

A SHIFT-SHARE ANALYSIS
OF THE GROWTH AND STRUCTURAL CHANGE OF
MANUFACTURING INDUSTRIES IN SINGAPORE

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INTRODUCTION

Less-developed countries (LDCs) face many problems in their efforts to accelerate growth. Like any economy, a developing nation is faced with the problem of how to optimally allocate resources to achieve stipulated objectives given resources constraints. Industrial development is one of the important aspects of economic policy in LDCs. The need for industrialization has never been in dispute. What is disputable is the way to achieve it. The strategy of industrial development followed by many LDCs has been one of import substitution over a wide range of manufacturing industries. In recent years there has been considerable disenchantment with this strategy. On the other hand, an alternative strategy which argues that industrial growth could come from the expansion of manufactured exports has been gaining impetus. The phenomenal growth of Hong Kong, Taiwan, South Korea, Singapore and other LDCs in the last two decades clearly indicates that manufactured export expansion played a major role in economic growth of these countries¹. This development has been dubbed the "new orthodox".

This paper analyses the experience of Singapore during the period 1960-1974. Singapore is a small semi-industrialized country. Its average annual real GDP growth rate was 9.9 percent during the 1960-1974 period². During 1965-1973, its average annual growth rate of GNP at market prices was 9.3 percent which was the highest among developing Asia countries³. Manufacturing growth has played a major role in the process. Annual rate of growth of manufacturing output during 1960-1974 was 25.1 percent at market prices. Gross manufacturing output increased 22 times over this period⁴. Other major indicators of manufacturing

industries are shown in appendix Table I. Another notable feature of Singapore during the 1960-1974 period is that it had undergone major changes in development strategy and political environment. Singapore gained full internal self-rule from the British in June 1959 and merged with Federation of Malaya, Sarawak and Sabah to become part of Malaysia in September 1965. Its postmerger relations with the Malaysian Government came under increasing strain and was finally forced to withdraw from Malaysia on August 9, 1965 to become an independent nation. During the 1959-1965 period Singapore had adopted an import-substituting industrialization policy but has vigorously pursued an outward-looking strategy since its separation from Malaysia.

The purpose of this paper is to analyse the process of transition from initial import-substitution industrialization to one oriented towards exports and the structural changes of manufacturing industries in Singapore. We shall employ a shift-share analysis based on a modified Chenery-Lewis-Soligo model⁵ which apportions output growth in manufacturing to import substitution, domestic demand expansion and export expansion. 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.

CONCEPTS AND MEASURES OF IMPORT SUBSTITUTION

Various measures of import substitution have been developed. These measures are based on different reference framework, i. e. zero growth, optimal growth, balanced growth and non-proportional growth. The different reference frameworks are discussed by Hoffmann and Tan⁶. Hoffmann and Tan suggest the use of balanced growth à la Nurkse as a reference framework, i. e. "growth according to the development of internal market"⁷. 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.

On the other hand, we suggest that Chenery's definition of import substitution with reference to non-proportional growth has some theoretical

justification for small open economies. Theoretically, a small country faces a given set of prices at which it is able to exchange commodities. 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 trade⁸. 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 intensively⁹. 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.

A MODIFIED MODEL OF "SOURCES" OF INDUSTRIAL GROWTH A LA LEWIS-SOLIGO

Due to the appealing of Chenery's definition of import substitution with reference to a small open economy, we shall adopt a modified model of industrial growth along the line of Lewis-Soligo which parallels that used by Chenery. We shall deal with the analysis of growth in terms of gross output.

- Notations: Q = domestic production of manufacture
 M = manufactured imports
 S = Q + M, total supply of manufactures
 H = domestic demand for manufactures¹⁰
 X = manufactured exports
 D = H + X, total demand for manufactures

We shall start with the following identity:

$$Q + M \equiv S \equiv D \equiv H + X \quad \dots\dots\dots (1)$$

Define: $u = \frac{Q}{S}$ $\dots\dots\dots (2)$

From (2) Q = uS
 dQ = udS + Sdu
 dQ = u (dH + dX) + Sdu

For finite changes,

$$\Delta Q = u_1 (\Delta H + \Delta X) + (u_2 - u_1) S_2 \quad \dots\dots (3.a)$$

$$\text{or: } \Delta Q = (u_2 - u_1) S_2 + u_1 \Delta H + u_1 \Delta X \quad \dots\dots (3.b)$$

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

$$\therefore \Delta Q = (u_2 - u_1) S_2 + u_1 (\Delta S - \Delta X) + u_1 \Delta X \quad \dots\dots (4)$$

(IS) (EDD) (EE)

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). The portion of import substitution is the change in domestic output implied by the actual change in the ratio of domestic output to total supply.

$$\text{Define: } m = \frac{M}{S} \quad \dots\dots (5)$$

where m is the ratio of imports in total supply.

$$\therefore u + m = 1 \quad (\because S = M + Q) \quad \dots\dots (6)$$

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 (i. e. negative import substitution), "import liberalization" is said to have occurred.

It should be noted that Chenery-Lewis-Soligo's measure of import substitution has limitations. As demonstrated in equations (3) and (6), 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 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.

"SOURCES" OF INDUSTRIAL GROWTH IN SINGAPORE**a) Definitions and Statistical Problems**

As indicated in equation (4), 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.

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 equation (4), 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 exported¹¹. 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. prices¹².

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.

Table I: Relative Effects of Import Substitution, Expansion of Domestic Demand and Export Expansion on Manufacturing Output by Major Industries (Percentage)

Year/Industrie	IS	EDD	EE
	$\frac{(u_2 - u_1)S_2}{\Delta Q} \times 100$	$\frac{u_1(\Delta S - \Delta X)}{\Delta Q} \times 100$	$\frac{u_1 \Delta X}{\Delta Q} \times 100$
<u>1960-1963:</u>			
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	72.59	11.77
Textile, Footwear and Wearing Apparels and Leather Products	-166.84	200.96	15.88
Printing and Publishing and 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	91.98	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
<u>1963-1965:</u>			
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

(Cont'd) Table I

Year/Industry	IS	EDD	EE
Printing and Publishing	0.12	96.32	3.58
Paper and Paper Products	7.12	72.61	20.28
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	29.79	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	60.71	38.10	1.73
(b) Clothing a. 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
Chemicals, 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 a. Petroleum Prod. ^a	-23.09	106.64	16.45
Non-metallic Mineral Products	-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

(Cont'd) Table I

Year/Industrie	<u>IS</u>	<u>EDD</u>	<u>EE</u>
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
<u>1968-1971:</u>			
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	75.46	24.38
Photographic and Optical Goods a. Scientific Instruments ^b	97.86	1.67	0.48
Wood and Corks 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 Products	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 and Appliance	43.48	33.30	23.23
Transport Equipment	7.61	80.27	12.12
<u>1971-1974:</u>			
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 and Footwear	35.78	1.06	63.16

(Cont'd) Table I

Year/Industrie	IS	EDD	EE
Printing and Publishing	13.07	69.26	17.67
Photo. a. Optical Goods	52.49	36.26	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 a. Chemical Prod.	50.11	33.68	16.21
Petr. Refinery a. Petr. Prod.	20.32	26.14	53.53
Non-metallic Mineral Prod.	-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
Electr. Machin. a. Appliance	12.83	48.75	38.42
Transport Equipment	19.26	55.72	25.02
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	2.88
Clothing and Footwear	43.96	16.54	39.49
Printing and Publishing	9.81	70.99	19.20
Photogr. a. Optical Goods			
a. Scientific Instr.	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 a. Chemical Prod.	10.62	74.13	15.25
Petr. Refinery a. Petr. Prod.	17.59	26.23	56.19
Non-metallic Mineral Prod.	-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
Electr. Machin. a. 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 Singapore, Department of Statistics, Report on the Census of Industrial Production, various years; and United Nations, Yearbook of International Trade Statistics, various issues.

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 magnitude.

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 periods¹³. Table I 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 I.

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 substitution 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.

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 refining¹⁴. 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 à la Chenery¹⁵. 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 countries¹⁶. 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, intermediate and capital goods industries¹⁷. The statistical results are shown in Table II. The salient features are discussed below:

(1) **Consumer Goods**: Table II 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"¹⁸. In Singapore, import substitution in consumer goods occurred 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 III.

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 mainly in "food" and "beverages" for most of the periods under study. Limitations of the classification system as discussed earlier 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 (Table I).

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".

Table II: "Sources" of Output Growth by Sub-groups of Industries:
1960-1963, 1963-1965, 1965-1968, 1968-1971, 1971-1974
(Percentage)

Industry/Year	$\frac{(u_2 - u_1)S_2}{\Delta Q} 100$	$\frac{u_1(\Delta S - \Delta X)}{\Delta Q} 100$	$\frac{u_1 \Delta X}{\Delta Q} 100$
<u>1960-1963:</u>			
Consumer Goods	40.48 %	50.85 %	8.68 %
Intermediate Goods	86.63	11.40	1.97
Capital Goods	-72.62	185.06	-10.44
Total Manufacturing	51.50	46.58	1.93
<u>1963-1965:</u>			
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
<u>1965-1968:</u>			
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
<u>1968-1971:</u>			
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
<u>1971-1974:</u>			
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
<u>1968-1973:⁺</u>			
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

+) Including 5-9 workers.

Sources: Table I, op. cit.

Table III: 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 a. Footwear a. Leather Prod.	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 a. 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 a. Petroleum Products	16.49	6.13	6.74	10.42	12.16	7.34
(a) Chemicals and Chemical Prod.	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 Prod.	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: Table I, op. cit. and Singapore, Ministry of Finance, Economic Survey of Singapore, 1974.

(2) Intermediate Goods: Table II 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 1966-1968¹⁹. 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. The expansion of production started in 1964²⁰. 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 Linder²¹ 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 countries²².

(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 negative value. This was mainly due to the expansion of construction activity in Singapore²³.

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.

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 (Table I).

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's²⁴. 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 III. 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.

CONCLUSIONS

The shift-share analysis à la Chenery-Lewis-Soligo has shown that in the early phase (1960-1965) of the industrialization process in Singapore, the growth of gross output 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 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 tend to support the hypothesis that industrial growth is export-induced.

Footnotes:

- +) The author wishes to thank Dr. Kenji Okuda and Dr. Dennis R. Maki of the Simon Fraser University, Canada, and Dr. Geoffrey Hainsworth of the University of British Columbia, Canada, for their helpful comments on an earlier draft of this paper. The responsibility for any errors or shortcomings, of course, rests solely with the writer.
- 1) Balassa, B. : "Export Incentives and Export Performance in Developing Countries: A Comparative Analysis", *Weltwirtschaftliches Archiv*, Band 114, Heft 1, 1978.
- 2) Singapore, Department of Statistics, *Yearbook of Statistics*, various issues; and Ministry of Finance, *Economic Survey of Singapore*, 1974 and 1975.
- 3) During the same period, South Korea was 8.7 %, Hong Kong 5.8 %, Malaysia 3.7 %, the Philippines 2.6 %, Thailand 4.5 %, Indonesia 4.5 %, Pakistan 2.5 %, India 1.5 %, Sri Lanka 2.0 %, Bangladesh -1.6 % and Burma 0.7 %. See International Bank for Reconstruction and Development (IBRD), *World Bank Atlas: Population, Per Capita Product and Growth Rates*, 1975 edition.
- 4) Singapore, Department of Statistics, *Report on the Census of Industrial Production*, various issues.
- 5) Chenery, H. B. : "Patterns of Industrial Growth", *American Economic Review*, Vol. 50 (1160), September 1960, pp. 624-54; Lewis, S. R. and Soligo, R. : "Growth and Structural Change in Pakistan Manufacturing Industry, 1954-1964", *The Pakistan Development Review*, Vol. V, Spring 1965, pp. 94-139; and Lewis, S. R. : *Economic Policy and Industrial Growth in Pakistan*, London: George Allen and Unwin, Ltd, 1969.
- 6) Hoffmann, L. and Tan, T. N. : "Patterns of Growth and Structural Change in West Malaysia's Manufacturing, 1959-1968", *Kajian Ekonomi Malaysia*, Vol. VIII, No. 2, December 1971, pp. 44-69.

- 7) Hoffmann and Tan, *op. cit.*, p. 46.
- 8) Johnson, H.G. : *International Trade and Economic Growth*, London: George Allen and Unwin Ltd, 1961, Chapter III.
- 9) Rybczynski, T. : "Factor Endowments and Relative Commodity Prices", *Economica*, Vol. XXII, No. 4, November 1965, pp. 336-41.
- 10) The domestic demand for manufactures includes both intermediate and final demand, broadly defined.
- 11) See Singapore, Department of Statistics, *Report on the Census of Industrial Production, 1960*.
- 12) Both exports and imports are used in equation (4). Since the export and import valuation systems are different, they will affect the magnitude of our estimates.
- 13) Critical industrial-relations laws were passed in 1968 and 1971. Both laws were aimed to tighten control over labors and unions.
- 14) 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.
- 15) 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.
- 16) 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, *op. cit.*, p. 641.
- 17) The classification of industries was adapted from Chenery and Lewis-Soligo 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. See Chenery, *op. cit.* and Lewis-Soligo, *op. cit.*
- 18) Hirschman, A. O. : "The Political Economy of Import Substituting Industrialization in Latin America", *The Quarterly Journal of Economics*, Vol. LXXXII, No. 2, February 1968, p. 6.
- 19) Separate output data for the textile industry was not available before 1966.

- 20) Report on the Census of Industrial Production, op. cit.
- 21) Linder, S.B. : An Essay on Trade and Transformation, New York: John Wiley and Sons, 1961.
- 22) Vernon, R. : "International Investment and International Trade in Product Cycle", The Quarterly Journal of Economics, Vol. LXXX, No.2, May 1966, pp.190-207; and Hirsch, S. : Location of Industry and International Competitiveness, Oxford: Clarendon Press, 1967.
- 23) Cement was the most important industry in "non-metallic mineral product" group. See Report on the Census of Industrial Production, op. cit.
- 24) Singapore, Department of Statistics, Statistical Yearbook, various issues.

Appendix

Table I: Selected Major Indicators of Manufacturing Industries in Singapore, 1960-1974 (Current Prices)

Year/Industry	<u>Output</u> (S\$m)	<u>Value</u> <u>Added</u> (S\$m)	<u>Direct</u> <u>Exports</u> (S\$m)	<u>Employment</u> (No. of workers)
I. <u>All Industries</u>¹:				
1960	465.6	142.1	164.2	27 416
1965	1 086.4	348.4	349.2	47.334
1974	10 258.6 ³	3 060.2 ³	5 776.4 ³	206.067
II. <u>Pioneer Industries</u>²:				
1961	36.4	6.9	n. a.	241
1965	318.2	86.4	88.0	10.495
1973	4 684.0	1 410.0	2 983.0	96.018
III. <u>Average Annual Growth Rates</u>:				
(a) <u>All Industries</u>				
1960-1965	18.7	19.6	16.7	11.9
1965-1974	28.6	27.6	42.1	18.1
1960-1974	25.1	24.8	33.1	15.9
(b) <u>Pioneer Industries</u>				
1961-1965	82.6	99.7	n. a.	168.5
1965-1973	40.8	51.3	58.4	33.4
1961-1973	54.7	67.4	n. a.	78.4

Notes: 1) Covering establishments with at least 10 workers only.

2) A pioneer industry is one which "is not being carried out in Singapore on a scale adequate to the needs of Singapore". Data for pioneer industry are available only from 1961 to 1973.

3) Prices for "petroleum refinery and petroleum products" sub-group are adjusted to maintain comparability.

Sources: Derived from Singapore, Department of Statistics, Report on the Census of Industrial Production, various years; and Singapore, Economic Development Board, Annual Report, (various years), and Singapore's Major Economic Indicators, 1960-1973/74.