111,760 (53.9)	4460,657 (55.3)	1508,330 (58.3)
Sub-total	332 (10.0)	147,374 (71.0)	6132,981 (76.0)	1995,491 (77.1)
Total	3,327 (100)	207,532 (100)	8,074,226 (100)	2,587,317 (100)

Note: Figures may not add to 100 because of rounding.

Source: Singapore, Department of Statistics, Report on the Census of Industrial Production, 1973.

Appendix Table A-4.1

Estimates of Retained Imports of Manufacturing
Industries: 1960, 1963, 1965, 1968
1971, 1973, 1974
(Current Prices)

(Unit: S$ million)

Industries	1960	1963	1965	1968	1971	1973	1974
Food	193.79	111.81	67.19	280.72	367.17	461.82	590.67
Beverages	9.74	21.39	2.45	25.47	46.25	59.17	54.22
Tobacco	9.96	11.20	11.50	14.37	24.36	17.62	32.13
Wood and Cork Products	n.a.	n.a.	8.73	22.00	33.73	73.34	68.44
Paper and Paper Products	39.03	19.98	37.38	64.40	105.62	162.88	221.05
Printing and Publishing	n.a.	11.84	13.71	19.02	32.52	34.51	43.97
Textile, Clothing & Footwear and Leather Products	106.88	204.82	176.33	566.80	-	-	-
(a) Textiles	n.a.	n.a.	172.29[a]	467.65	708.88	880.39	811.66
(b) Clothing and Footwear	n.a.	n.a.	41.76[a]	74.64	37.38	89.63	8.32
(c) Leather Products	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Rubber Products	n.a.	12.86	18.00	12.53	39.38	40.58	68.49
Plastic Products	n.a.	n.a.	16.10[a]	29.07	67.96	136.27	174.46
Chemicals, Chemical and Petroleum Products	213.50	110.35	125.89	374.16	806.24	715.18	-
(a) Chemicals & Chem. Prod.	n.a.	n.a.	102.92[a]	170.07	232.37	317.57	327.10
(b) Petroleum Refinery & Petroleum Products	n.a.	n.a.	61.11[a]	204.09	574.87	397.61	955.26

(Cont'd)

Appendix Table A-4.1

Industries	1960	1963	1965	1968	1971	1973	1974
Non-metallic Mineral Products	21.67	27.74	37.02	63.23	122.03	224.72	227.58
Basic Metal Products	37.68	46.53	90.42	122.38	352.43	556.82	1228.24
Nonelectrical Machinery	18.48	54.35	41.29	216.78	832.53	848.47	1846.57
Electrical Machinery	33.93	98.89	119.71	144.72	527.94	1190.31	1750.04
Transport Equipment	20.47	63.89	76.87	200.85	581.55	852.38	1222.49
Photographic and Optical Goods and Scientific Instruments	n.a.	n.a.	n.a.	143.14[b]	190.15	310.15	461.02
Total Retained Manufactured Imports[c]	719.57	844.98	862.22	2148.25	5322.88	6886.91	10590.18
Total Retained Imports	1295.00	1801.00	1868.00	3591.00	6631.00	9748.00	n.a.

Notes: [a] 1966; [b] 1969; [c] Miscellaneous manufactured products are excluded.

Sources: (1) Singapore, Department of Statistics, <u>Report on the Census of Industrial Production</u>, various years;
(2) United Nations, <u>Yearbook of International Trade Statistics</u>, various years;
(3) Singapore, Ministry of Finance, <u>Economic Survey of Singapore, 1974</u>.

Appendix Table A-4.2

Relative Effects of Import Substitution, Expansion of Domestic Demand and Export Expansion on Manufacturing Output: 1960 to 1974

(Current Prices)

(S$ million)

Industry	Increase in Domestic Output	IS	EDD	EE
	$\Delta Q = Q_2 - Q_1$	$(u_2-u_1)S_2$	$u_1(\Delta S-\Delta X)$	$u_1\Delta X$
<u>1960-1963</u>:				
Consumer Goods:	81.85	33.13	41.62	7.10
Food	41.14	52.57	-14.25	2.82
Beverages	3.20	-8.70	17.04	-5.14
Tobacco	20.91	3.27	15.18	2.46
Textiles, Wearing Apparels & Footwear & Leather Products	5.97	-6.98	12.00	0.95
Printing and Publishing	10.63	-11.84	18.97	3.50
Intermediate Goods:	201.58	174.63	22.97	3.97
Paper and Paper Products	1.08	3.19	-2.10	-0.01
Rubber Products	-3.31	-12.86	14.98	-5.43
Chemicals, Chemical & Petroleum Products	159.50	146.56	9.61	3.33
Non-metallic Mineral Prod.	44.31	22.16	19.74	2.41
Capital Goods:	60.80	-44.15	111.30	-6.35
Basic Metals	6.08	4.35	1.42	0.31
Metal Products	25.47	-6.05	27.85	3.68
Non-electrical Machinery	-1.06	-17.64	33.70	-17.12
Electrical Machinery & Appliance	3.91	-19.16	23.38	-0.32
Transport Equipment	26.40	-16.03	33.58	8.85
Total Manufacturing	344.23	177.27	160.33	6.63
<u>1963-1965</u>:				
Consumer Goods:	99.05	94.94	-18.15	22.26
Food	38.54	41.64	-13.26	10.16
Beverages	6.20	14.68	-10.23	1.76
Tobacco	19.37	2.80	12.79	3.78
Textiles, Wearing Apparels & Footwear and Leather Products	26.47	26.66	-2.27	2.08
Printing and Publishing	8.47	0.01	8.16	0.30

(Cont'd)

Appendix Table A-4.2

Industry	Increase in Domestic Output	IS	EDD	EE
1963-1965: (Cont'd)				
Intermediate Goods:	44.26	-5.04	27.23	22.07
Paper and Paper Products	9.94	9.56	0.35	0.03
Rubber Products	7.00	0.50	5.08	1.42
Chemicals, Chemical and Petroleum Products	37.85	2.13	14.42	21.30
Non-metallic Mineral Products	-10.53	-10.01	-0.38	-0.14
Capital Goods:	72.76	24.48	37.74	10.54
Basic Metals	16.44	4.90	10.32	1.22
Metal Products	38.03	14.65	18.69	4.69
Non-electrical Machinery	4.20	6.19	-2.58	0.59
Electrical Machinery & Appliance	4.48	0.05	4.02	0.41
Transport Equipment	9.61	-1.15	5.51	5.25
Total Manufacturing	216.07	109.23	52.40	54.45
1965-1968:				
Consumer Goods:	301.16	-252.63	490.76	63.03
Food	202.16	-87.97	236.81	53.31
Beverages	9.49	-21.46	31.31	-0.35
Tobacco	8.57	-1.42	12.78	-2.79
Textile, Clothing & Footwear and Leather Prod.	74.24	-24.65	90.79	8.08
Clothing & Footwear[a]	33.40	0.27	24.36	8.77
Printing and Publishing	6.73	-3.12	13.32	-3.47
Intermediate Goods:	543.66	19.22	468.53	55.91
Wood and Cork Products	62.41	4.41	47.69	19.12
Paper and Paper Products	15.35	5.83	9.06	0.46
Rubber Products	13.00	8.87	4.31	-0.19
Chemicals, Chemical & Petroleum Products	429.87	-1.61	390.87	40.62
(a) Chemicals & Chemical Products[a]	57.26	-1.94	47.08	12.13
(b) Petroleum Refinery & Petrol Products[a]	276.80	-63.92	295.18	45.54
Non-metallic Mineral Prod.	23.03	-5.52	26.66	1.90
Textiles[a]	24.02	14.45	9.15	0.42
Plastic Products[a]	11.28	5.15	5.68	0.45

(Cont'd)

Appendix Table A-4.2

Industry	Increase in Domestic Output	IS	EDD	EE
1965-1968: (Cont'd)				
Capital Goods:	185.00	-39.42	208.73	16.69
Basic Metals	34.21	18.80	12.78	2.63
Metal Products	34.64	-14.29	40.47	8.46
Non-electrical Machinery	21.62	-42.59	65.41	-1.20
Electrical Machinery & Appliance	27.74	18.48	7.87	1.39
Transport Equipment	67.79	-22.03	82.62	7.19
Total Manufacturing	1030.82	-239.61	1141.54	128.89
1968-1971:				
Consumer Goods:	358.54	85.66	203.72	69.16
Food	220.46	48.78	141.65	30.03
Beverages	11.85	-10.85	23.75	-1.05
Tobacco	6.28	-7.61	12.45	1.50
Clothing and Footwear	71.12	54.14	-5.28	22.26
Printing and Publishing	48.83	0.07	36.86	11.90
Photographic and Optical Goods & Scientific Instr.[b]	24.57	24.04	0.41	0.12
Intermediate Goods:	1278.89	226.86	695.97	356.06
Wood and Cork Products	70.80	0.62	27.79	42.39
Paper and Paper Products	18.25	1.06	16.58	0.60
Rubber Products	22.35	-13.83	24.77	11.41
Chemicals and Chemical Prod.	-17.00	-38.28	32.57	-11.29
Petroleum Refinery and Petroleum Products	1013.32	8.78	553.72	450.82
Non-metallic Mineral Prod.	39.17	-13.70	56.02	-3.15
Textiles	99.13	79.04	17.12	2.98
Plastic Products	32.87	2.51	24.97	5.36
Capital Goods:	799.90	-101.98	752.32	149.57
Basic Metals	17.40	-65.51	86.43	-3.52
Metal Products	94.02	-37.75	126.79	4.98
Non-electrical Machinery	46.42	-60.13	101.48	5.07
Electrical Machinery and Appliance	347.68	151.18	115.76	80.76
Transport Equipment	294.38	22.41	236.29	35.68
Total Manufacturing	2437.33	-35.22	1864.86	607.69

(Cont'd)

Appendix Table A-4.2

Industry	Increase in Domestic Output	IS	EDD	EE
1971-1974:				
Consumer Goods:	773.29	18.45	501.76	253.09
Food	352.57	0.38	239.63	112.57
Beverages	27.78	6.25	16.25	5.28
Tobacco	48.69	3.85	42.09	2.76
Clothing and Footwear	150.06	53.69	1.59	94.78
Printing and Publishing	103.89	13.58	71.96	18.35
Photographic and Optical Goods and Scientific Instr.	90.30	47.40	32.73	10.17
Intermediate Goods:	5087.39	1712.12	1483.57	1891.70
Wood and Cork Products	158.23	-6.75	72.31	92.67
Paper and Paper Products	59.19	7.49	49.28	2.42
Rubber Products	19.96	-9.10	27.62	1.43
Chemicals and Chemical Prod.	258.91	129.75	87.20	41.96
Petroleum Refinery and Petroleum Products	4152.06	843.84	1085.47	2221.75
Non-metallic Mineral Prod.	178.32	-11.30	171.96	17.66
Textiles	163.92	123.00	23.88	17.04
Plastic Products	96.81	11.03	73.43	12.35
Capital Goods:	2727.24	515.05	1570.35	641.88
Basic Metals	143.79	043.03	181.49	5.33
Metal Products	207.65	-26.38	199.21	34.82
Non-electrical Machinery	464.72	323.42	106.54	34.77
Electrical Machinery and Appliance	1198.66	153.83	584.33	460.51
Transport Equipment	712.42	137.21	396.98	178.24
Total Manufacturing	8587.92	1911.47	3924.35	2752.10

Notes: [a] 1966-1968; [b] 1969-1971.

Sources: Derived from Appendix Tables A-3.6, A-3.7 and A-4.1.

Appendix Table A-4.3

Relative Effects of Import Substitution, Expansion of Domestic Demand and Export Expansion on Manufacturing Output Including 5-9 Workers: 1968-1973

(Current Prices)

(S$ million)

Industry	Increase in Domestic Output	IS	EDD	EE
	$\Delta Q = Q_2 - Q_1$	$(u_2-u_1)S_2$	$u_1(\Delta S-\Delta X)$	$u_1 \Delta X$
1968-1973:*				
Consumer Goods:	793.00	149.47	448.69	198.84
Food	367.57	55.84	255.56	56.18
Beverages	22.85	-16.49	39.53	-0.19
Tobacco	42.04	3.16	37.67	1.21
Clothing and Footwear	253.43	111.42	41.93	100.09
Printing and Publishing	107.11	10.50	76.04	20.57
Photographic and Optical Goods and Scientific Instr.[c]	128.16	125.99	1.40	0.77
Intermediate Goods:	2476.66	666.14	1005.32	805.20
Wood and Cork Products	340.82	5.48	138.02	197.33
Paper and Paper Products	16.00	-18.41	32.25	2.16
Rubber Products	29.41	-13.87	34.63	8.66
Chemicals and Chemical Prod.	145.34	15.44	107.74	22.17
Petroleum Refinery and Petroleum Products	1427.76	251.08	374.45	802.23
Non-metallic Mineral Prod.	122.73	-32.02	149.36	5.40
Textiles	287.87	246.51	30.15	11.22
Plastic Products	106.73	14.87	78.18	13.68
Capital Goods:	2293.04	376.01	1361.05	555.98
Basic Metals	76.07	-96.35	174.96	-2.54
Metal Products	205.36	-39.06	223.81	20.61
Non-electrical Machinery	17.30	29.01	128.41	16.88
Electrical Machinery and Appliance	1200.75	583.69	312.41	304.65
Transport Equipment	636.56	111.79	407.56	117.21
Total Manufacturing	5562.69	698.9[illegible]	3168.09	1695.67

Note: [c] 1969-1973

Sources: Derived from Appendix Tables 3.6, A-3.7 and A-4.1.

Appendix Table A-4.4

Ratio of Domestic Production to Total Supply of Major Industries: 1960, 1963, 1965, 1968, 1971, 1974

Industry	1960	1963	1965	1968	1971	1974
Food	0.2799	0.5102	0.6976	0.5597	0.6114	0.6116
Beverages	0.8015	0.6654	0.9521	0.6957	0.6024	0.6435
Tobacco	0.7962	0.8423	0.7832	0.8593	0.7942	0.8162
Textile, Clothing and Footwear and Leather Products	0.1246	0.0937	0.2127	0.1770	-	-
(a) Textiles	n.a.	n.a.	0.0300[a]	0.0590	0.1534	0.2648
(b) Clothing and Footwear	n.a.	n.a.	0.4998[b]	0.5016	0.7964	0.9727
Printing and Publishing	-	0.8183	0.8184	0.7824	0.7830	0.8342
Photographic and Optical Goods and Scientific Instruments	n.a.	n.a.	n.a.	0.0074[b]	0.1188	0.2009
Wood and Cork Products	n.a.	n.a.	0.8829	0.8535	0.8551	0.8392
Paper and Paper Products	0.1174	0.2389	0.2246	0.2890	0.2961	0.3192
Rubber Products	-	0.5356	0.5481	0.7354	0.5921	0.5297
Chemicals, Chemical and Petroleum Products	0.2296	0.6691	0.6746	0.6730	-	-
(a) Chemicals and Chemical Products	n.a.	n.a.	0.4759[a]	0.4698	0.3652	0.5455
(b) Petroleum Refinery and Petroleum Products	n.a.	n.a.	0.8117[a]	0.7253	0.7299	0.8566
Non-metallic Mineral Products	0.4441	0.6935	0.5798	0.5396	0.4814	0.4635
Plastic Products	n.a.	n.a.	0.2529	0.3653	0.4219	0.4563
Basic Metal Products	0.1157	0.1913	0.2329	0.3350	0.1832	0.1536
Metal Products	0.6776	0.6113	0.7243	0.6519	0.5573	0.5251
Non-electrical Machinery	0.4763	0.2247	0.3258	0.1609	0.0956	0.2304
Electrical Machinery and Appliance	0.3350	0.1752	0.1755	0.2689	0.4316	0.4776
Transport Equipment	0.6077	0.4763	0.4684	0.4029	0.4250	0.4380
Total Manufacturing	0.3667	0.4781	0.5461	0.4894	0.4724	0.5533

Notes: [a] 1966; [b] 1969.

Sources: Derived from Appendix Tables A-3.6 and A-4.1.

Appendix Table A-4.5

The Ratio of Domestic Production to Total Supply by Sub-groups of Industries: 1960, 1963, 1965, 1968, 1971 and 1974

Industry	1960	1963	1965	1968	1971	1974
Consumer Goods	0.3976	0.4482	0.5193	0.4334	0.5965	0.6025
Intermediate Goods	0.2755	0.6422	0.6439	0.6572	0.5473	0.7131
Capital Goods	0.4467	0.3509	0.3918	0.3582	0.3306	0.3802
Total Manufacturing	0.3667	0.4781	0.5461	0.4894	0.4724	0.5533

Sources: Derived from Appendix Tables A-3.6 and A-4.1.

Appendix Table A-4.6

Sources of Growth in Value Added by Industry

Groups: 1960 - 1974

(Current Prices)

(S$ million)

Industry	ΔV V_2-V_1	IS $(u_2-u_1)r_1S_1$	EDD $u_1r_1(\Delta S-\Delta X)$	EE $u_1r_1\Delta X$	Residual $(r_2-r_1)u_2S_2$
1960-1963:					
Consumer Goods:	22.58	11.45	14.38	2.45	-5.70
Food	3.67	11.66	-3.16	-.63	-5.45
Beverages	2.88	-4.36	8.53	-2.57	1.28
Tobacco	11.03	0.65	3.02	0.49	6.88
Textile, Clothing & Footwear and Leather Products	-0.52	-2.04	3.50	0.28	-2.26
Printing and Publishing	5.52	-6.80	10.89	2.01	-0.58
Intermediate Goods:	49.08	34.17	4.50	0.78	9.64
Paper and Paper Products	0.19	1.16	-0.77	0.00	-0.20
Rubber Products	0.56	-2.35	2.74	-0.99	1.17
Chemicals, Chemical & Petroleum Prod.	29.11	22.39	1.47	0.51	4.75
Non-metallic Mineral Products	19.22	7.00	6.24	0.76	5.22
Capital Goods:	26.80	-15.53	39.15	-2.23	5.42
Basic Metals	3.04	1.69	0.55	0.12	0.69
Metal Products	9.57	-2.17	9.96	1.32	0.46
Non-electrical Machinery	0.59	-6.85	13.09	-6.65	1.00
Electrical Machinery and Appliance	1.59	-8.85	10.80	-0.15	-0.22
Transport Equipment	12.01	-4.20	8.79	2.32	5.10
1963-1965:					
Consumer Goods:	38.07	30.96	-5.92	7.26	5.77
Food	11.74	7.28	-2.32	1.78	5.00
Beverages	4.78	7.79	-5.43	0.93	1.49
Tobacco	7.80	0.88	4.01	1.19	1.73
Textile, Clothing and Footwear and Leather Products	8.99	4.93	-0.42	0.39	4.09
Printing & Publishing	4.76	0.01	4.59	0.18	-0.01

(Cont'd)

Appendix Table A-4.6

Industry	ΔV	IS	EDD	EE	Residual
1963-1965: (Cont'd)					
Intermediate Goods:	25.13	-1.16	6.30	5.10	14.90
Paper and Paper Prod.	1.81	22.33	0.83	0.08	-21.42
Rubber Products	3.61	0.13	1.33	0.37	1.78
Chemicals, Chemical & Petroleum Products	20.79	0.37	2.51	3.71	14.20
Non-metallic Mineral Products	-1.09	-4.01	-0.15	-0.06	3.14
Capital Goods:	24.80	9.43	14.54	4.06	-3.23
Basic Metals	6.25	2.20	4.64	0.55	-1.14
Metal Products	9.04	5.36	6.84	1.72	-4.88
Non-electrical Machinery	1.54	2.80	-1.17	0.27	-0.36
Electrical Machinery	1.66	0.02	1.82	0.18	-3.36
Transport Equipment	6.31	-0.40	1.93	1.84	2.95
1965-1968:					
Consumer Goods:	50.17	-86.10	167.25	21.48	-52.46
Food	29.92	-18.22	49.06	11.04	-11.96
Beverages	2.24	-12.05	17.57	-0.20	-3.09
Tobacco	-4.15	-0.48	4.29	-0.93	-7.02
Textile, Clothing & Footwear and Leather Products	19.40	-6.68	24.60	2.19	-0.71
-- Clothing & Footwear[a]	11.75	0.07	6.36	2.29	3.03
Printing and Publishing	2.76	-1.76	7.50	-1.95	-1.03
Intermediate Goods:	118.27	5.34	130.11	15.53	-32.71
Wood and Cork Products	25.55	-1.30	14.06	5.64	5.15
Paper and Paper Prod.	5.36	2.10	3.26	0.16	-0.15
Rubber Products	4.95	3.05	1.48	-0.06	0.49
Chemicals, Chemical & Petroleum Products	17.60	-0.37	89.29	9.28	-18.60
(a) Chemicals and Chemical Products[a]	18.20	-0.43	10.40	2.68	5.55
(b) Petroleum Refinery & Petro. Products[a]	38.62	-14.99	69.21	10.68	-26.28
Non-metallic Mineral Products	4.81	-2.55	12.32	0.88	-5.83
Textiles[a]	4.72	5.41	3.42	0.16	-4.27
Plastic Products[a]	5.58	1.71	1.89	0.15	1.83
Capital Goods:	78.01	-14.57	77.18	6.17	9.24
Basic Metals	10.34	7.67	5.21	1.08	-3.62

(Cont'd)

Appendix Table A-4.6

Industry	ΔV	IS	EDD	EE	Residual
1965-1968: (Cont'd)					
Capital Goods:					
Metal Products	14.24	-4.49	12.71	2.66	3.37
Non-electrical Machinery	9.14	-18.49	28.39	-0.52	-0.25
Electrical Machinery & Appliance	6.32	8.08	3.44	0.61	-5.81
Transport Equipment	37.97	-8.53	31.99	2.79	11.72
Total Manufacturing	246.45	-77.24	368.00	41.55	-85.86
1968-1971:					
Consumer Goods:	87.50	21.90	54.25	18.20	-6.85
Food	30.06	8.47	24.60	5.22	-8.23
Beverages	9.46	-4.77	10.44	-0.46	4.25
Tobacco	2.31	-1.96	3.18	0.38	0.71
Clothing and Footwear	20.78	16.31	-1.59	6.71	-0.64
Printing and Publishing	24.89	0.04	20.20	6.52	-1.87
Photographic and Optical Goods and Scientific Instruments[b]	57.13	12.93	0.22	0.06	43.92
Intermediate Goods:	301.99	55.87	171.41	87.69	012.98
Wood and Cork Products	23.38	0.21	9.31	14.20	-0.34
Paper and Paper Prod.	5.55	0.38	5.85	0.21	-0.89
Rubber Products	12.44	-4.94	8.84	4.07	4.46
Chemicals and Chemical Products	19.26	-9.87	8.40	-2.91	23.64
Petroleum Refinery and Petroleum Products	180.68	1.63	102.89	83.77	-7.61
Non-metallic Mineral Products	15.74	-5.25	21.47	-1.21	0.73
Textiles	33.60	18.08	3.92	0.68	10.93
Plastic Products	11.34	1.11	11.04	2.37	-3.18
Capital Goods:	341.47	-39.95	294.69	58.59	28.14
Basic Metals	0.05	-22.88	30.19	-1.23	-6.03
Metal Products	29.28	-12.84	43.13	1.69	-2.70
Non-electrical Machinery	15.34	-25.75	43.45	2.17	-4.54
Electrical Machinery & Appliance	157.04	49.59	37.98	26.49	42.98
Transport Equipment	139.76	10.62	111.93	16.90	0.32
Total Manufacturing	730.96	-9.90	524.29	170.85	45.73

(Cont'd)

Appendix Table A-4.6

Industry	ΔV	IS	EDD	EE	Residual
1971-1974:					
Consumer Goods:	215.79	4.71	128.23	64.68	18.17
Food	55.07	0.06	38.20	17.95	-1.14
Beverages	10.62	3.12	8.13	2.64	-3.28
Tobacco	17.17	1.01	11.06	0.73	4.37
Clothing and Footwear	44.71	15.94	0.47	28.13	0.17
Printing and Publishing	58.29	7.23	38.29	9.77	3.02
Photographic and Optical Goods and Scientific Instruments	29.93	10.67	7.37	2.29	9.60
Intermediate Goods:	857.96	411.93	356.94	455.13	-348.04
Wood and Cork Products	30.80	-2.25	24.10	30.88	-21.94
Paper and Paper Prod.	21.62	2.49	16.41	0.81	1.92
Rubber Products	0.42	-3.96	12.02	0.62	-8.26
Chemical and Chemical Products	103.94	56.39	37.90	18.24	-8.59
Petroleum Refinery and Petroleum Products	583.57	152.67	196.38	402.13	-167.61
Non-metallic Mineral Products	62.22	-4.41	67.02	6.88	-7.27
Textiles	45.56	38.59	7.49	5.35	-5.87
Plastic Products	27.83	4.17	27.74	4.67	-8.75
Capital Goods:	1057.27	213.61	651.33	266.23	-73.97
Basic Metals	90.33	-11.75	49.56	1.46	51.06
Metal Products	72.79	-8.65	65.35	11.42	4.68
Non-electrical Machinery	236.04	121.81	40.12	13.10	61.01
Electrical Machinery & Appliance	327.23	66.96	254.34	200.45	-194.51
Transport Equipment	330.82	65.09	188.34	84.56	-7.17
Total Manufacturing	2148.96	556.08	1141.66	800.64	-349.42

Notes: [a] 1966-1968; [b] 1969-1971.

Sources: Derived from Appendix Tables A-3.6, A-3.7 and A-4.1.

Appendix Table A-4.7

Relative Effects of Import Substitution, Expansion of Domestic Demand and Export Expansion on Manufacturing Value Added by Major Industries, 1960-1974

Industry/Year	IS $\frac{(u_2-u_1)r_1S_1}{\Delta V}$	EDD $\frac{r_1r_1(\Delta S-\Delta X)}{\Delta V}$	EE $\frac{u_1r_1\Delta X}{\Delta V}$	Residual $\frac{(r_2-r_1)u_2S_2}{\Delta V}$
1960-1963:				
Total Manufacturing	55.73%	50.40%	2.08%	-8.21%
Food	317.60	-86.08	17.03	-148.55
Beverages	-151.28	296.21	-89.31	44.37
Tobacco	5.90	27.53	4.43	62.34
Textile, Clothing & Footwear and Leather Products	391.56	-673.48	-53.22	435.14
Printing and Publishing	-123.13	197.27	36.40	-10.55
Paper and Paper Prod.	611.23	-403.11	-1.13	-106.70
Rubber Products	-420.29	489.58	-177.47	208.18
Chemicals, Chemical and Petroleum Prod.	76.29	5.05	1.75	16.30
Non-metallic Mineral Products	36.43	32.46	3.96	27.15
Basic Metals	55.47	18.09	3.92	22.52
Metal Products	-22.64	104.09	13.75	4.81
Non-electrical Machinery	-1161.52	2218.58	-1126.85	169.79
Electrical Machinery and Appliance	-556.31	678.98	9.14	-13.53
Transport Equipment	34.94	73.18	19.30	42.47
1963-1965:				
Total Manufacturing	37.36	17.92	18.86	26.09
Food	62.04	-19.76	15.14	42.58
Beverages	162.95	-113.61	19.50	31.17
Tobacco	11.27	51.41	15.21	22.12
Textile, Clothing & Footwear and Leather Products	54.89	-4.68	4.29	45.51
Printing & Publishing	0.11	96.51	3.85	-0.20
Paper and Paper Prod.	1233.68	45.57	4.20	-1183.46
Rubber Products	3.61	36.84	10.29	49.27

(Cont'd)

Appendix Table A-4.7

Industry/Year	IS	EDD	EE	Residual
1963-1965: (Cont'd)				
Chemicals, Chemical & Petroleum Products	1.78%	12.07%	17.83%	68.32%
Non-metallic Mineral Prof.	371.37	14.15	5.15	-290.67
Basic Metals	35.22	74.26	8.78	-18.26
Metal Products	59.32	75.64	18.98	-53.94
Non-electrical Machinery	181.73	-75.85	17.41	-23.29
Electrical Machinery & Appliance	1.32	109.42	11.10	-21.83
Transport Equipment	-6.37	30.50	29.10	46.77
1965-1968:				
Total Manufacturing	-31.34	149.32	16.86	-34.84
Food	-60.91	163.97	36.91	-39.97
Beverages	-537.80	784.40	-8.83	-137.78
Tobacco	11.47	-103.24	22.51	169.26
Textile, Clothing and Footwear and Leather Products	-34.42	126.78	11.28	-3.64
(a) Textiles[a]	114.54	72.52	3.29	-90.36
(b) Clothing & Footwear[a]	0.60	54.11	19.47	25.82
Printing and Publishing	-63.71	271.26	-70.78	-3.64
Wood and Cork Products	-5.52	59.70	23.94	21.88
Paper and Paper Products	39.08	60.73	3.06	-2.87
Rubber Products	61.50	29.90	-1.29	9.89
Chemicals, Chemical and Petroleum Products	-0.46	112.18	11.66	-23.37
(a) Chemicals and Chemical Products[a]	-2.36	57.16	14.72	30.47
(b) Petroleum Refinery & Petroleum Products[a]	-38.81	179.21	27.65	-68.06
Non-metallic Mineral Prod.	53.05	256.09	18.22	-121.26
Basic Metals	74.19	50.41	10.39	-34.99
Metal Products	-31.51	89.23	18.66	23.62
Non-electrical Machinery	-202.28	310.66	-5.69	-2.68
Electrical Machinery	127.86	54.43	9.62	-91.90
Transport Equipment	-22.46	84.25	7.34	30.87
1968-1971:				
Total Manufacturing	-1.36	71.73	23.37	6.26
Food	28.18	81.84	17.35	-27.37
Beverages	-50.41	110.35	-4.88	44.94
Tobacco	-84.80	137.61	16.62	30.57
Clothing and Footwear	78.47	-7.65	32.27	-3.09

(Cont'd)

Appendix Table A-4.7

Industry/Year	IS	EDD	EE	Residual
1968-1971: (Cont'd)				
Printing and Publishing	0.16%	81.14%	26.20%	-7.50%
Photographic and Optical[b] Goods and Precision Equip.	22.63	0.39	0.11	76.87
Wood and Cork Products	0.89	39.81	60.73	-1.44
Paper and Paper Products	6.75	105.47	3.84	-16.06
Rubber Products	-36.69	71.07	32.73	35.86
Chemical and Chemical Prod.	-51.24	43.59	-15.11	122.76
Petroleum Refinery & Prod.	0.90	56.95	46.36	-4.21
Non-metallic Mineral Prof.	-33.36	136.41	-7.66	4.61
Textiles	53.80	11.65	2.03	32.53
Plastic Products	9.79	97.37	20.88	-28.04
Basic Metals	-12056.80	60383.00	-2460.20	-45766.00
Metal Products	43.86	147.30	5.79	-9.23
Non-electrical Machinery	-167.84	283.27	14.14	-24.57
Electrical Machinery & App.	31.58	24.18	16.87	27.37
Transport Equipment	7.80	80.09	12.09	0.23
1971-1974:				
Total Manufacturing	25.88	53.13	37.26	-16.26
Food	0.11	69.37	32.59	-2.07
Beverages	29.41	76.55	24.88	-30.85
Tobacco	5.89	64.44	4.22	25.45
Clothing and Footwear	35.64	1.06	62.92	0.38
Printing and Publishing	12.39	65.68	16.75	5.17
Photographic & Optical Goods and Scientific Instruments	35.65	24.62	7.65	32.08
Wood and Cork Products	-7.30	78.25	100.27	-71.22
Paper and Paper Products	11.52	75.88	3.73	8.87
Rubber Products	-942.10	861.01	148.42	-1967.38
Chemical & Chemical Prod.	54.25	36.46	17.55	-8.26
Petroleum Refinery & Prod.	26.16	33.65	68.91	-28.72
Non-metallic Mineral Prod.	-7.08	107.71	11.06	-11.69
Textiles	84.71	16.45	11.73	-12.89
Plastic Products	14.98	99.68	16.77	-31.43
Basic Metals	-13.01	54.87	1.61	56.53
Metal Products	-11.89	89.77	15.69	6.43
Non-electrical Machinery	51.61	16.70	5.55	25.85
Electrical Machinery	20.46	77.73	61.26	-59.44
Transport Equipment	19.68	56.93	25.56	-2.17

Notes: [a] 1966-1968; [b] 1969-1971.

Sources: Derived from Appendix Tables A-3.6, A-3.7 and A-4.1.

Appendix Table A-4.8

Growth of Domestic Demand (H) and Exports (X) for Major Industry Groups including 5-9 Workers: 1968-1973

(Percentage)

Industry Groups	X/X	Rank	H/H	Rank
Food	46.86	14	86.52	12
Beverages	5.51	16	80.68	13
Tobacco	-41.90	17	45.03	14
Footwear and Wearing Apparels	426.91	4	-34.52	17
Printing and Publishing	142.96	8	110.61	9
Wood Products	508.43	2	173.61	8
Paper and Paper Products	85.82	11	174.43	7
Rubber Products	118.09	9	385.05	2
Chemicals and Chemical Products	225.51	6	90.32	11
Petroleum Refinery and Petroleum & Coal Products	115.67	10	3.21	16
Non-metallic Mineral Products	19.86	15	239.83	5
Textiles	149.35	7	105.44	10
Basic Metals	67.12	12	330.56	3
Metal Products (excluding Machinery and transport equipment)	58.96	13	205.66	6
Non-electrical Machinery	505.90	3	276.08	4
Electrical Machinery and Appliance	1779.30	1	649.72	1
Transport Equipment	264.06	5	3.38	15

Sources: Calculated from Singapore, Report on the Census of Industrial Production, 1968 and 1973; and Appendix Table A-4.1.

Appendix Table A-4.9

Gross Value Added by Industry Sub-groups
(Current Prices)

(S$ '000)

Industry Sub-groups	1960	1963	1965	1968	1971	1974
Consumer Goods	$ 7,306	$ 9,564	$ 13,371	$ 17,020[a]	$26,347	$ 47,926
Intermediate Goods	3,047	8,332	11,401	26,435[b]	54,834	142,431
Capital Goods	3,550	6,230	8,670	16,471	50,618	156,339
Total Manufacturing	13,903	24,126	33,442	58,126	131,799	346,696

Notes: [a] beginning 1968, "textiles" is reclassified as intermediate goods industry;
[b] some minor miscellaneous manufactured products are excluded.

Sources: Singapore, Department of Statistics, Report on the Census of Industrial Production, various years.

Appendix Table A-5.1

Capital Intensities of Manufacturing Industries in terms of Net Fixed Assets (NFA) Per Employee, 1974

Industrial Sectors	NFA (S$'000)	E_m	NFA/E_m
Food	$168,679	8,966	$18,813
Beverages	33,346	2,661	12,531
Tobacco	12,030	1,129	10,656
Textiles	158,759	12,150	13,067
Clothing	62,868	18,325	3,431
Leather and Leather Products	2,733	649	4,211
Footwear	5,436	1,814	2,997
Wood and Cork Products	148,455	11,806	12,575
Furniture and Fixtures	13,822	2,589	5,339
Paper and Paper Products	36,590	3,242	11,262
Printing and Publishing	72,739	8,701	8,360
Industrial Chemicals	64,622	1,313	46,933
Other Chemicals	57,385	3,363	17,658
Petroleum	1,124,596	3,103	362,422
Natural Rubber and Gums	218	4,171	19,133
Rubber Products	22,652	1,493	15,172
Plastic Products	48,165	4,584	10,507
Pottery and China	2,100	171	12,281
Glass and Glass Products	9,554	838	11,401
Structural Clay Products	21,288	943	22,575
Cement and Concrete Products	25,468	1,211	21,031
Non-metallic Mineral Prod. n.e.s.	21,262	1,740	12,220
Iron and Steel	44,132	1,506	29,304
Non-ferrous Metals	19,936	555	35,921
Fabricated Metal Products	123,011	10,581	11,626
Non-electrical Machinery	144,685	11,654	12,415
Electrical Machinery and Components	201,631	48,889	4,124
Transport Equipment	368,530	28,350	12,999
Instruments, Watches, Clocks and Optical Goods	127,280	8,088	15,737
Other Manufacturing	19,773	4,183	4,727

Source: Singapore, Department of Statistics, Report on the Census of Industrial Production, 1974.

Appendix Table A-5.2

Capital Intensities of Manufacturing Industries
in terms of Value Added Per Employee, 1974

ISIC Industrial Code		Value Added Per Employee (S$)	Index (% of national average)
311-312	Food	16,413	95
31112	Meat and Meat Products (prepared and preserved)	8,454	49
31121	Condensed and powdered milk	20,987	121
31131-31132	Preserved and canned fruit	8,206	48
31142	Canned and preserved sea food	7,610	44
31151	Coconut Oil	13,126	76
31153	Other refined edible oil	27,089	157
31164	Processed coffee seeds	22,942	133
31171	Biscuits	5,561	32
31172	Bread	10,080	58
31173	Cakes and Confectionery	7,584	44
31174	Beehoon, nooddles	6,342	37
31192-31193	Coco, chololate & sugar confectionery	7,659	44
31211	Sugar bean products	9,843	57
31211	Coffee powdered	10,540	61
31220	Prepared animal feed	20,173	117
313	Beverages	17,161	99
31310-31330	Bear, ale and related products	30,944	179
31341-3	Soft drinks and carbonated water	12,068	70
314	Cigaretes	37,100	215
321	Textiles	3,775	22
32111-32112	Spinning, weaving and finishing textiles	7,421	43
32121	Curtains, sheets and bed spreads	5,981	35
32132-32133	Socks, briefs, singlets, etc.	6,706	49
32140-32150	Carpets, rugs, ropes, etc.	6,899	40
322	Wearing Apparels	4,327	25
32001	Shirts	5,801	34
32202	Other outer garments	4,036	23
32202-32204	Brassiers and other undergarments	4,481	26
323	Leather and Leather Products	9,011	52
32301	Tennaries and leather finishing	14,976	87
32331	Bags and brief cases	8,609	50
324	Footwear	5,086	29

(Cont'd)

Appendix Table A-5.2

ISIC Industrial Code		Value Added Per Employee (S$)	Index (% of national average)
32401	Rubber footwear	5,459	32
32401	Leather Products	4,813	28
331	Sawmills, wood and cork prod.	6,533	38
33111	Sawmilling	8,748	51
33113	Plywood and veneer	7,544	44
33114	Fabricated wooden building structure	10,969	64
33121	Wooden boxes, packing cards	9,828	57
33131	Rattan processing	6,657	39
332	Furniture and Fixtures	7,451	43
33201	Furniture and fixtures of wood	7,532	44
341	Paper and Paper Products	11,206	65
34120	Cardboard boxes, bags & other containers	13,418	20
34191	Joss papers & other ceremonial papers	4,114	24
34192	Sanitary towels and toilet papers	15,157	88
342	Printing and Publishing	14,963	87
34202	Newpapers, periodicals, books and magazines	27,913	162
34203	Leithographing and silk screening printing	10,064	58
34204-34205	Commercial and job printing, book bindings, printed cards, stationery	9,370	54
34206	Engineering and photo-engraving	9,561	55
351	Industrial Chemicals	33,918	196
352	Other Chemical Products	34,942	202
35201	Paints, varnishes and lacquers	24,752	143
35229	Medicinal and Pharmaceutical products	73,929	428
35231	Soap and other washing prep.	25,062	146
35232	Perfumes, cosmetics	24,359	148
35250	Incense and joss sticks	5,674	33
35292	Inks and carbon black	22,989	133
353-354	Petroleum refinery, petroleum and coal products	278,639	16,176
355	Natural Gums	9,853	57
356	Rubber Products	14,833	86
35611-35612	Tyres and tubes	22,668	131
35691	Foam rubber products	9,031	52
35692	Rubber auto-spare parts	7,179	42
357	Plastic Products	10,159	59

(Cont'd)

Appendix Table A-5.2

ISIC Industrial Code		Value Added Per Employee (S$)	Index (% of national average)
35701	Plastic household & kitchen wares	9,888	57
35702	Plastic and polythene bag	10,932	63
35703	Plastic industrial supplies	6,951	40
361	Pottery and China	7,129	41
362	Glass and Glassware	14,785	86
363	Structural Clay Products	15,720	91
364	Cement	60,186	348
365	Structural Cement and Concrete Products	16,654	96
369	Other Non-metallic Minerap products, n.e.s.	20,418	118
36910	Cut sones and stone products	5,476	32
371	Iron and Steel	65,835	381
372	Non-ferrous Metals	22,982	133
381	Fabricated Metal Product	13,779	80
38112-38119	Cultery, hand and edge tools	11,540	67
38120	Furniture and fixture (metals)	7,944	46
38131	Metal doors, windows & door frames, grilles	10,960	63
38139	Structural metal products, n.e.s.	14,429	84
38141-38149	Wire netting, nails and other wire and cable prod.	14,216	82
38151	Tin cans	12,753	74
38152	Other metal containers	29,595	171
38159	Zinc and tin-plate articles, n.e.s.	10,173	59
38160	Electroplating, plating	12,613	73
38191	Bolts, nuts, rivets and screw products	3,222	19
38193	Kitchen and household utensils of metals	6,813	39
382	Non-electrical Machinery	23,097	134
38211-2	Data processing equipment and Office machinery	30,850	179
38221-29	Lifting and hoisting mach.	12,603	73
38231	Air conditioning and refrigerating machinery	18,730	108
38291	Industrial and agr. machinery	18,630	108

(Cont'd)

Appendix Table A-5.2

ISIC Industrial Code		Value Added Per Employee (S$)	Index (% of national average)
38292	General engineering works	11,486	66
383	Electrical Machinery & Appl.	10,263	59
38311	Electric motors and generators	18,155	107
38319	Elect. industrial machinery & apparatus	15,393	89
38321	~~Radio~~, T.V. and sound recording	7,907	46
38322-29	Gramophone records, radio, T.V. and communication equipment	10,105	59
38330	Electrical household appl.	13,827	80
38392	Insulated electrical wires, cables	15,695	91
38393	Electrical lamps, tubes, etc.	7,646	44
384	Transport Equipment	18,863	109
38411	Building and rep. of tankers & ships	20,535	119
38412	Barges, lighters, and boats	12,307	71
38413	Marine engines and ship parts	17,139	99
38431	Motor vehicles, assem. & mfg.	14,292	83
38433	Motor vehicle parts & access.	8,735	51
385	Instruments, Clocks, Watches & Optical goods	4,414	26
381510-30	Photo. & scientific measurements, watches, clocks	6,573	38
38520	Photographic and optical goods	3,974	23
390	Miscellaneous Manufacturing	8,629	50
39011	Mfg. of jewellery	11,427	66
39022	Toys	7,901	46
39091	Umbrellas	6,175	36
	Total Manufacturing	7,287	100

Sources: Singapore, Report on the Census of Industrial Production, 1974.

[redacted]

Appendix Table 5.3

Total Capital and Labor Requirements for Singapore's Exports and Imports (1973) Based on US Input-Output Data

Industrial Sectors	Direct and Indirect Requirements Per US$ Million of Final Output		Exports Per Million of US$ of Total Export Singapore '73	Imports Per Million of US$ of Total Import Singapore '73
	Capital (US$ million)	Labor (man-years)		
(1)	(2)	(3)	(4)	(5)
Food	3.3023	173.206	0.048981	0.051967
Beverages	3.2923	169.712	0.003803	0.007917
Tobacco	3.2887	173.472	0.001835	0.002610
Wood and Cork Products	1.4618	223.490	0.086318	0.030189
Furniture and Fixtures	1.6821	233.687	0.001994	0.001338
Paper and Paper Products	1.7523	163.172	0.006351	0.021680
Printing and Publishing	1.3216	196.597	0.007606	0.005633
Textiles	2.2884	192.913	0.055376	0.116169
Footwear	1.6574	262.612	0.002792	0.001532
Clothing	1.7806	214.935	0.050038	0.010159
Leather and Leather Products	1.6648	227.199	0.001763	0.004931
Rubber Products	1.8140	197.038	0.003378	0.004598
Chemicals and Chemical Products	2.3424	166.399	0.061821	0.081577
*Petroleum Refinery and Petroleum Products	2.9894	105.548	0.274460	0.053337
Pottery and China	1.3682	261.934	0.001563	0.007401
Glass and Glass Products	1.9293	199.932	0.002545	0.006299
Structural Clay Products	1.7718	271.334	0.000610	0.003497
Cement and Concrete Products	2.4944	167.940	0.000950	0.007400
Non-metallic Mineral Products, n.e.s.	1.8850	169.212	0.000392	0.003027
Basic Metal Products	2.4127	167.211	0.019747	0.075476
Metal Products	1.9867	201.150	0.015934	0.030007
Non-electrical Machinery	1.9087	197.046	0.105156	0.160652
Electrical Machinery and Components	1.7478	218.635	0.149759	0.134873
Transport Equipment	1.8402	193.252	0.053057	0.097346
Instruments, Watches, Clocks and Optical Goods	1.8443	261.539	0.023893	0.040498
Miscellaneous Manufacturing	1.4382	186.429	0.019901	0.039916
Total Manufacturing			1.000000	1.000000

Appendix Table 5.3 (Cont'd)

Total Capital and Labor Requirements for Singapore's Exports and Imports (1973) Based on US Input-Output Data

Industrial Sectors	Direct and Indirect Requirements Per Million Dollars of Exports		Direct and Indirect Requirements Per Million Dollars of Imports	
	Capital (US$)	Labor (man-years)	Capital (US$)	Labor (man-years)
(1)	(6)=(2)x(4)	(7)=(3)x(4)	(8)=(2)x(5)	(9)=(3)x(5)
Food	161,750	8.484	171,611	9.001
Beverages	12,521	0.645	26,065	1.344
Tobacco	6,035	0.318	8,584	0.453
Wood and Cork Products	126,179	19.291	44,130	6.747
Furniture and Fixtures	3,354	0.466	2,251	0.313
Paper and Paper Products	11,129	1.036	37,990	3.538
Printing and Publishing	10,052	1.495	7,445	1.107
Textiles	126,722	10.683	265,841	22.411
Footwear	4,628	0.733	2,539	0.399
Clothing	93,601	10.759	19,003	2.184
Leather and Leather Products	2,935	0.401	8,209	1.120
Rubber Products	6,128	0.666	8,341	0.906
Chemicals and Chemical Products	144,810	10.283	191,086	13.569
*Petroleum Refinery and Petroleum Products	820,470	28.969	159,446	5.630
Pottery and China	10,126	0.409	10,086	1.939
Glass and Glass Products	4,910	0.509	12,153	1.259
Structural Clay Products	108	0.166	6,196	0.949
Cement and Concrete Products	18,459	0.160	18,459	1.243
Non-metallic Mineral Products, n.e.s.	739	0.066	5,706	0.512
Basic Metal Products	47,644	3.302	182,101	12.666
Metal Products	31,656	3.209	59,615	6.036
Non-electrical Machinery	200,711	20.721	318,203	31.656
Electrical Machinery and Components	261,749	32.743	235,731	29.488
Transport Equipment	97,636	10.254	179,136	18.413
Instruments, Watches, Clocks and Optical Goods	44,066	6.249	74,691	10.591
Miscellaneous Manufacturing	28,622	3.710	57,407	7.442
Total Manufacturing	2,276,740	175.723	2,111,665	190.906

Appendix Table 5.3 (Cont'd)

Total Capital and Labor Requirements for Singapore's Exports and Imports (1973) Based on US Input-Output Data

Notes: (a) The total value of exports f.o.b. (including petroleum) in 1973 was US$2,589.580 millions; the actual value of exports of each industry can be obtained by multiplying each item in column (4) by US$2,589.580 millions.

(b) The total value of imports c.i.f. (including petroleum) in 1973 was US$3,607.790 millions; column (5) times US$3,607.790 millions gives the actual value of each type of competitive imports.

Sources: Column (2) and (3) capital and labor requirements are based on US input-output data, Leontief (1960); exports and imports figures for Singapore in 1973 are based on United Nations, Commodity Trade Statistics.

Appendix Table 5.4

Exports and Imports of Manufactures: 1970 & 1973

(Unit: US$'000)

Industrial Sectors	1970 Exports	1970 Imports	1973 Exports	1973 Imports
Food	142,976	115,036	126,841	187,477
Beverages	8,838	116,933	9,847	28,561
Tobacco	11,417	16,517	4,752	9,417
Textiles	63,714	264,630	143,400	419,112
Clothing except Footwear	80,941	23,159	129,578	36,650
Leather and Leather Products	2,983	6,826	4,566	17,789
Footwear	4,416	2,769	7,203	5,527
Wood & Cork Products	54,788	50,450	223,527	108,915
Furniture and Fixture	1,953	2,278	5,163	4,826
Paper and Paper Products	7,238	36,068	16,447	78,216
Printing and Publishing	8,445	13,198	19,696	20,324
Industrial Chemicals	15,333	51,114	47,139	110,105
Other Chemicals	17,893	45,069	112,951	184,207
Petroleum	358,597	142,710	710,737	192,430
Plastic Products	1,252	3,331	5,884	11,834
Pottery and China	5,075	12,321	4,047	26,700
Glass and Glass Products	3,844	8,852	6,591	22,726
Structural Clay	679	5,020	1,579	12,618
Cement and Cement Products	1,939	10,254	2,430	26,696
Non-metallic Minerals, n.e.s.	750	4,840	1,014	10,920
Iron and Steel	12,785	102,026	37,828	225,222
Non-ferrous Metal	3,761	22,224	13,307	47,081
Fabricated Metal Products	20,767	52,461	41,263	108,259
Non-electrical Machinery	61,931	275,465	272,310	579,600
Electrical Machinery & Appl.	62,100	160,328	387,812	486,594
Transport Equipment	46,116	125,554	137,396	351,204
Instruments, Watches, Clocks & Optical Goods	10,115	62,558	61,873	146,017
Miscellaneous Manufacturing	20,487	56,551	51,535	114,007
Total Manufacturing	1,037,302	1,800,885	2,589,580	3,607,790

Sources: United Nations, Commodity Trade Statistics, (various issues).

Appendix Table A-5.5

Singapore's Direction of Exports of Manufactures, 1965

(Unit: US$'000)

Industrial Sectors	To Developed Countries	To LDCs	To the World[1]
Food	20,598	49,187	69,787
Beverages	27	7,008	7,035
Tobacco	3	7,120	7,123
Wood and Cork Products	14,349	6,255	20,604
Furniture and Fixtures	37	1,850	1,887
Paper and Paper Products	2	6,222	6,224
Printing and Publishing	283	8,669	8,951
Textiles	4,831	41,036	45,888
Footwear	84	3,020	3,104
Clothing	5,429	11,041	16,471
Leather Products	85	1,746	1,831
Rubber Products	81	4,121	4,202
Plastic Products	5	863	868
Chemicals and Chemical Products	2,290	34,143	36,451
Petroleum and Coal Products	74,663	117,611	193,311
Pottery and China	16	2,479	2,495
Glass and Glass Products	51	3,248	3,299
Structural Clay Products	20	595	615
Cement and Concrete Products	1	3,146	3,147
Non-metallic Minerals, n.e.s.	1	709	710
Basic Metal Products	2,724	18,812	21,537
Metal Products	111	18,385	18,496
Non-electrical Machinery	207	34,966	35,173
Electrical Machinery and Appliance	224	16,464	16,691
Transport Equipment	1,356	48,851	50,207
Instruments, Watches, Clocks and Optical Goods	124	6,067	6,191
Miscellaneous Manufacturing	391	7,494	7,885
Total Manufacturing	127,993	461,106	589,099

Notes: [1] including exports to centrally-planned economies.

Sources: United Nations, Commodity Trade Statistics, (various issues).

Appendix Table A-5.6

Singapore's Direction of Exports of Manufactures, 1968

(Unit: US$'000)

Industrial Sectors	To Developed Countries	To LDCs	To the World[1]
Food	44,987	44,196	88,934
Beverages	50	7,162	7,212
Tobacco	5	6,528	6,533
Wood and Cork Products	28,742	10,147	38,854
Furniture and Fixtures	114	1,831	1,945
Paper and Paper Products	15	7,057	7,072
Printing and Publishing	242	6,236	6,378
Textiles	6,749	39,206	45,956
Footwear	438	2,375	3,072
Clothing	11,250	9,607	20,860
Leather and Leather Products	145	2,071	2,216
Rubber Products	236	5,143	5,465
Plastic Products	28	938	966
Chemicals and Chemical Products	4,080	35,219	39,302
Petroleum and Coal Products	116,156	226,029	346,332
Pottery and China	38	2,151	2,189
Glass and Glass Products	31	4,478	4,509
Structural Clay Products	38	379	417
Cement and Concrete Products	11	1,752	1,763
Non-metallic Minerals, n.e.s.	2	547	549
Basic Metal Product	4,621	19,831	24,452
Metal Products	269	20,475	20,744
Non-electrical Machinery	453	35,258	35,914
Electrical Machinery and Components	775	15,664	16,490
Transport Equipment	1,567	28,591	30,158
Instruments, Watches, Clocks & Optical Goods	723	9,173	9,899
Miscellaneous Manufacturing	2,973	8,394	11,387
Total Manufacturing	224,738	550,420	

Note: [1] including exports to centrally-planned economies.

Source: United Nations, Commodity Trade Statistics, (various issues).

Appendix Table A-5.7

Singapore's Direction of Exports of Manufactures, 1970

(Unit: US$'000)

Industrial Sectors	To Developed Countries	To Developing Countries	To the World[1]
Food	70,109	71,942	142,976
Beberages	43	8,795	8,838
Tobacco	14	11,403	11,417
Textiles	8,954	44,405	63,714
Clothing	17,105	13,416	80,941
Leather and Leather Products	218	2,767	2,983
Footwear	904	3,030	4,416
Wood and Cork Products	36,360	18,428	54,788
Furniture and Fixtures	188	1,765	1,953
Paper and Paper Products	28	7,210	7,238
Printing and Publishing	1,888	6,556	8,445
Industrial Chemicals	3,694	11,639	15,333
Other Chemicals	1,236	16,659	17,893
Petroleum	144,817	207,642	358,597
Rubber Products	350	5,241	6,169
Plastic Products	69	1,183	1,252
Pottery and China	2,510	2,555	5,075
Glass and Glass Products	8	3,836	3,844
Structural Clay	165	514	679
Cement and Concrete Products	41	1,898	1,939
Non-metallic Mineral, n.e.s.	4	746	750
Iron and Steel	306	12,479	12,785
Non-ferrous Metals	807	2,733	3,716
Fabricated Metal Products	731	20,037	20,767
Non-electrical Machinery	13,416	48,440	61,931
Electrical Machinery & Components	35,446	26,638	62,100
Transport Equipment	5,014	41,099	46,116
Instruments, Watches, Clocks & Optical Goods	1,400	8,671	10,115
Miscellaneous Manufacturing	10,625	9,861	20,487
Total Manufacturing	356,532	611,586	1,037,302

Note: [1] including exports to centrally-planned economies.

Sources: United Nations, Commodity Trade Statistics, (various issues).

Appendix Table A-5.8

Singapore's Direction of Manufactured Exports: 1973

(Unit: US$'000)

Industrial Sectors	To Developed Countries	To LDCs	To the World[1]
Food	33,482	92,561	126,841
Beverages	334	9,504	9,847
Tobacco	46	4,706	4,752
Wood and Cork Products	173,688	49,839	223,527
Furniture and Fixtures	2,262	2,899	5,163
Paper and Paper Products	170	16,107	16,447
Printing and Publishing	6,391	13,304	19,696
Textiles	44,709	97,662	143,400
Footwear	2,267	4,638	7,203
Clothing	115,196	14,309	129,578
Leather Products	888	3,623	4,566
Rubber Products	764	7,981	8,747
Plastic Products	2,409	3,158	5,884
Industrial Chemicals	21,107	45,303	47,139
Other Chemicals	17,289	74,504	112,951
Petroleum	295,774	398,279	710,737
Pottery and China	201	3,846	4,047
Glass and Glass Products	180	3,269	6,591
Structural Clay	312	1,266	1,579
Cement and Concrete Products	223	2,207	2,430
Non-metallic Mineral Prod., n.e.s.	17	997	1,014
Iron and Steel	694	37,125	37,828
Non-ferrous Metals	5,637	7,670	13,307
Metal Products	6,938	34,294	41,263
Non-electrical Machinery	160,201	111,313	272,310
Electrical Machinery and Components	278,141	108,441	387,812
Transport Equipment	40,692	93,151	137,396
Watches, Clocks, Instruments and Optical Goods	41,060	20,813	61,873
Miscellaneous Manufacturing	29,236	16,401	45,651
Total Manufacturing	1,280,308	1,279,170	2,589,580

Note: [1] including exports to centrally-planned economies.

Sources: United Nations, Commodity Trade Statistics, (various issues).

Appendix Table A-5.9

Sectoral Shares of Manufactured Exports
Based on Singapore CIP Data:
1970 and 1974
(Percentage)

Industrial Sectors	$x_i/\sum x_i$ 1970	$x_i/\sum x_i$ 1974	$x_i/\sum x_i$ (to Malaysia) 1970	$x_i/\sum x_i$ (to SEA) 1974
Food	12.19%	4.82%	24.71%	6.88%
Beverages	0.80	0.27	1.31	0.80
Tobacco	0.27	0.13	0.36	0.56
Textiles	2.68	2.28	6.29	2.53
Clothing	3.64	2.53	1.09	0.25
Leather & Leather Prod.	0.55	0.24	0.33	0.05
Footwear	0.27	0.15	0.58	0.02
Wood & Cork Products	5.57	2.70	0.23	0.46
Furniture and Fixtures	0.16	0.18	0.30	0.20
Paper and Paper Products	0.39	0.19	1.97	0.56
Printing and Publishing	0.87	0.58	3.12	0.81
Industrial Chemicals	0.34	0.34	1.46	0.97
Other Chemicals	1.45	1.57	2.38	2.17
Petroleum	38.09	48.71	29.71	60.63
Natural Rubber & Gums	0.71	0.17	-	-
Rubber Products	0.98	0.19	0.69	0.41
Plastic Products	0.67	0.58	1.35	1.19
Pottery and China	0.14	0.01	-	0.01
Glass and Glass Products	0.42	0.12	1.06	0.23
Structural Clay	0.01	0.01	0.05	0.02
Cement and Cement Products	0.10	0.17	0.04	0.75
Non-metallic Mineral, n.e.s.	1.00	0.40	0.79	0.91
Iron and Steel	0.12	0.31	0.22	1.05
Non-ferrous Metals	0.93	0.23	6.04	0.81
Fabricated Metal Products	3.35	1.38	8.79	3.43
Non-electrical Machinery	1.11	3.10	1.92	2.68
Electrical Machinery & Components	13.92	17.80	0.89	8.12
Transport Equipment	6.47	7.04	3.54	2.52
Instruments, Watches, Clocks & Optical Goods	0.39	1.30	0.35	0.55
Miscellaneous Mfg.	2.38	0.56	0.44	0.23

Notations: x_i denotes domestic exports of industry i;
SEA denotes Southeast Asia countries.

Sources: Singapore, Report on the Census of Industrial Production, 1970 & 1974.

Appendix Table A-5.10

Occupational Skill Requirements of Manufacturing Industries, 1970

Industrial Sectors	Distribution of Employment: Occupational Classes						
	I	II	III	IV	V	VI	VII
Food	2.1	2.6	9.9	8.8	2.6	0.6	73.5
Beverages	1.4	1.7	13.2	8.3	3.4	0.7	71.3
Tobacco	1.9	3.1	14.8	5.3	4.5	0.9	69.5
Textiles	2.8	2.0	4.7	1.9	1.8	0.08	86.8
Clothing except Footwear	0.3	0.5	1.9	2.4	1.3	-	93.5
Leather and Leather Products	0.6	3.3	4.0	8.6	0.9	-	82.7
Footwear	0.5	1.7	4.1	4.0	0.5	0.03	89.1
Wood and Cork Products	0.8	2.0	7.9	2.0	1.9	0.2	85.1
Furniture and Fixtures	0.8	1.0	2.7	4.4	0.7	0.01	90.4
Paper and Paper Products	1.4	3.2	7.3	6.6	1.7	-	78.9
Printing and Publishing	8.6	4.3	16.2	4.0	1.7	0.04	65.2
Industrial Chemicals	6.6	5.4	23.2	4.8	2.0	0.6	57.2
Other Chemicals	5.9	4.6	13.8	7.7	3.2	0.6	64.1
Petroleum	17.7	4.2	18.0	1.8	4.9	0.2	53.1
Natural Rubber and Gums	0.5	1.8	7.3	0.4	2.2	3.2	84.5
Rubber Products	2.4	3.1	9.8	4.6	2.9	0.3	76.9
Plastic Products	1.6	4.3	8.3	4.6	2.0	0.2	79.0
Pottery, China and Earthenware	2.4	1.7	4.0	1.4	2.1	-	88.4
Glass and Glass Products	2.1	3.1	6.6	3.2	3.4	0.2	81.4
Structural Clay Products	1.7	2.9	5.2	0.6	2.3	0.2	87.1
Cement and Concrete Products	4.7	3.9	11.3	1.2	3.4	0.2	75.4
Non-metallic Mineral Prod. n.e.s.	2.6	3.1	6.9	2.6	0.9	0.2	83.7
Iron and Steel Basic Industries	3.1	2.6	7.6	1.6	1.7	0.2	83.3
Non-ferrous Metals	2.8	2.5	8.6	0.6	4.7	0.3	80.6
Feabricated Metal Products	2.7	3.1	7.9	2.8	2.6	0.2	80.7
Non-electrical Machinery	6.4	3.2	10.3	2.3	1.8	0.05	76.0
Electrical Machinery and Components	5.9	1.8	7.5	0.9	1.3	0.08	82.4
Transport Equipment	4.4	2.1	9.8	1.0	2.0	0.06	80.5
Instruments, Watches, Clocks and Opticals	6.5	3.4	13.4	4.8	3.0	0.1	68.7
Other Manufacturing	1.2	1.8	3.7	3.0	1.4	0.09	88.8

Source: Singapore, Report on the Census of Population 1970, II, Table 88.

Appendix Table A-6.1

Consumers' Price Index (CPI)[1] and Real Rates of Exchange, 1959-1974

Year	US's CPI 1963 = 100	Singapore's CPI 1963 = 100	Real Rates of Exchange[2] (S$ per US$)
1959	95	100	2.907
1960	97	97	3.060
1961	98	97	3.082
1962	99	98	3.091
1963	100	100	3.060
1964	101	102	3.040
1965	103	102	3.090
1966	106	104	3.139
1967	109	107	3.127
1968	114	108	3.251
1969	120	108	3.[illegible]33
1970	127	108	3.634
1971	132	110	3.480
1972	137	112	3.450
1973	144	136	2.637
1974	157	162	2.239

Notes: [1] All items;

[2] Calculated in the following manner: the nominal rates of exchange (S$ per US$) (See Appendix Table A-1.2) were first inflated by US CIP and then deflated by the corresponding Singapore's price index.

Sources: United Nations, Statistical Office, Statistical Yearbook, (various years); United Nations, Monthly Bulletin of Statistics (January 1976); and Appendix Table A-2.2.

Appendix Table 6.2

Singapore's Domestic Manufactured Exports (X_m) and Manufacturing Output (Q_m): 1959-1974

(Valued at US$ million)[1]

Year	Manufactured Exports		Manufacturing Output	
	X_m	X_m'	Q_m	Q_m'
1959	45.4	45.4	130.4	130.4
1960	53.7	53.7	152.2	152.2
1961	58.7	58.7	170.0	170.0
1962	71.1	71.1	215.8	215.8
1963	73.2	73.2	275.8	233.2
1964	86.8	86.8	302.3	249.5
1965	114.1	104.1	355.0	298.0
1966	131.5	104.6	430.5	343.0
1967	165.5	133.7	549.6	430.9
1968	194.3	169.0	706.4	531.0
1969	409.5	222.4	1,041.1	673.6
1970	492.9	305.2	1,259.2	863.8
1971	674.0	411.9	1,620.4	1,084.7
1972	936.8	646.7	2,029.2	1,433.3
1973	1,714.8	1,215.1	3,188.0	2,325.4
1974	2,500.6	1,744.9	4,441.0	3,308.0

Notes: [1] Converted into US dollars by nominal rates of exchange (Appendix Table A-2.2); X_m' and Q_m' denote manufactured exports and manufacturing output respectively (excluding "petroleum refinery and petroleum products.")

Sources: Appendix Table A-2.1, A-3.2, A-3.7 and A-1.2.

Appendix Table A-6.3

Singapore's Domestic Manufactured Exports (X_m) and Gross Manufacturing Output (Q_m): 1959-1974

(US$ million at 1960 constant prices)[1]

Year	Manufactured Exports		Manufacturing Output	
	X_m	X'_m	Q_m	Q'_m
1959	45.4	45.4	130.4	130.4
1960	53.7	54.7	152.2	152.2
1961	59.3	59.3	171.7	171.7
1962	71.8	71.8	218.0	218.0
1963	73.2	73.2	275.8	233.2
1964	85.9	85.9	299.3	247.0
1965	111.9	102.1	348.0	292.2
1966	126.4	100.6	413.9	331.7
1967	159.1	128.6	528.5	414.3
1968	185.1	161.0	672.8	505.7
1969	381.3	207.1	969.4	627.2
1970	449.7	278.5	1,148.9	788.1
1971	587.6	359.1	1,412.7	945.7
1972	774.9	543.9	1,678.4	1,185.5
1973	1,239.9	878.6	2,305.1	1,681.4
1974	1,538.8	1,073.8	2,732.9	2,035.7

Notes: [1] All values are deflated by GDP price deflators (1960 = 100) (Appendix Table A-2.2);

X'_m and Q'_m denote manufactured exports and manufacturing output respectively (excluding "petroleum refinery and petroleum products.")

Sources: Derived from Appendix Tables A-2.2 and A-6.2.

Appendix Table A-6.4

World Exports of Manufactures (SITC 5-8):
1959-1974

(US$ million)

Year	Value at Current Prices*	Unit Value (1964=100)	Quantum (at 1964 prices)
1959	61,349	96	63,905
1960	69,972	98	71,400
1961	73,863	99	74,609
1962	79,436	99	80,238
1963	86,495	100	86,495
1964	98,502	101	97,527
1965	109,425	103	106,238
1966	122,153	106	115,239
1967	130,904	107	122,340
1968	149,684	107	139,892
1969	175,765	110	159,786
1970	201,748	117	172,434
1971	225,725	124	182,033
1972	269,522	134	201,137
1973	361,898	156	231,986
1974	480,515	186	258,341

Note: [1] Excluding exports of Singapore.

Sources: United Nations, Yearbook of International Trade Statistics, various years.

Appendix Table A-6.5

Estimates of Rate of Capacity Utilization of Total Manufacturing Industries (U_t): 1959 - 1974

Year	Including "Petroleum Refinery"		Excluding "Petroleum Refinery"	
	$\hat{U}_t = Q_m - \hat{Q}_m$	$\hat{U}_t = Q_m - \hat{Q}_m + 200$	$\hat{U}'_t = Q'_m - \hat{Q}'_m$	$\hat{U}_t = Q'_m - \hat{Q}'_m + 200$
1959	16.3	216.3	7.7	207.7
1960	11.9	211.9	6.9	206.9
1961	-1.0	199.0	-0.3	199.7
1962	5.5	205.5	14.4	214.4
1963	14.4	214.4	-7.9	192.1
1964	-22.3	177.7	-38.4	161.6
1965	-47.7	152.3	-45.7	154.3
1966	-72.9	127.1	-68.4	131.6
1967	-70.5	129.5	-21.0	179.0
1968	-64.1	135.9	-55.1	144.9
1969	62.7	262.7	-36.8	163.2
1970	33.4	233.4	2.0	202.0
1971	40.3	240.3	15.0	215.0
1972	-10.1	189.9	83.5	283.5
1973	277.7	477.7	376.7	576.7
1974	177.0	377.0	491.0	691.0

Notes: [1] The fitted exponential growth trends with and without "petroleum refinery and petroleum products" were $\hat{Q}_m = 114.08\ (1 + 0.2303)^t$ and $\hat{Q}'_m = 122.70\ (1 + 0.1840)^t$ respectively.

Sources: Estimated from Appendix Table A-6.3.

Appendix Table A-6.6

Labor Productivity as Measured by Value Added per Worker in Singapore, 1959-1974

(US$ '000 at 1960 constant prices)

Year	Value Added US$ million	Value Added at 1960 price	Value Added/Worker	Index 1959 = 100
1959	46.67	46.67	1.823	100
1960	46.44	46.44	1.694	93
1961	57.18	57.76	2.096	115
1962	65.92	66.59	2.325	129
1963	82.55	82.55	2.357	124
1964	92.02	91.11	2.196	121
1965	113.86	111.63	2.358	129
1966	134.74	129.56	2.454	135
1967	155.90	149.90	2.569	141
1968	198.64	189.18	2.528	139
1969	280.13	260.83	2.589	142
1970	353.95	322.95	2.680	147
1971	471.21	410.82	2.923	160
1972	633.02	522.76	3.069	168
1973	1,020.32	737.76	3.715	203
1974	1,324.76	815.24	3.956	217

Sources: Singapore, Department of Statistics, Report on the Census of Industrial Production, (various years) and Appendix Table A-2.2.

Appendix Table A-6.7

Analysis of Changes in Singapore's Manufactured Exports by Commodity Classes, 1960 - 1973
(US$ million)

Commodity Class (SITC)	Chemicals (SITC 5)	Machinery & Transp. Equip. (SITC 7)	Other Manufactures (SITC 6+8)	Total (SITC 5-8)
Exports in: 1960	27.124	72.272	122.397	211.793
1967	37.676	88.570	169.781	296.027
1969	45.558	114.209	205.307	365.074
1971	60.619	241.888	286.517	589.023
1973	160.091	839.374	654.309	1653.773
(I) Changes in Manufactured Exports, 1960-1967	10.550	16.300	47.384	74.230
1. Due to world trade	23.610	62.900	106.520	193.020
2. Due to commodity composition	3.010	11.840	-18.920	-4.050
3. Due to market distribution	-0.420	-11.190	-22.020	-33.640
4. Due to increased competitiveness	-15.648	-47.252	-18.196	-81.100
(II) Changes in Manufactured Exports, 1967-1969	7.882	25.639	35.526	69.047
1. Due to world trade	12.910	30.340	58.170	101.420
2. Due to commodity composition	-1.780	2.380	-2.310	-1.710
3. Due to market distribution	-3.500	-0.250	-19.430	-23.180
4. Due to increased competitiveness	0.252	-6.831	-0.904	-7.480

Appendix Table A-6.7 (Cont'd)

Commodity Class (SITC)	Chemicals (SITC 5)	Machinery & Transp. Equip. (SITC 7)	Other Manufactures (SITC 6+8)	Total (SITC 5-8)
(III) Changes in Manufactured Exports, 1969-1971	15.061	127.679	81.210	223.949
1. Due to world trade	14.360	36.000	64.720	115.090
2. Due to commodity composition	-2.700	11.150	-16.550	-16.550
3. Due to market distribution	-2.930	-14.880	4.12	4.12
4. Due to increased competitiveness	6.286	95.407	28.98	219.829
(IV) Changes in Manufactured Exports, 1971-1973	99.472	597.486	367.792	1064.750
1. Due to world trade	34.490	137.640	163.030	335.160
2. Due to commodity composition	5.100	-15.990	15.140	4.250
3. Due to market distribution	6.640	22.510	3.960	33.100
4. Due to increased competitiveness	53.242	453.326	185.662	692.240
(V) Changes in Manufactured Exports, 1960-1973	132.967	767.102	501.962	1431.980
1. Due to world trade	113.430	302.230	511.850	927.510
2. Due to commodity composition	3.970	53.010	-79.390	-18.400
3. Due to market distribution	-8.010	-44.280	-89.110	-141.410
4. Due to increased competitiveness	23.577	456.142	154.562	664.280

Sources: Derived from Appendix Table A-6.8 and Appendix Table A-6.9.

Appendix Table A-6.8

World Trade by Commodity Class and Regions of Distribution

(at current prices, US$ m)

Exporting to / SITC	0+1	2+4	3	5	7	6+8	9	0-9
1960:								
United States	3410	3070	1630	450	1600	4530	90	14840
Canada	550	465	430	335	1910	1530	200	5420
Latin America	880	470	630	790	3010	1960	200	7940
Western Europe	10630	10470	5320	3160	9290	13900	1270	54130
Japan	510	1860	530	240	340	285	115	3880
Developing Asia	2390	1350	955	875	2870	3580	610	12630
Australia & N.Z.	185	255	290	220	930	1070	70	3020
Developing Africa	1140	265	510	440	1810	2150	155	6470
Rest of World	2615	3115	2345	1010	5950	5765	74	20874
Total	22310	21320	12640	7520	27770	34860	2784	129204
1967:								
United States	4510	2980	2250	860	6110	9150	300	26160
Canada	730	610	690	520	4540	2400	180	9670
Latin America	1260	660	660	1280	4120	2460	150	10590
Western Europe	16160	12240	9640	6890	21380	27420	1600	95330
Japan	1530	3500	2000	520	860	1370	69	9849
Developing Asia	3610	1520	1345	1710	5410	5460	705	19760
Australia & N.Z.	215	255	295	365	1610	1180	160	4080
Developing Africa	1350	390	540	660	2830	2420	150	8430
Rest of World	4215	3315	3190	2095	9630	7950	116	30511
Total	33580	25470	20610	14900	56490	59810	3430	214290

(Cont'd)

Appendix Table A-6.8

Exporting to / SITC	0+1	2+4	3	5	7	6+8	9	0-9
1969:								
United States	2880	3450	2730	1140	10260	12240	2510	35210
Canada	140	700	720	660	6110	3010	1010	12350
Latin America	520	800	1720	1760	6060	3810	1480	16150
Western Europe	4650	14450	11640	9450	28570	38670	15270	122700
Japan	630	4090	2650	690	1320	1930	1230	12540
Developing Asia	1205	2070	1585	2060	7410	6520	3370	24200
Australia & N.Z.	90	280	355	425	1720	1360	280	4510
Developing Africa	345	425	630	840	3680	2770	1220	9910
Rest of World	1180	3465	2450	2275	12230	9180	3540	34320
Total	11640	29730	24480	19300	77360	79490	29910	271910
1971:								
United States	3460	3570	4620	1380	14710	15060	3220	46020
Canada	195	720	940	770	7210	3610	1295	14740
Latin America	570	1120	2670	2210	7410	4580	1980	20540
Western Europe	5000	15810	17810	12060	41020	47870	19550	159120
Japan	900	4880	4360	790	1840	2041	1669	16480
Developing Asia	1270	2485	2160	2450	9230	8230	3985	29810
Australia & N.A.	84	295	315	500	2250	1730	326	5500
Developing Africa	400	600	640	1080	5540	3560	1600	13420
Rest of World	1391	4160	23005	3000	20090	11459	4050	67155
Total	13270	33640	56520	24240	103930	98140	37675	372785

(Cont'd)

Appendix Table A-6.8

Exporting to / SITC	0+1	2+4	3	5	7	6+8	9	0-9
1973:								
United States	4380	5200	10660	2270	21860	20680	4910	69960
Canada	245	960	1470	1120	10520	5210	1925	21450
Latin America	810	1430	3760	3340	10740	6630	3570	30280
Western Europe	8480	27080	29210	20520	67490	81510	32150	266440
Japan	1660	10010	8100	1620	2750	6110	4210	34460
Developing Asia	2240	4590	3840	4350	15300	13560	6410	50290
Australia & N.Z.	110	610	450	850	2960	2920	590	8490
Developing Africa	600	900	1010	1550	8780	4910	2460	20210
Rest of World	2115	7170	4180	4450	23870	17640	11225	70650
Total	20640	57950	62680	40070	164270	159170	67450	572235

Sources: UNCTAD, Handbook of Trade and Development Statistics, 1969.
United Nations, Yearbook of International Trade Statistics, 1974.

Appendix Table A-6.9

Singapore's Exports by Commodity Class and Regions of Distribution

(US$ million)

SITC	0+1	2+4	3	5	7	6+8	9	0-9
1960:								
U.S.	10.229	65.294	-	0.143	0.007	0.643	2.785	79.171
Canada	1.876	14.180	-	-	0.002	0.018	0.022	16.098
Latin America	0.746	37.496	-	0.010	0.304	0.021	2.024	40.601
W. Europe	31.077	177.962	0.635	1.498	0.762	3.668	33.269	248.871
Japan	1.832	40.081	3.826	0.050	0.011	0.172	5.201	51.173
Developing Asia	104.901	68.447	84.096	24.487	68.823	111.752	39.246	501.752
Australia & N.Z.	2.375	24.965	30.967	0.301	0.646	0.830	1.497	61.572
Developing Africa	0.444	4.231	0.001	0.015	0.693	0.162	0.027	5.573
Rest of World	7.218	72.224	2.199	0.620	1.024	5.131	3.300	91.716
Total	160.698	504.870	121.724	27.124	72.272	122.397	87.371	1096.525
1967:								
U.S.	32.795	29.547	4.845	0.253	0.334	9.944	1.974	76.692
Canada	3.301	7.080	0.002	0.002	0.071	0.513	0.105	11.074
Latin America	0.580	14.396	2.055	0.002	0.417	0.149	0.506	18.105
Western Europe	30.322	97.755	48.242	0.311	0.847	9.184	0.015	186.676
Japan	3.536	19.335	24.903	0.077	0.306	1.793	1.030	50.980
Developing Asia	99.481	54.945	177.790	33.291	82.845	138.709	24.017	611.077
Australia & N.Z.	2.202	10.050	14.261	2.938	0.653	1.462	1.777	33.343
Developing Africa	2.620	4.687	9.013	0.235	2.227	3.754	0.310	22.846
Rest of World	6.752	92.923	12.077	0.567	0.870	4.273	9.015	126.477
Total	181.589	330.712	293.188	37.676	88.570	169.781	38.749	1140.270

Appendix Table A-6.9 (Cont'd)

SITC	0+1	2+4	3	5	7	6+8	9	0-9
1969:								
U.S.	36.107	87.693	5.006	0.193	13.655	19.598	3.866	166.118
Canada	2.907	12.747	-	-	0.230	3.947	0.201	20.032
Latin America	0.421	27.454	2.562	-	0.159	-	0.597	31.175
Western Europe	27.602	153.944	42.314	0.675	2.016	19.421	10.135	256.107
Japan	3.776	47.253	54.672	0.371	0.732	1.584	1.475	109.863
Developing Asia	117.541	73.407	232.166	39.856	92.554	146.186	19.868	721.586
Australia & N.Z.	1.856	13.670	21.519	3.406	1.566	2.298	6.038	50.362
Developing Africa	2.069	26.006	7.256	0.880	1.642	7.058	0.594	45.505
Rest of World	1.974	127.242	12.495	0.168	1.655	5.215	0.875	149.624
Total	194.262	569.416	377.990	45.558	114.209	205.307	43.631	1550.371
1971:								
U.S.	26.578	64.102	11.276	0.324	65.632	32.516	6.942	207.370
Canada	3.950	11.333	-	0.006	1.548	3.616	0.221	20.674
Latin America	1.370	22.169	3.435	-	2.291	1.231	0.625	31.121
Western Europe	24.572	141.525	45.481	0.603	14.335	34.153	10.110	270.778
Japan	5.311	24.498	82.215	0.659	2.621	6.488	2.285	124.077
Developing Asia	125.632	82.829	232.321	52.748	146.142	178.315	15.961	833.948
Australia & N.Z.	3.008	9.792	41.714	4.733	4.011	8.727	20.133	92.097
Developing Africa	6.184	29.815	15.545	1.363	4.020	13.502	0.957	71.404
Rest of World	1.731	71.918	19.357	0.183	1.289	7.969	0.711	103.158
Total	198.336	457.979	451.344	60.619	241.889	286.516	57.943	1754.625

(Cont'd)

Appendix Table A-6.9

SITC	0+1	2+4	3	5	7	6+8	9	0-9
1973:								
U.S.	14.979	123.888	35.372	7.971	350.052	116.381	10.042	658.685
Canada	2.181	19.303	-	0.125	5.971	9.148	0.546	37.284
Latin America	3.692	60.622	7.408	-	3.925	2.766	0.865	79.277
Western Europe	40.871	289.399	79.614	4.069	118.738	153.252	16.247	702.189
Japan	16.616	68.932	132.608	17.467	15.975	32.284	5.217	289.098
Developing Asia	168.318	131.619	352.255	113.467	292.279	283.585	24.505	1336.027
Australia & N.Z.	5.152	26.364	49.053	8.635	32.467	26.690	13.768	162.169
Developing Africa	7.664	63.946	23.711	6.023	14.379	21.449	0.996	138.168
Rest of World	3.439	160.194	36.270	2.334	5.579	8.754	2.202	218.772
Total	262.910	944.266	716.291	160.091	839.374	654.309	74.388	3651.627

Note: "Developing Asia" excludes China (Mainland), North Korea and North Vietnam; exports to Indonesia were also excluded.

Sources: United Nations, Commodity Trade Statistics, (various issues).

Appendix Table A-6.10

Number of Strikes/Work Stoppages and Man-days Lost, 1959-1974

Year	No. of Strikes/ Work Stoppages	Workers Involved	Man-days Lost
1959	40	1.939	n.a.
1960	45	5,939	152,005
1961	116	43.584	410,891
1962	88	6,647	164,936
1963	47	33,004	388.219
1964	39	2,535	35.908
1965	30	3,374	45,800
1966	14	1,288	44,762
1967	10	4,494	41,322
1968	4	172	11,447
1969	-	-	8,512*
1970	5	1,749	2,514
1971	2	1,380	5,449
1972	10	3,168	18,233
1973	5	1,312	2,295
1974	10	1,901	5,380

Notes: n.a. = not available;

* refers to man-days lost on account of a work-stoppage which began in 1968.

Sources: Singapore, Yearbook of Statistics, various years.

Appendix Table A-6.11

Index of Wages in Manufacturing Sector
in Selected Countries, 1963-1974

(1963 = 100)

Year	U.S.	Japan	Singapore	South Korea[1]	Hong Kong[1]	Taiwan
1963	100	100	100	-	-	100
1964	103	111	102	100	100	102
1965	106	120	102	112	112	111
1966	111	134	98	131	119	118
1967	115	151	114	159	121	133
1968	122	177	103	196	126	148
1969	130	207	99	243	140	153
1970	137	240	97	292	163	n.a.
1971	145	309	105	304	204	n.a.
1972	155	372	115	329	228	n.a.
1973	166	498	144	367	282	n.a.
1974	179	584	181	408	306	n.a.

Note: [1] 1964 = 100.

Source: International Labor Organization (ILO), Yearbook of Labor Statistics, 1975.

Appendix Table A-6.12

Wage Ratios Between Selected Countries
and Singapore, 1963-1964

Year	U.S.	Japan	South Korea	Hong Kong	Taiwan
1963	8.17	1.15	-	-	0.45
1964	8.26	1.26	0.21	0.61	0.45
1965	8.49	1.36	0.23	0.68	0.49
1966	9.22	1.58	0.28	0.75	0.54
1967	8.26	1.53	0.30	0.66	0.53
1968	9.67	1.97	0.40	0.75	0.64
1969	10.72	2.42	0.52	0.88	0.67
1970	11.59	2.86	0.64	1.04	n.a.
1971	11.24	3.36	0.61	1.20	n.a.
1972	10.96	3.72	0.60	1.22	n.a.
1973	9.38	3.99	0.54	1.21	n.a.
1974	8.07	3.72	0.48	1.05	n.a.

Source: Derived from Table 6.5.

Appendix Table A-6.13

Value of Output and Excess Capacity of "Pioneer Firms," 1967-1968

Industrial	Output Value (S$m)		Capacity Utilized		Excess Capacity	
	1967	1968	1967	1968	1967	1968
Food and Beverages	112.6	155.5	35.6 %	38.1 %	64.4 %	61.9 %
Textiles and Garments	28.8	59.0	28.1	34.8	61.9	65.2
Wood and Paper Products	22.5	35.6	74.2	42.2	25.8	57.8
Rubber and Leather Products	16.3	22.7	78.6	68.3	21.4	31.7
Chemicals and Chemical Prod.	14.1	29.0	34.1	18.9	65.9	81.1
Petroleum Refinery and Petroleum Products	308.6	578.3	94.7	66.5	5.3	33.5
Non-metallic Mineral Products	18.3	22.0	57.2	60.9	42.8	39.1
Metals and Engineering	98.2	125.1	60.6	46.1	40.0	53.9
Electrical Machinery, Appliances and Components	21.4	25.0	46.6	43.8	53.4	56.2
Plastic Products	3.1	6.5	32.5	26.5	67.5	73.5
Miscellaneous Manufacturing	4.6	13.7	20.5	28.9	79.5	71.1
(1) Total of "Pioneer Firms"	648.5	1072.5				
(2) Total of All Firms	1687.2	2175.7				
(3) (1)/(2)	38.5%	49.3%				

Sources: Singapore, Department of Statistics, Yearbook of Statistics, 1967, 1968.

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