
**Assessing Singapore's Export
Competitiveness Through
Dynamic Shift-Share Analysis**

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ASSESSING SINGAPORE'S EXPORT COMPETITIVENESS THROUGH DYNAMIC SHIFT-SHARE ANALYSIS*

BY

**TING SU CHERN
TU SUH PING
EDWARD ROBINSON**

**ECONOMIC POLICY DEPARTMENT
MONETARY AUTHORITY OF SINGAPORE**

PETER WILSON

**DEPARTMENT OF ECONOMICS
NATIONAL UNIVERSITY OF SINGAPORE**

HO SHIH CHUAN

**RESEARCH & STATISTICS DIVISION
IE SINGAPORE**

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	<u>Page</u>
ABSTRACT	i
INTRODUCTION	ii
I. TRENDS IN WORLD TRADE	1
II. TRENDS IN SINGAPORE'S DOMESTIC EXPORTS	7
III. METHODOLOGY OF SHIFT-SHARE ANALYSIS	12
IV. SETTING UP THE PARAMETERS FOR SHIFT-SHARE ANALYSIS	18
V. KEY FINDINGS	23
VI. SUM-UP	41
Appendix	52
References	53

ABSTRACT

This paper uses dynamic shift-share analysis to examine Singapore's export performance in electronics and chemicals in the export markets of US, EU and Japan over the period 1988 to 2001. It compares Singapore's export competitive position against that of China, Hong Kong, Korea, Malaysia and Taiwan. The analysis identifies 1996 as the turning point, at which Singapore's net positive gains in electronics exports switched to losses vis-à-vis the reference economies. The paper however recognises Singapore's evolving role, from exporting final electronics products to the developed markets, to supplying higher-end intermediate electronics components to support assembly-type operations in the other East Asian economies. Chemicals has also emerged as a new source of growth within the manufacturing sector, while various government initiatives have been directed at supporting the development of services exports, including information services, healthcare, education, tourism and financial services.

INTRODUCTION

i) Singapore has enjoyed robust trade growth over the past two decades, with domestic exports expanding by an average of 8% per annum over the period 1985 to 2001. However, the external landscape has changed significantly in recent years. The globalisation of the world economy has led to intense competition, whereby even small shifts in cost conditions can lead to significant changes in competitive positions among nations.

ii) Against the backdrop of these changes, this study takes a close look at Singapore's export competitiveness vis-à-vis a group of selected Asian economies in developed markets using the dynamic shift-share analysis. The study begins with a brief analysis of the changes in global trade patterns in Section I, and then highlights some of the important trends in Singapore's trade patterns in Section II, before turning to the shift-share analysis in Sections III and IV. The key results and implications are summarised in the concluding section.

iii) This present study is an extension of an MAS Occasional Paper¹ that was published in 1998, which looked at export trends in broad categories of goods from 1992 to 1996 using a static shift-share approach. The authors concluded that Singapore had outperformed her competitors over the period of the study. For this paper, besides adopting a dynamic shift-share approach, a closer look is also taken at the export competitiveness of specific segments within the electronics industry.

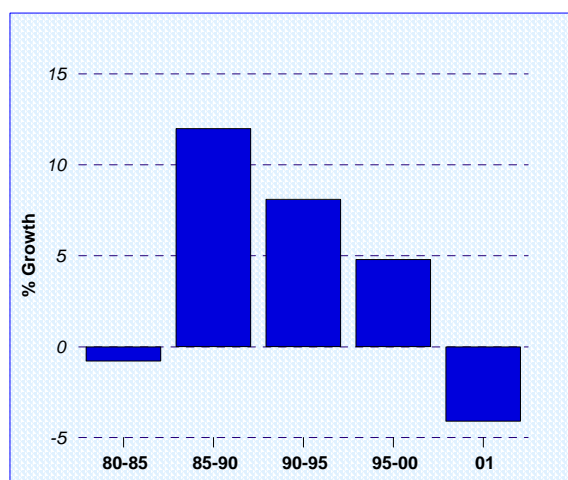
¹ MAS Occasional Paper No. 9, Oct 1998, "*Export Competition Among Asian NIEs, 1991-1996 : An Assessment*".

I TRENDS IN WORLD TRADE

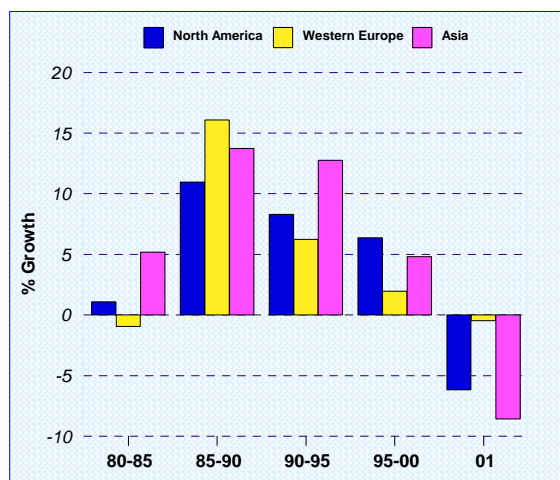
1.1 Global trade expanded by an annualised rate of about 5.4% between 1980 and 2001. In particular, the period 1985 to 1990 witnessed the strongest trade expansion of about 12% per annum, underpinned by robust export growth in Asia and Europe. Since then, growth in world trade has moderated to an average of 4.8% in the more recent period 1995-2000. (Chart 1.1a) The slowdown in trade over this period was mainly due to slower export growth in North America, Europe and Asia, although the slowdown was most noticeable in Europe. (Chart 1.1b) In 2001, world trade contracted by 4.1%, as Asia and the US were severely affected by the global electronics downturn.

Chart 1.1

a) Average Growth of Global Trade



b) Average Growth of Global Trade by Region



1.2 A significant proportion of world trade is accounted for by intra-regional exchange, especially in Asia, Europe and North America. The remainder of this section takes a closer look at the development of intra-regional trade within major trading blocs in the world over the period 1985 to 2001. These developments will provide some background for an examination of the trends in Singapore's trade performance over the same period in Section II.

1.3 The European Union (EU) is the most integrated trading bloc, with intra-EU trade accounting for about 60% of its total exports to the world. However, in the last five years, intra-regional trade links have been strengthening in NAFTA, although there was some weakening in East Asia and the EU. If this trend persists, NAFTA may overtake the EU to become the most integrated trading bloc in the world. In most instances, the patterns in regional trade flows were determined largely by prior investment flows into the region. The discussion below provides more details of these emerging trends.

Intra East Asian Trade

1.4 There was a substantial increase in intra-regional trade in the East Asian region between 1985 and 1995.² The share of intra-regional exports in East Asia's exports expanded from 34% in 1985 to 49% in 1995, underpinned by the significant increase in intra-ASEAN³ trade. The share of intra-ASEAN exports in ASEAN's total exports had risen from 21% to 28% during this period. The ASEAN Free Trade Area (AFTA), established in 1992, boosted the region's attractiveness as a production base. As a result, there was a significant increase in investment inflows into the region in the early 1990s, which fuelled the rapid growth of the East Asian economies during this period. Foreign investors, particularly the Japanese, set up different stages of their production chain in different countries within the ASEAN region based on the economies' relative comparative advantage. This led to greater trade flows within the region over the period.

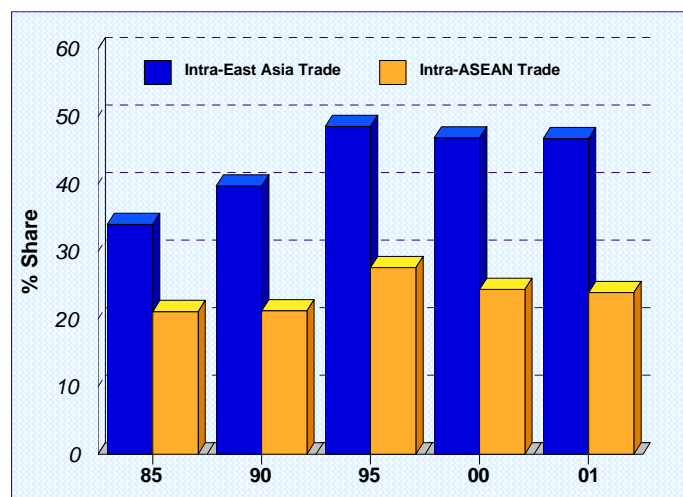
1.5 However, there was a decline in intra-regional export trade in East Asia (notably ASEAN) between 1995 and 2001. Growth of inward foreign direct investment (FDI) had slowed somewhat from 13% per annum between 1990 and 1995, to 8% in the period 1995 to 2000. Reduced foreign

² Includes exports within Singapore, Malaysia, Thailand, Philippines, Indonesia, Korea, Taiwan, Hong Kong, Japan and China.

³ Includes exports within Singapore, Thailand, Malaysia, Indonesia, Philippines, Brunei, Cambodia, Laos, Myanmar and Vietnam.

investment, coupled with weaker domestic economic conditions in ASEAN, resulted in a decline in the share of intra-ASEAN exports from 28% in 1995 to 24% in 2001. (Chart 1.2)

Chart 1.2
% Share of Total East Asia's Exports



1.6 Intra-East Asian trade has been mainly driven by intra-Northeast Asian trade over the period 1995 to 2001. In particular, trade flows in Asia have become increasingly dominated by the large bilateral flows between China and Japan.⁴ China's emerging importance, albeit from a small base, has also led to an increase in her trade with ASEAN. In addition, intra-East Asian trade is characterised by several natural pairings arising from historical and natural complementarities. These include Singapore-Malaysia, Singapore-Hong Kong and Hong Kong-Taiwan.

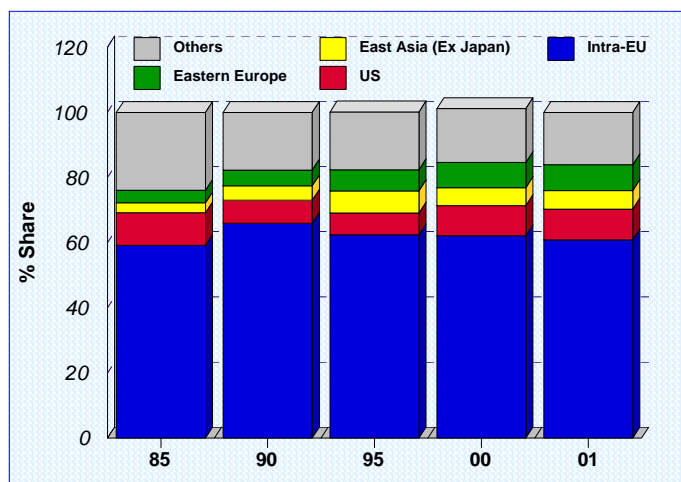
Intra-EU Trade

1.7 Intra-EU exports rose sharply between 1985 and 1990, stimulated by policies to create a single European market, before declining somewhat in the 1990s. The EU's exports to other major regions also performed well in the 1990s. Exports to Asia grew robustly from 1990 to

⁴ Trade between Japan and China increased 17% per annum in the period 1990 to 2000.

1995 while exports to the US picked up after 1995. Another significant trend has been the steady increase in the export share of Central and Eastern Europe in total EU exports over the past decade, in line with the opening up of some of these countries. In fact, many European companies have used the neighbouring Eastern European countries as a production base for their lower-end manufacturing operations. (Chart 1.3)

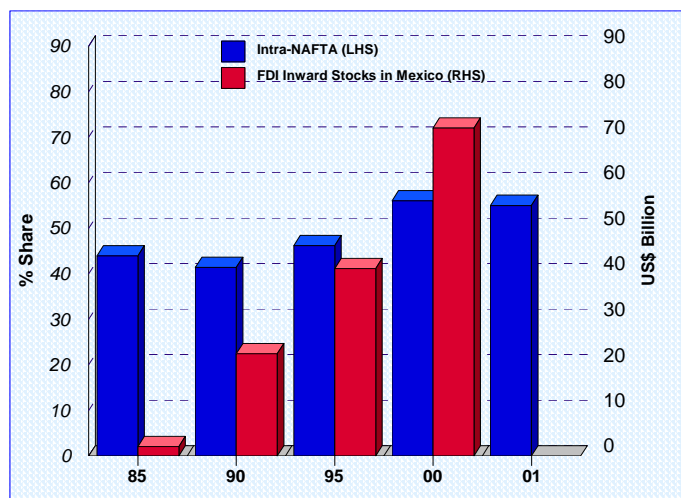
Chart 1.3
% Share of Total EU Exports



NAFTA Trade

1.8 While there has been a general decline in intra-East Asian and intra-EU trade in recent years, share of intra-regional exports in NAFTA increased steadily from 44% in 1985 to 46% in 1995 and jumped to 55% in 2001. The formation of NAFTA in 1994 has facilitated greater trade flows between the US and Mexico. Mexico, as an emerging economy, has attracted large international investment flows aimed at exploiting her relatively low costs of production and free entry of exports to the US and Canada. FDI flows into Mexico expanded by an average of 27% per annum over the period 1985 to 2000. (Chart 1.4)

Chart 1.4
Share of Intra-NAFTA Trade and FDI in Mexico*



* FDI data for Mexico in 2001 is unavailable.

Major Gainers in World Exports

1.9 These trends in intra-regional trade were also reflected in the rankings at the individual country level. In line with the surge in intra-EU trade, the major gainers in world exports between 1985 and 1990 were European economies, while a few East Asian economies joined the league of top gainers between 1990 and 1995. Of the top 10 gainers between 1990 and 1995, seven were from East Asia, of which three were ASEAN economies.

1.10 However, many of the East Asian economies dropped out of the top ten in the latter half of the 1990s. Mexico was the top exporter showing the greatest improvement over the period 1995 to 2000. Whilst her increase in market share was modest between 1990 and 1995, the subsequent five years saw rapid growth. In 2001, the European economies emerged as the top 10 gainers as they were relatively unaffected by the global electronics downturn. (Table 1.1)

Table 1.1
Top 10 Gainers in World Exports

Ranking	1985-1990		1990-1995		1995-2000		2001	
	Country	% Point Share Increase	Country	% Point Share Increase	Country	% Point Share Increase	Country	% Point Share Increase
1	Germany	2.8	China	1.1	Mexico	1.1	Germany	0.7
2	France	1.1	Malaysia	0.6	China	1.0	China	0.4
3	Italy	1.0	Korea	0.6	United States	0.8	Italy	0.2
4	Belgium-Luxembourg	0.7	Thailand	0.4	Canada	0.6	Ireland	0.2
5	Switzerland	0.4	Mexico	0.4	Saudi Arabia	0.3	France	0.1
6	China	0.4	Japan	0.4	Ireland	0.3	Netherlands	0.1
7	Taiwan	0.4	S'pore	0.4	Iraq	0.3	Czech Republic	0.09
8	Spain	0.4	Taiwan	0.2	Philippines	0.3	Brazil	0.09
9	Korea	0.3	Ireland	0.2	Korea	0.3	Austria	0.09
10	Netherlands	0.3	Spain	0.2	Hungary	0.2	Poland	0.08

Source: WTO website www.wto.org

1.11 Over the past decade, China has clearly been the winner in terms of the increase in world export share. China's share more than doubled from 1.8% in 1990 to 4.3% in 2001. In fact, China is the only economy that managed to remain in the top ten list over the entire period between 1985 and 2001, although Korea also managed to do the same except for the latest year. China's strong export performance was closely linked to the surge in investment into the country over the past decade. The country's share in world FDI inflows increased from 1.4% in 1990 to 6.2%⁵ in 2001, supported by her low-cost environment and large domestic market.

⁵ World FDI inflow for 2001 estimated by UNCTAD.

II TRENDS IN SINGAPORE'S DOMESTIC EXPORTS

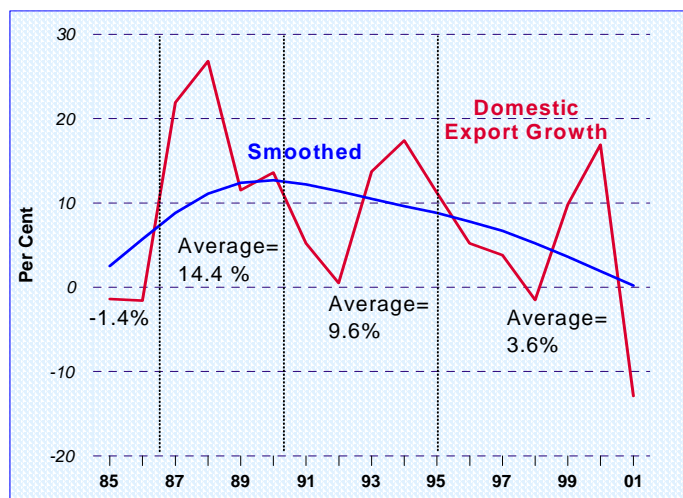
Three phases of growth

2.1 The changes in the global trade landscape over the past 15 years noted in the previous section have also led to some significant shifts in Singapore's trade pattern with the rest of the world. These developments are briefly reviewed below.

2.2 The performance of Singapore's domestic exports can be usefully assessed over three different phases between 1985 and 2001. The post-recession years of 1986 to 1990 saw domestic exports expanding at double-digit rates, coinciding with the surge in Japanese investments into Singapore.⁶ Singapore's domestic exports also enjoyed fairly decent growth, averaging 10% per annum over the period 1991 to 1995. AFTA was initiated during this period and this facilitated greater trade flows within the ASEAN region. Singapore's exports slowed down dramatically in the most recent phase (1996-2001), largely due to three external shocks hitting the domestic economy. Domestic exports of electronics moderated sharply in 1996, with the emergence of a serious supply glut in the global electronics industry. Before the country could fully recover from the electronics downturn in 1996, domestic exports were severely affected by the Asian financial crisis in 1998. After a year of exuberant growth in the global tech sector and the world economy in 2000, Singapore was again hard hit by a major correction in the global IT market, precipitated by a synchronised slowdown in the G3 economies. As a result, the average annual growth of 3.6% during this period was significantly slower than in the two previous phases. (Chart 2.1)

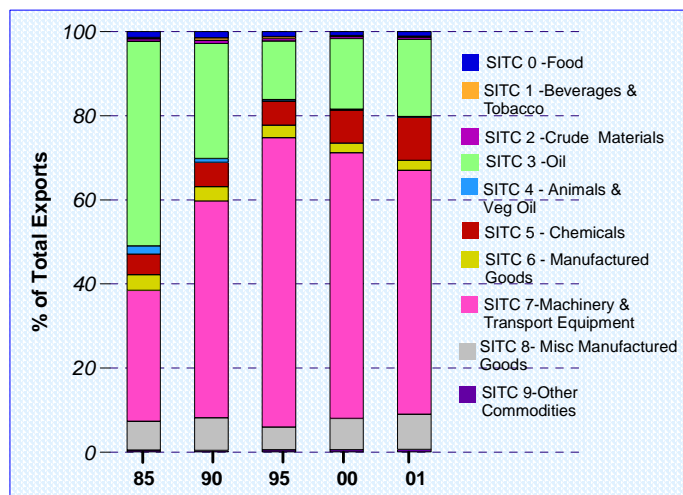
⁶ FDI flows from Japan expanded at an average rate of 28% per annum over the period of 1986-1990.

Chart 2.1
Three Phases of Growth in Singapore's Domestic Exports



2.3 A striking feature of Singapore's exports is the change in product-mix over the years. This was due in part to the changing landscape of the manufacturing sector, especially after the economic recession in 1985. In the first phase of export growth (1985-1990), oil accounted for almost half of Singapore's domestic exports, reflecting the country's status as a major oil-refining centre. A relatively high proportion of domestic exports also comprised traditional lower value-added products, such as food and beverages; furniture and garments. Electronics only accounted for about one-third of Singapore's domestic exports, with production concentrated in lower value-added items such as consumer electronics. (Chart 2.2)

Chart 2.2
Singapore's Export Structure



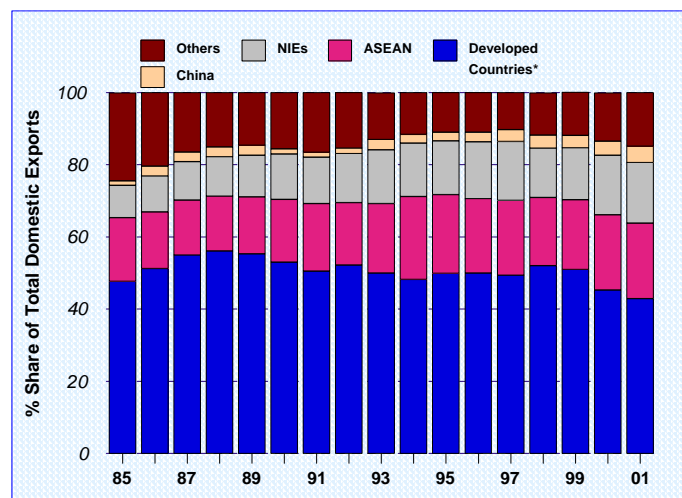
2.4 The share of electronics in domestic exports grew significantly in the second phase (1991-1995) with rapid expansion in the production and export of disk drives/PCs. These products rose in importance during the period, accounting for 23% of domestic electronics exports in 1995, as compared to 18% in 1991. The late 1990s (1995-2001) saw higher value-added semiconductors gaining in importance as several big wafer fabrication plants came on stream. Increasingly however, Singapore's electronics exports have been facing keener competition from the Asian economies. Besides constantly moving into electronics segments with high value-added content, efforts have also been made to diversify into the biomedical and petrochemical sectors. As a result, the share of the chemical cluster⁷ in Singapore's domestic exports rose from 5% in 1985 to about 10% in 2001, while the share of electronics slowly declined to around 50%, compared to the peak of almost 60% in the mid-1990s.

Export Market Profile

2.5 The profile of Singapore's export markets has also seen some changes over the past 15 years. Although the G3 economies remained the most important export markets, absorbing half of domestic exports, their share has been declining over the years. (Chart 2.3) This could be due to the intense competition that Singapore exports have been facing from other emerging Asian countries and more recently from countries in Latin America and Central and Eastern Europe. With significant overlap in both the commodity and destination market composition of exports for several Asian economies, Singapore's exports to the developed markets have inevitably been affected.

⁷ Includes biomedical (pharmaceuticals), petrochemicals and industrial chemicals industries.

Chart 2.3
Singapore's Domestic Exports by Market

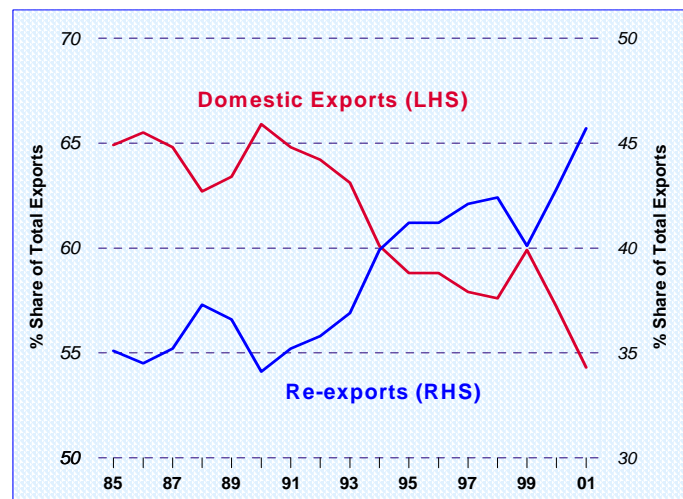


* EU, Japan and USA

2.6 In more recent years, exports to Asia, particularly the newly-industrialising economies (NIEs) and China grew robustly, due to the strengthening in the production network within the region. Singapore has been increasingly exporting intermediate components, such as semiconductors and computer parts, to other Asian countries, which then assemble them into end products, such as PCs and telecommunication equipment.

2.7 Nevertheless, Singapore's domestic exports recorded slower growth between 1995 and 2001, with its share in total exports declining. In comparison, re-export trade has grown in importance over the years. (Chart 2.4)

Chart 2.4
Composition of Singapore's Total Exports



2.8 Is this declining share of domestic exports in total exports a result of erosion of competitiveness? Or does it reflect the effect of cyclical shocks to the economy? The rest of the paper will look more closely at the apparent decline in Singapore's domestic export growth using the shift-share analysis.

III METHODOLOGY OF SHIFT-SHARE ANALYSIS

Overview of Shift-Share Analysis

3.1 Shift-share analysis has been used extensively to analyse differences between regional and national growth rates in variables such as export growth, employment and productivity. When applied to the study of export growth, it can be used to assess the implications of structural developments over time on a country's international competitive position. This provides a comparative dimension to trade performance. It is also a more relevant comparison than simply observing absolute changes or percentage changes in exports to particular markets. While the former tends to overstate the importance of larger markets, the latter conversely exaggerates the importance of smaller markets.

3.2 The shift-share analysis compares changes in a country's exports with the corresponding exports of a selected group of reference economies. Any difference between a country's performance and that part of the total change in exports that might be ascribed to the rate of export growth of the reference group as a whole - the *share effect* - is referred to as the *export differential* or *shift effect*. A positive net shift implies an improvement in competitiveness for the country concerned relative to the reference group as a whole, while a negative value constitutes deterioration in competitiveness. The export differential is in turn accounted for by three additive factors: (a) *industry mix effect (IME)*; (b) *competitive effect (CE)*; and (c) *interaction effect (IE)*.

3.3 *Industry mix effect* shows how much of the export differential is due to a divergence between the competing economy's economic structure compared to the reference group. Thus, it looks at how much of the differential is attributed to a difference in the industry's importance in the competing economy's structure vis-à-vis its importance in the structures of the reference economies. It will be positive if a country's share of that commodity in its total exports is larger than the reference group, and

provided there is growth in the reference economies' exports of the commodity to the market. Conversely, if a country's export structure is heavily concentrated in a product that is declining across the reference economies, its industry mix effect will be negative.

3.4 *Competitive effect* shows how much of the export differential is due to a difference between the export growth rate of the particular country and the group as a whole. In other words, it captures the contribution due to the special dynamism of that sector in the individual country compared with the growth of that sector at the reference group level. If a country's growth exceeds the rate for the group, the effect is positive and the country is deemed to have a *competitive advantage* in that product category. Thus, even if the mix of exports to a particular market may be the same, the difference in growth rates of individual commodity exports of the home country vis-à-vis the reference competing economies can contribute to a net shift in export market shares.

3.5 *Interaction effect* shows how much of the export differential is attributable to a combination of the industry mix effect and the competitive effect or a combination of economic structure and competitiveness. It will take on a positive value if the competing economy specializes in exports in which it enjoys a competitive advantage or produces little of the exports in which it has no such advantage. Conversely, interaction effect will be negative if the competing economy specialises in exports in which it does not enjoy a competitive advantage or if it does not concentrate on exports in which it has competitive advantage. Further details on the formula used to calculate the shift-share results in this study can be found in the Appendix.

Dynamic Versus Static Shift-Share Analysis

3.6 Most studies using shift-share methods are comparative static in that they only consider changes in the variable of interest, such as exports, between the beginning and the terminal years of the time period under investigation. This can be a problem if there are significant changes in industrial structures over time. Failure to take into account changes in the size of a country's total exports over the period can also lead to problems if these exports grow faster or slower than those of the reference group. If they grow faster, then the comparative static approach will assign too little of the export growth to the 'share effect' and vice versa if a country's exports grow more slowly than the group.⁸ Only by applying an annual growth rate to a country's exports at the beginning of the year can the share effect be accurately measured.

3.7 In this study, the dynamic shift-share analysis is used. This variation of shift-share analysis allows growth rates and industry mixes to vary over the time period. Such changes are taken into account by automatically updating the industry mix component each year and allowing for changes in the size of total exports in each of the countries in the sample. Moreover, by providing a *continuous* picture of the evolution of the export differential and its components over time using annual growth rates, the analysis can help to identify any structural breaks that may have occurred during the period of the study. The results of the analysis will also be useful in revealing trends in export competition between reference economies, rather than simply identifying the direction of the net shift that a country experienced between the two end-points of the start and end period. The latter may give a somewhat myopic picture of a county's export performance and be unduly influenced by exceptional years or errors in the primary data.

⁸ See Barff and Knight (1988) for an elaboration on this point.

Limitations of Shift-Share Analysis

3.8 Although a widely-used and helpful technique for descriptive analysis, shift-share has a number of practical limitations that need to be taken into account when evaluating the results.

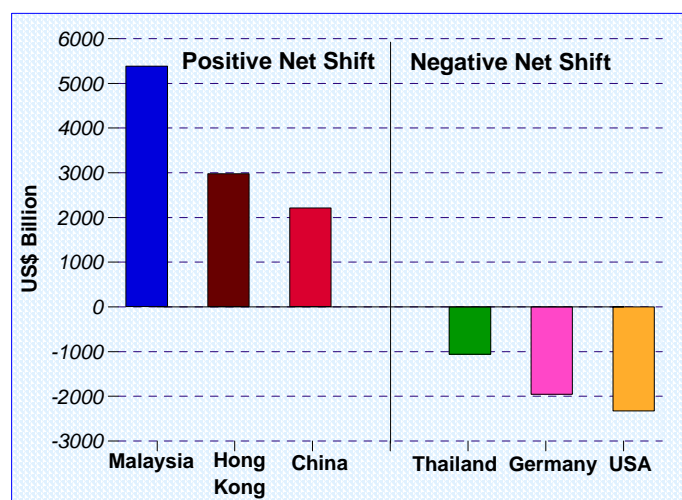
3.9 Positive and negative export differentials in shift-share analysis are useful in revealing changes in relative competitiveness of a country. However, they are best viewed as being indicative of changes in the structure of a country's trade over time relative to a relevant group of countries exporting broadly similar categories of goods to similar markets. Such differentials should be seen within the context of the aggregate performance of the export sector in the country concerned. Thus, a negative export differential within a broad manufacturing category need not signify a loss of competitiveness overall but rather conceal a natural process of changing comparative advantage or a process of 'catching-up'. This can arise if for example, the increase in real wages and productivity in the NIEs result in a restructuring away from labour-intensive industries towards higher value-added activities within a given manufacturing category. This is also the case if the diversification takes the form of a movement out of manufacturing and into services, or into markets that are not included in the analysis.

Previous Studies on Shift-Share Analysis

3.10 Shift-share analysis is a well-established methodology in regional economic analysis, with several studies analysing export market growth in the East and Southeast Asian economies. In Monetary Authority of Singapore (1998a), no reference group was involved but rather the objective was to identify which export markets were of growing (diminishing) importance to Singapore over the period 1991 to 1996. A positive net shift in this context signifies a higher increase in export earnings to a specific market compared to that implied by Singapore's overall export performance. The highest net gains (positive export differentials) for Singapore were to the

markets of Malaysia, Hong Kong and China; while the biggest losses were to USA, Germany and Thailand. (Chart 3.1) The gains to ASEAN-5 and Northeast Asia contrast with the loss of competitiveness in North America and the EU-15. This study highlighted the growing significance of the regional economies as export markets, even as the importance of the traditional developed markets diminished somewhat over the period.

Chart 3.1
Top Three Positive and Negative Net Shift Markets



3.11 A second study by Monetary Authority of Singapore (1998b) using shift-share methods chose South Korea, Hong Kong, Taiwan, Singapore and Malaysia as reference economies and analysed trade competitiveness for selected exports during the same timeframe of 1991 to 1996. The results complement the earlier findings that Singapore had been losing some market share, especially in the developed markets with the intense competition from regional economies.

3.12 Wilson (2000) used dynamic shift-share analysis to compare changes in the competitive position of Singapore, Malaysia, Thailand, Hong Kong, Korea and Taiwan between 1983 and 1995. Two-digit trade data were used for the top five categories of manufactured exports to the USA and the EU, and the top four in the case of Japan. The results underlined the magnitude of the structural transformation that occurred over this period. Emerging economies such as Malaysia and Thailand became more

'competitive' across a broad range of manufactured goods relative to the other reference economies, while the other economies endeavoured to switch their export focus to higher value-added manufacturing and services, move into new markets, or establish manufacturing facilities overseas as a substitute for exports.

IV SETTING UP THE PARAMETERS FOR SHIFT-SHARE ANALYSIS

4.1 In using shift-share analysis to study Singapore's export competitiveness, the selection of the relevant exports, reference economies and destination markets is important since the conclusions that can be drawn are inevitably affected by these choices.

Domestic Exports or Total Exports?

4.2 The focus of this study is on non-oil domestic exports, which comprises approximately half of Singapore's total exports. For most countries, the use of gross export data would be perfectly adequate to capture exports' contribution to the domestic economy, as the import content of exports is relatively small. In the case of Singapore however, since a substantial part of the country's trade has historically taken the form of 'entrepot' trade, the results of the shift-share analysis may be distorted if total exports were used. Thus, domestic exports are used instead, which exclude re-exports. This gives a more accurate representation of Singapore's export competitiveness, as it reflects the exports that the economy generates from her own industrial base. A further distinction is made between domestic exports and non-oil domestic exports, given the rather specific nature of the petroleum trade. Oil exports have historically been influenced by different dynamics from the rest of Singapore's exports, with minimal co-movements being observed. They have also diminished in importance through the years as the country's industry structure has moved towards higher value-added electronics exports.

4.3 Electronics account for the bulk of Singapore's exports. Specifically, these electronics exports comprise disk drives, printers and PCs (SITC 752); printed circuit boards (SITC 759); consumer electronics (SITC 761, 762, 763); telecommunication equipment (SITC 764) and semiconductors (SITC 776). In more recent years, chemical exports (SITC 5) have also gained in importance in line with the rise in pharmaceutical

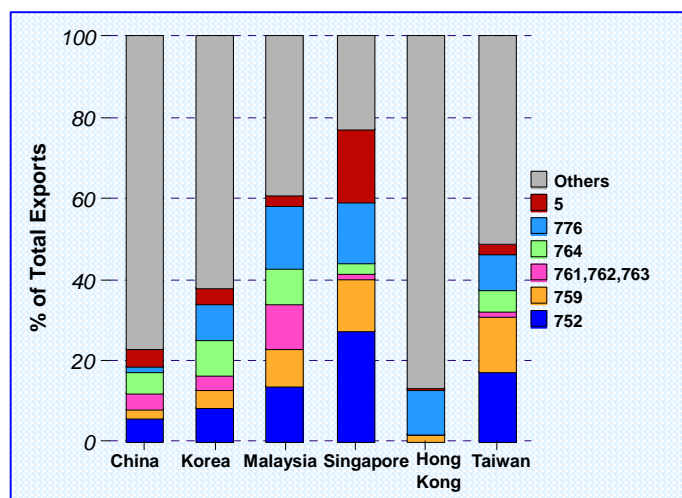
exports and new growth strategies relying on the life sciences. With Singapore's electronics exports and chemical exports accounting for 70% of total domestic exports, the present study focuses on these six three-digit SITC categories and one single-digit SITC 5 category. Past studies on Singapore's exports using shift-share methods have generally focused on the broader one or two-digit categories. A study focusing on these specific three-digit electronic categories and chemicals would thus be particularly useful for identifying Singapore's export strengths and weaknesses.

Choice of Reference Economies

4.4 Apart from Singapore, the other economies selected to be in the reference group for the shift-share study are those that are deemed to be the closest export competitors. These include *China, Hong Kong, Korea, Malaysia and Taiwan*. Total exports were used for all the reference economies except Singapore and Hong Kong. Hong Kong, like Singapore, has a high proportion of re-export trade in her total exports.

4.5 With the exception of China, these regional Asian economies have generally matured approximately at the same pace as Singapore from the mid-1980s to the present. They underwent rapid industrialization and achieved substantial growth and structural change over this period. They have developed comparable industry structures and adopted similar growth strategies. As a response to increasing wage rates and appreciating exchange rates in the 1980s, many have also moved into more technology and capital-intensive exports, especially electronics. (Chart 4.1) In 2001, electronics and chemical goods accounted for 61% of Malaysia's total exports to the developed economies, followed by Taiwan (49%), Korea (38%), China (23%) and Hong Kong (13%). With strong export similarity, these economies inevitably become Singapore's main competitors.

Chart 4.1
Reference Economies' Exports to Developed Markets in 2001



4.6 While China is not a traditional export competitor of Singapore in electronics, she has progressed rapidly in this area in more recent times. Despite her relatively later economic development and more recent emergence in world trade, China has done exceptionally well especially in the late 1990s as shown in Section 1. Her rising export power partly reflects her low cost base and the surge in FDI into the country. As part of her rapid industrialization, the country has been developing her manufacturing base and shifting her focus to higher value-added exports, such as machinery and equipment. The electronics and IT industry is now China's largest industry, with output of computers accounting for close to two-thirds of overall industrial production in China.⁹ In terms of turnover, China's electronics and IT industry currently ranks third in the world.¹⁰

4.7 Although China is likely to pose a competitive challenge to the region, her trade data must still be interpreted with some caution. Hong Kong reverted to Chinese sovereignty in 1997, but the rather special characteristics of the Hong Kong economy mean that she continues to be

⁹ Source : CEIC.

¹⁰ Source : An MTI-TDB study on *Highlights of Singapore's 2000 Trade Rankings by the World Trade Organisation (2001)*.

treated independently in empirical work on trade. However, a significant amount of Hong Kong's manufacturing production, particularly processing and assembly, has been shifted to mainland China since the early 1980s. This tends to overstate China's bilateral exports to the rest of the world, which are measured inclusive of the Hong Kong component, and understate those of Hong Kong.

Choice Of Destination Markets

4.8 The destination markets chosen for the shift-share analysis are the developed economies: US, Japan and the EU. These three markets have been traditional export markets for Singapore as well as for the other reference economies.

Sensitivity Analysis

4.9 While the choice of the reference group of economies, export categories and destination markets have been selected such that they best reflect current export conditions and dynamics, the study also examines the sensitivity of the analysis to the following two further scenarios:

- a) Excluding China from the reference group of economies
- b) Using total exports instead of domestic exports for Singapore and Hong Kong

4.10 The decision to exclude China from the reference group was on account of her very rapid structural change and development over the period covered by this study. At the start of the period, China's export focus was different from the rest of the competing reference economies, concentrating mainly on traditional low value-added exports of clothing accessories and textiles. However, China's export performance in the late 1990s has been spectacular, partly reflecting the country's rapid growth and expansionary phase of economic development. This contrasts with the other

more mature economies in the reference group. Thus, it could be useful to see if China's exclusion/inclusion affects the dynamics of the reference economies significantly.

4.11 Total exports include re-exports, which contribute less than their full value to Singapore's export earnings and export competitiveness. However, as re-exports make up around half of total exports, it is useful to observe if the trends in total exports identified by the shift-share analysis differ significantly from those of domestic exports.

4.12 The results of the shift-share analysis using these alternative scenarios will be discussed in the next section.

V KEY FINDINGS

5.1 This study applies the dynamic shift-share analysis to the exports of electronics and chemicals of the six reference economies (Singapore, Malaysia, Taiwan, Korea, Hong Kong and China) over the period 1988 to 2001. The key results and analysis are summarised in this section.

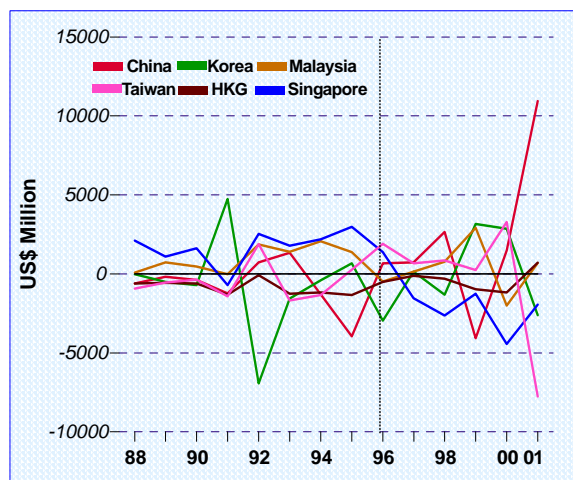
Shift-share calculations suggest that...

5.2 The calculations from the shift-share study suggest that Singapore's electronics exports generally performed well between 1988 and 1995, in terms of gaining positive net shifts, compared to the other reference economies. (Chart 5.1a) Singapore was often the top performer, coinciding with a period when there were strong foreign investments in the domestic electronics sector. There were also spillover effects from the ASEAN economies, which were expanding strongly during this period. However, the general trend of positive net shifts for Singapore seems to have reversed around 1996, which coincided with the period of slower growth that was noted in Section II. In fact, Singapore was the only economy among the reference economies to experience persistently negative net shifts throughout 1997 to 2001. In comparison, Malaysia, Korea and Taiwan registered on average positive net shifts (in descending order of magnitude).

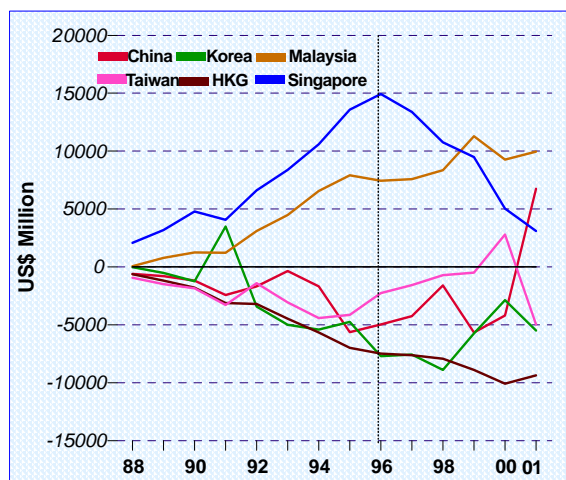
5.3 The general trend of reversing negative net shifts after 1996 can also be seen in the cumulative net shifts over the past 12 years. (Chart 5.1b) While Singapore's net shift is positive on a cumulative basis, both Malaysia and China overtook her in the late 1990s, with China now emerging as the country with the second largest cumulative net shift.

Chart 5.1
Electronics & Chemical Exports to US, EU and Japan Markets

a) Net Shifts



b) Cumulative Net Shifts



Singapore was top of the league in the earlier years...

5.4 The period 1991 to 1995 were the “golden” years for Singapore’s domestic exports of electronics and chemicals. Singapore (and to a lesser extent, Malaysia) was able to widen the gap with the rest of the reference economies, underpinned by strong export performance in disk drives, printers and PCs (SITC 752).

5.5 In comparison, the North Asian economies of Taiwan, Korea and Hong Kong did not perform as well during the late 1980s. These economies were relatively more entrenched in slower-growing labour-intensive exports, such as textiles and clothing. (Table 5.1) Singapore’s higher wages had acted as an impetus to switch to higher value-added and capital-intensive electronics exports earlier than the other reference economies. Thus, the ability to capitalise on the first-mover advantage had enabled the country to gain a foothold as an important production and export centre for electronics.

Table 5.1
Changes in Export Structure (% of Total Exports)

	Textiles & Clothing ^{1/}		Machinery ^{2/}	
	1980	1989	1980	1989
Hong Kong	40.7	39.5	17.5	23.3
Taiwan	21.8	16.3	24.7	35.6
Korea	29.9	23.9	20.3	35.0
Singapore	4.3	5.0	26.8	47.0

Source: ESCAP 1991, Management of external sector policy, Economic and Social Survey of Asia and the Pacific, p 151

^{1/} Textiles fibres, yarn and clothing (SITC 26+ 65+ 84).

^{2/} Machinery and Transport Equipment (SITC 7), which include electronics products.

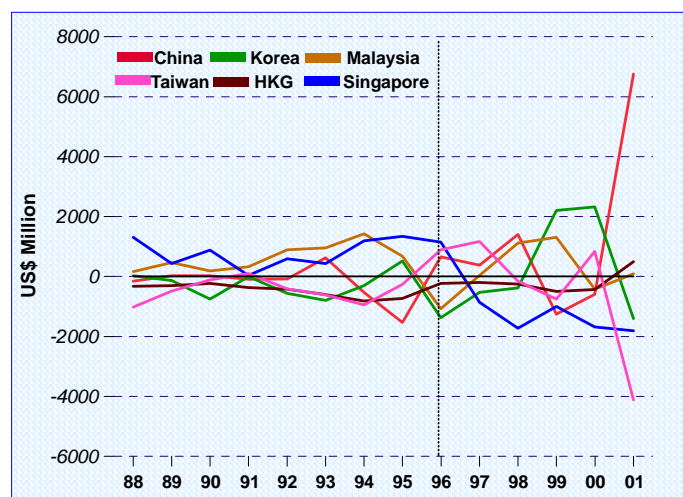
...but the trend began to reverse sharply after 1996

5.6 However, the general trend of positive net shifts for Singapore began to reverse in the late 1990s. There was a distinct downward trend in Singapore's net shifts from 1996, which subsequently turned negative. In fact, Singapore was the only country among the reference economies to experience negative net shifts continuously since 1997. The principal gainers after 1996 were Taiwan and Korea. Malaysia was able to register positive net shifts in some years. China's net shifts, on average, were not impressive and Hong Kong's performance was lacklustre. However, Hong Kong's results must be interpreted with care as her share of electronics and chemical exports was the lowest amongst the reference economies, indicating that her export strength was concentrated elsewhere. In 2001, China and Malaysia had positive net shifts; Singapore's decline in net shift has moderated, while Taiwan seems to have been most affected by the recent global electronics downturn.

...with negative net shifts in the US market

5.7 Singapore's decline in net shift after 1996 has been largely due to relatively poor performance in the US market compared to the other reference economies. (Chart 5.2)

**Chart 5.2
Net Shifts in Electronics and Chemical Exports to US**



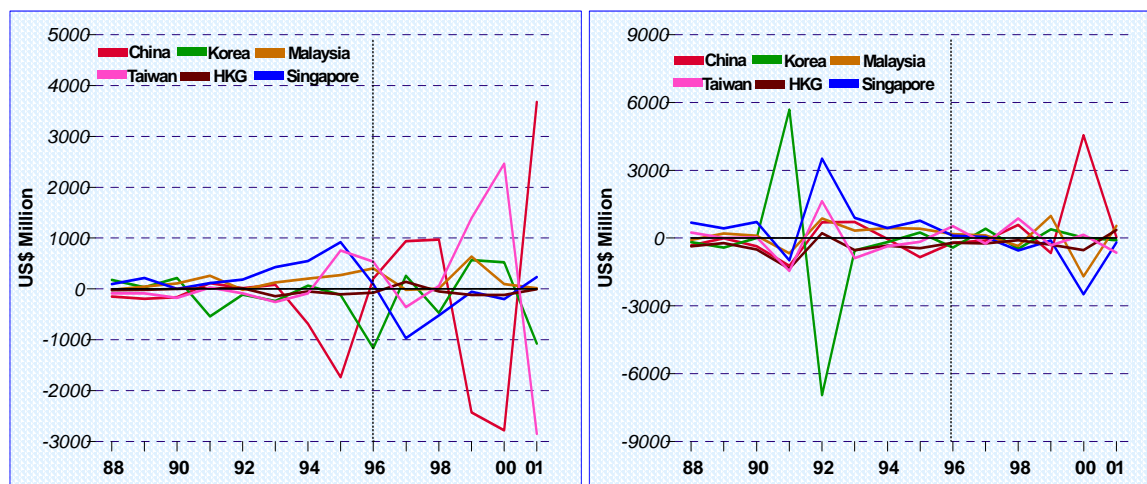
5.8 While Singapore's net shifts in Japan and the EU were also on a downward trend, the decline has been much less severe than in the US. (Charts 5.3a & b) Taiwan was able to widen the gap between herself and the rest of the reference economies in Japan in the late 1990s. After the 1998 Asian financial crisis, many Japanese electronics firms began to outsource their manufacturing operations outside Japan. Taiwanese contract manufacturers appeared to be the main beneficiaries of this trend. However, Taiwan's net shift plunged sharply into the negative territory in 2001 as their exports were hard hit by the global electronics downturn.

5.9 There was no clear picture in the EU market as the net shifts registered by all the reference economies were of similar magnitudes.

Chart 5.3

a) Net Shifts in Electronics and Chemical Exports to Japan

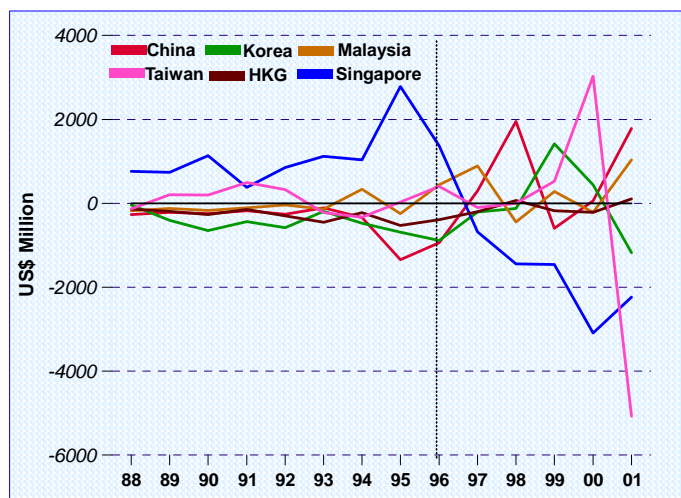
b) Net Shifts in Electronics and Chemical Exports to EU



...as well as in electronics exports

5.10 In terms of products, Singapore's electronics exports were generally competitive between 1988 and 1995. In disk drives, printers and PCs (SITC 752), her performance was exceptional, with large and growing positive net shifts that far exceeded the other reference economies. (Chart 5.4) Singapore's lead was most pronounced in the US market, although she was competitive in other markets as well. The share of disk drives, PCs and printers (STIC 752) in overall electronics exports to the developed economies increased steadily from about 28% in 1985 to almost 50% in the early 1990s.

Chart 5.4
Net Shifts in SITC 752 Exports to US, Japan and EU Markets

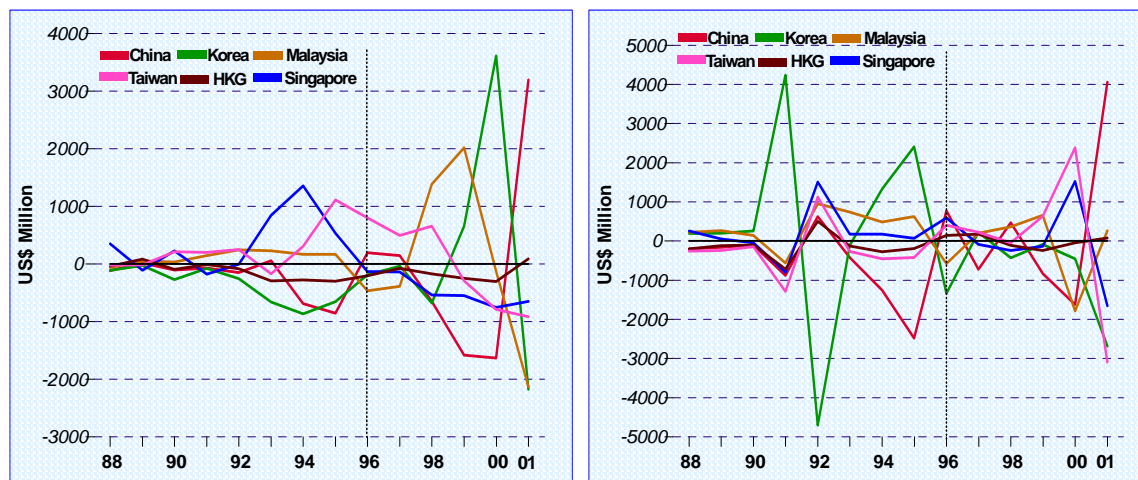


5.11 Exports of SITC 752 were boosted by the rapid expansion of the disk drive industry in Singapore, aided by huge FDI from several MNCs. These companies were attracted by supportive public policy, including various financial incentives, and efforts to deepen local capabilities to meet industry needs. In particular, Seagate, the world's largest manufacturer of hard disk drives shifted almost all of its disk drive assembly plants to Singapore by 1984. This helped in transforming Singapore into the world's largest hard disk drive assembler in less than a decade. By 1995, Singapore had attained a leading share of global hard disk drive output by volume, at about 33%.¹¹

5.12 Other products, such as printed circuit boards (SITC 759) and semiconductors (SITC 776), also experienced positive net shifts between 1988 and 1995. (Charts 5.5a & b) In comparison, domestic exports of consumer electronics (SITC 761, 762, 763) and telecommunication equipment (SITC 764) experienced mostly small negative net shifts throughout the period as Singapore moved away from these relatively low value-added electronics exports, even as early as the beginning of the 1990s.

¹¹ Figure obtained from EDB website (www.sedb.com).

Chart 5.5

a) Net Shifts in SITC 759 Exports
to US, Japan and EUb) Net Shifts in SITC 776 Exports
to US, Japan and EU

5.13 Singapore's net shift in electronics began to turn negative in the late 1990s. Domestic exports of disk drives, printers and PCs (SITC 752), which supported the robust expansion in the earlier years, contributed mainly to the deterioration. Most notably, several of the major disk drive manufacturers consolidated their manufacturing operations in Singapore in the late 1990s, with some, such as Western Digital, shifting their operations to other lower cost locations. Other electronics products, such as printed circuit boards (SITC 759), consumer electronics (SITC 761, 762, 763) and telecommunication equipment (SITC 764), also started to record negative net shifts in 1996. The only bright spot was semiconductor exports (SITC 776), which saw its net shift rebounding briefly into positive terrain in 1999-2000, boosted by the opening of several wafer fabrication plants in Singapore, including ST Microelectronics and Chartered Semiconductor Manufacturing. The positive net shift position for Singapore's semiconductor exports fell back into negative territory in 2001 with the global electronics downturn.

Each economy has carved out its own niche industries...

5.14 No single reference economy has dominated all categories of electronics exports in the second half of the 1990s. Each economy has developed its own niche industries over the years. Korea appears to have gained a competitive advantage in telecommunication equipment (SITC 764), while Taiwan's strength lies in the PC segment (SITC 752). China and Malaysia are more competitive in lower-end consumer electronics (SITC 761, 762, 763). In comparison, Singapore gained more in semiconductor exports (SITC 776) in the late 1990s. However, the advantage that Singapore has in the semiconductor segment in recent years was not sufficient to offset the loss in other segments of the electronics industry.

Competitive effect of Singapore's electronics exports was weak

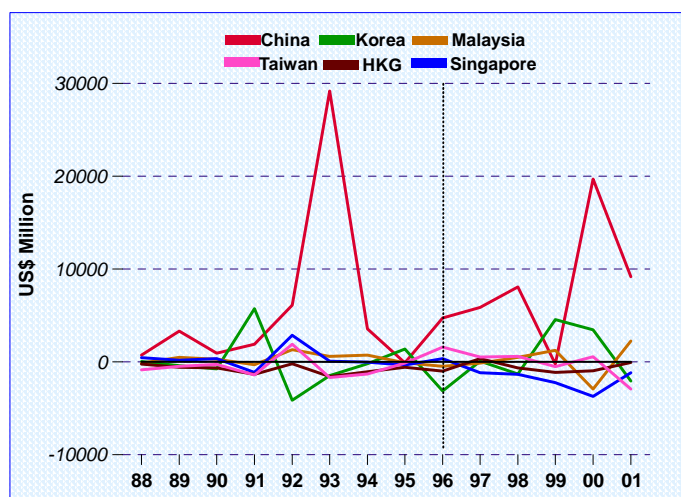
5.15 The decomposition of the overall net shift into its additive effects helps to identify the sources of the changes in export competitiveness. The components of the net shift in exports can be expressed as :

$$\text{Net Shift} = \text{Competitive Effect (CE)} + \text{Industry Mix Effect(IME)} + \text{Interaction Effect (IE)}$$

5.16 The competitive effect (CE), which is that proportion of the export differential due to the difference between the export growth rate of Singapore and the reference group as a whole, was lacklustre for Singapore compared to the rest of the reference economies over the whole 12 years covered by the study. The CE was mildly negative, or at best, marginally positive between 1988 and 2001, due to generally slower growth of the country's exports vis-à-vis the other reference economies. While Singapore's electronics exports expanded at a respectable average rate of 10% per annum, the exports of the other reference economies grew even more rapidly at 15% per annum. Indeed, China's spectacular export growth in most categories has been well ahead of the other reference economies for

much of the period. (Chart 5.6) Singapore's CE has been trending down sharply since 1996 as her export growth lagged more significantly behind the rest of the reference economies. Korea's CE was positive after the 1998 Asian financial crisis (except for 2001) and has coincided with the downward movement in Singapore's CE.

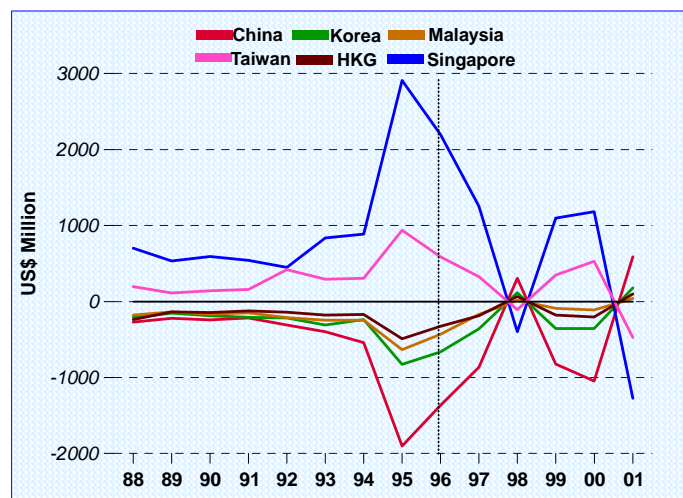
Chart 5.6
CE for Electronics Exports to the US, Japan and EU Markets



...while Singapore's industry mix effect was exceptionally high

5.17 While Singapore's CE for electronics exports was generally weak, this has been offset by a high positive industry mix effect (IME), especially between 1988 and 1996. In other words, the good overall performance of Singapore compared to the reference economies can be attributed to the higher concentration of fast-growing electronics in her exports compared to the reference group, particularly in disk drives, printers & PCs (SITC 752). Her high IME far surpassed every other economy between 1988 and 2000, with the exception of 1998 and 2001 when it dipped slightly into the negative region. (Chart 5.7) Singapore's high IME for these products was the key factor that supported the high net shift experienced during the period 1988 to 1996.

Chart 5.7
IME for SITC 752 Exports to US, Japan and EU Markets



5.18 While Singapore's lower value-added exports of consumer electronics (SITC 761, 762, 763) and telecommunication equipment (SITC 764) saw their IMEs turning increasingly negative after 1996, the country's exports of disk drives, printers and PCs (SITC 752), printed circuit boards (SITC 759) and chemicals (SITC 5) continued to experience generally positive IMEs. Nevertheless, in the post-Asian crisis years of 1998 to 2000, Malaysia's IME for most electronics export categories have been positive and on an upward trend. The electronics industry in Malaysia has seen rapid development in the late 1990s with the deliberate efforts to develop the industry.

However, Singapore's high concentration in electronics could be a double-edged sword...

5.19 However, the high concentration of electronics in Singapore's exports could be a double-edged sword. While such an industry structure contributes to a positive IME, the overall shift effect could be dragged down if it is not accompanied by relatively strong growth in these exports (a positive CE) when growth of electronics exports of the reference economies as a whole is positive. The IE component in the net shift decomposition embodies the combined effect of a country's export structure interacting with

her export growth. Thus, a positive IE will generally be obtained if the IME and CE reinforce each other.¹² Table 5.2 illustrates two possible scenarios. In scenario A, a positive CE and IME produces a positive IE. This occurs when a home country possesses an export structure that is concentrated in commodities whose exports are growing faster than the reference economies. If the three effects are summed up, the net shift would be positive. In scenario B, a combination of high positive IME and negative CE has led to a negative IE and the net shift turns out to be negative in this case.

Table 5.2
Two Possible Scenarios- Industry Mix, Competitive and Interaction Effects

Scenarios	Net shift	Industry Mix Effect	Competitive Effect	Interaction Effect
A (1988-1996)	Positive	High positive	Low positive	Moderate positive
B (1997-2000)	Negative	High positive	Negative	Negative

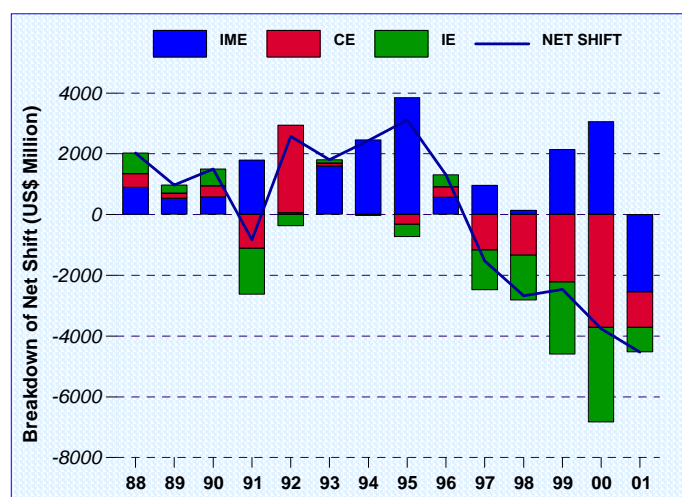
Note: Net Shift = Industry Mix Effect + Competitive Effect + Interaction Effect.
Export growth of total reference economies is positive in both scenarios.

5.20 Scenario A corresponds to the period 1988 to 1996 for Singapore when her exports were growing at about the same rate as the reference economies. However, due to the higher proportion of electronics in overall exports, Singapore was able to secure a competitive edge over the other reference economies. The situation began to reverse after 1996, and this corresponds to scenario B in Table 5.2. While a positive IME was maintained, the CE deteriorated significantly in the late 1990s, turning increasingly negative. This produced an increasingly negative IE, which further dragged down the overall net shift. (Chart 5.8) This was because Singapore's exports were heavily concentrated in electronic products, which were growing at a slower rate than the reference economies. There was a

¹² This will hold true only if the growth of electronics exports of the reference economies as a whole is positive.

significant deterioration in Singapore's CE over the period 1997 to 2000, with electronics exports contracting by an average of 5% per annum, largely due to the Asian crisis and the downturn in the electronics cycle. Comparatively, with the exception of Hong Kong, the other reference economies managed positive export growth, averaging 9% in the same period. While most of these reference economies recovered relatively quickly after the Asian crisis to achieve growth rates seen in the pre-crisis period, Singapore's performance in electronics exports has been sluggish in comparison.

Chart 5.8
Breakdown of Net shift for Singapore's Electronics Exports



5.21 Table 5.3 summarises Singapore's net shift position in 2001 when her IME turned negative. This is attributed to the negative overall export growth of the reference economies rather than to Singapore's industry structure being relatively less concentrated in electronics. (Figure 5.1) A positive IME can be achieved only if the optimal industry structure is accompanied by positive overall export growth of those commodities in the reference economies.¹³ All reference economies suffered a contraction in export growth in 2001 to varying degrees due to the global electronics downturn. Singapore's high concentration in electronics has put the economy in a relatively disadvantaged short-term position. However, the

¹³ Overall electronics export growth of reference economies has been positive throughout the period of the study except for 2001.

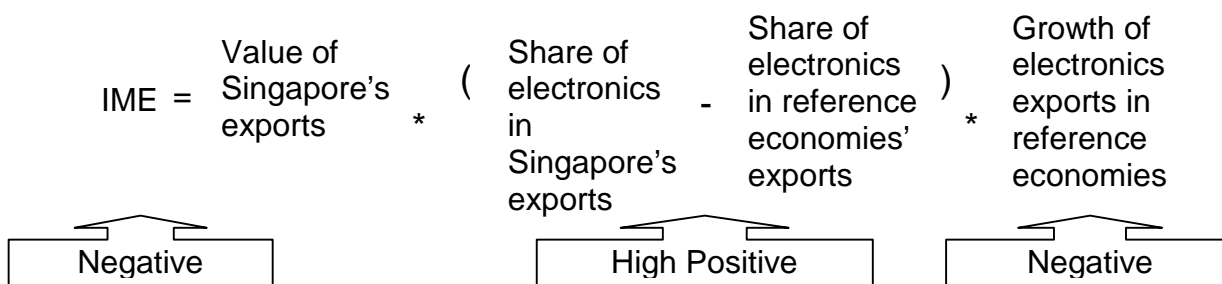
aberration in one particular year should not cause undue concern. An export structure geared towards electronics will continue to be advantageous with the long-term prospects of global electronics remaining bright.

Table 5.3
Breakdown of Net shift for Singapore’s Electronics Exports in 2001

Scenarios	Net shift	Industry Mix Effect	Competitive Effect	Interaction Effect
2001	Negative	Negative	Negative	Negative

Note: Net Shift = Industry Mix Effect + Competitive Effect + Interaction Effect.
Export growth of total reference economies is negative.

Figure 5.1
Singapore’s Industry-Mix Effect Equation in 2001

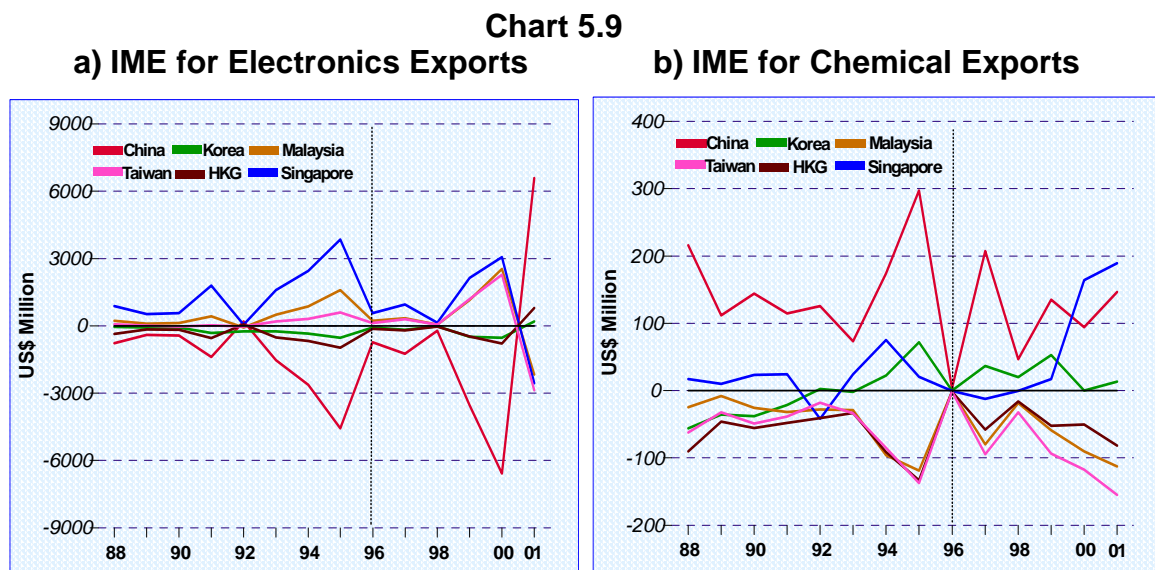


Competition from China likely to intensify in the future

5.22 In Section I, it was shown that China was one of the top gainers in global trade over the past decade. However, China’s overall net shifts in the specific industries and products examined in this study have actually not been particularly spectacular prior to 2001. China’s main strengths in recent years have been in lower-end exports, such as consumer electronics (SITC 761, 762, 763) and telecommunication equipment (SITC 764), which enjoyed sustained positive net shifts. However, in the higher-end exports of disk-drives, printers and PCs (STIC 752) and semiconductors (SITC 776), she has not done as well as the other more well-established

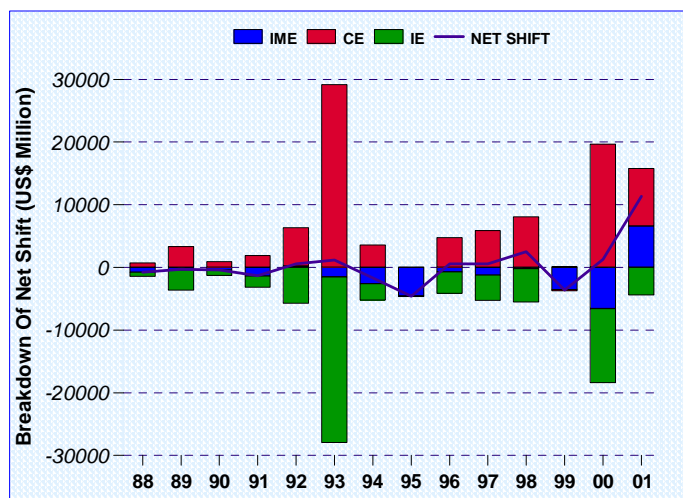
economies. In terms of export market, China has not yet gained any significant stronghold in the developed markets for electronics products.

5.23 Although China's electronics exports have been growing at a faster rate than most of the reference economies (thus having a higher CE), her IME has generally been lower as her electronics industry is not as well-established as the other reference economies. While China's chemical exports fared better, with an IME that was generally higher than that of the other competing economies, her lead has not been significant. (Chart 5.9) China's exports are still predominantly at the lower-end compared to the reference economies. Products such as clothing (SITC 84), footwear (SITC 85) and textile manufactures (SITC 65) accounted for a substantial 25% of her exports in the year 2000. (Chart 5.9).



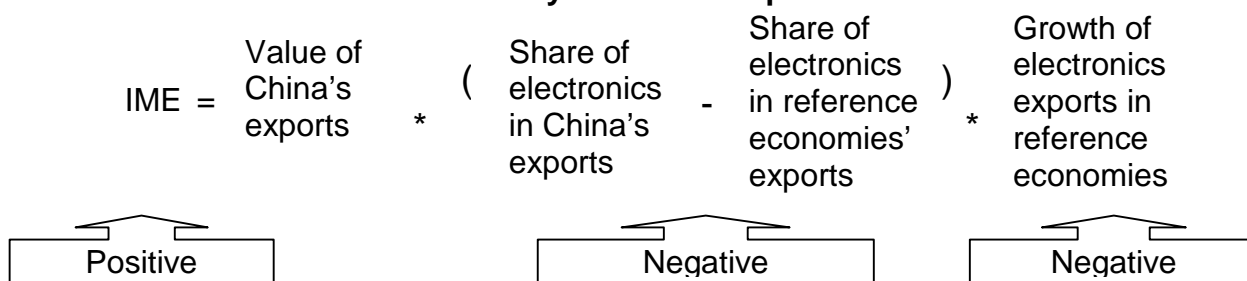
5.24 While slower export growth was the underlying reason for Singapore's recent downward trend in export performance, China's small net shifts have been due to a poor industry mix. The combination of a strong positive CE, on account of her spectacular export growth, together with a less-than-optimal industry mix that concentrates on lower-end products, has resulted in a large and negative IE for China which dragged down China's overall export performance. (Chart 5.10)

Chart 5.10
Breakdown of Net shift for China's Electronics Exports



5.25 China's net shift in electronics exports rose sharply in 2001, largely because of a sharp reversal in her IME from negative to positive. However, this was due to the negative overall export growth of the reference economies, rather than an improvement in the concentration of electronics in China's industry structure. (Figure 5.2) China, being less reliant on electronics, was relatively less affected by the global electronics downturn. Hence, in spite of a positive net shift for China in that year, her underlying fundamentals still indicate that her industry structure needs to focus more on electronics if she is to compete successfully with the other reference economies when the global electronics industry recovers.

Figure 5.2
China's Industry Mix Effect Equation in 2001



5.26 China's competitiveness position is expected to improve significantly in the future. China's low cost structure, an increasingly skilled workforce and an influx of technology and management skills associated with large FDI inflows, together with her recent entry into the World Trade Organisation, places her in a very favourable position. China's electronics exports have been growing at a robust rate of 26% per annum since 1997, albeit from a low base, with her share in total exports increasing from 11% in 1997 to 19% in 2001. China has been able to maintain a large CE that has dwarfed that of her competitors since 1988. China also has a particularly strong CE even in disk drives, printers and PCs (SITC 752) and semiconductors (SITC 776), two high-value added export categories that have traditionally been the strongholds of Singapore and other countries in the region. (Charts 5.11a & b) Such strong export growth is likely to continue in the future. Furthermore, if China is able to consolidate her industrial base, focusing on higher value-added electronics, her IME will rise to match that of the other reference economies.

Chart 5.11

a) CE for SITC 752 Exports

b) CE for SITC 776 Exports

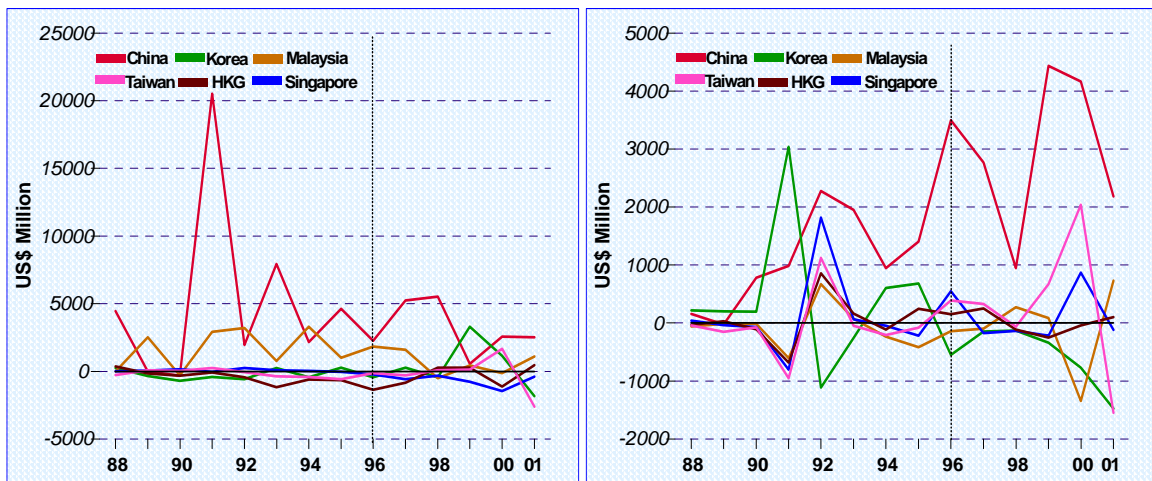


Table 5.4
China's Competitiveness Position: Present and Future

Scenarios	Net shift	Industry Mix Effect	Competitive Effect	Interaction Effect
Current	Low positive/negative	Low positive/negative	High positive	High negative
Future	Increasing	Increasing	High positive	High positive

Note: Net Shift = Industry Mix Effect + Competitive Effect + Interaction Effect.

Analysis excluding China still reveals a loss in competitiveness for Singapore

5.27 Since the emergence of China has been a relatively recent phenomenon, it is useful to determine if her exclusion from the reference economies affects the earlier results.

5.28 In general, the results do not differ significantly from the original analysis, suggesting that the trend decline in Singapore's net shift cannot be attributed solely to the emergence of China. In fact, up until the cyclical downturn of 2001, none of the other reference economies' trade patterns were disturbed significantly with the exclusion of China.

5.29 In 2001, however, the China factor did impact on the net shifts of the other reference economies, even as they suffered a sharp cyclical downturn. These reference economies performed worse with the inclusion of China as she was less reliant on electronics and thus was relatively unaffected by the sharp global electronics downturn.

The results do not differ significantly when re-exports are included

5.30 Likewise, using total exports instead of domestic exports did not affect the results significantly. The trends of all export categories remained generally intact, although the size of the positive or negative net shifts varied somewhat. However, an interesting feature of the analysis

using total exports was that, although Singapore's net shift in electronics remained negative in 2001, it had turned upward, suggesting an improvement in the country's re-export performance, a point that we will return to, in the next section.

VI SUM-UP

6.1 The results presented in Section V suggest that in the earlier period of the study between 1988 and 1995, Singapore was able to keep ahead of the other reference economies with significant positive net shifts, especially in exports of electronics to the developed markets. However, 1996 appears to be a turning point with net shifts starting to trend downwards and later become negative. Korea and Taiwan also began to surface as the top performers. China, which was less concentrated in electronics, emerged relatively unscathed from the 2001 global electronics downturn, while most of the other reference economies suffered a sharp negative supply shock. In this final section, some tentative conclusions are drawn.

Some structural changes in the global electronics industry after 1996...

6.2 It is important to note the changes that have taken place in the global electronics industry since 1996. Perhaps the most obvious is the increased volatility of the electronics cycle. Since 1996, there have already been three downturns (in 1996, 1998 and 2001), compared to only one slowdown (in 1985) between 1980 and 1995. The industry as a whole also grew at a slower rate after 1996. (Table 6.1)

6.3 It also appears that the global electronics industry has become more competitive after 1996. Some indirect indicators of this include the sharp decline in the prices of major electronics products. For instance, after 1996 the prices of PCs declined at an average rate of about 31% per annum, compared to 16% per annum prior to 1995.

Table 6.1
Key Changes in the Global Electronics Industry

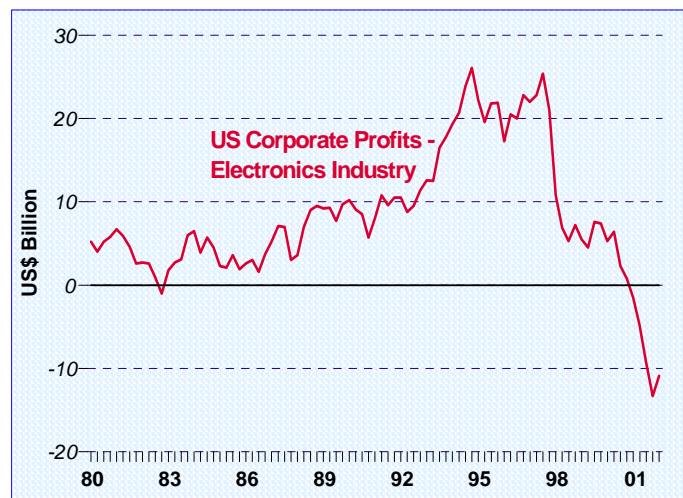
Indicators	Before 1996	After 1996
Average annual growth rates of global chip sales	21.3% (1988-1995)	1.8% (1996-2001)
Standard deviation of growth in chip sales	15.8% (1988-1995)	25.1% (1996-2001)
Average annual decline in PC prices	-15.5% (1994 ^{1/} -1995)	-31.3% (1996-2001)

Source: Semiconductor Industry Association, US Bureau of Labour Statistics

^{1/} Earliest available data.

6.4 In addition, corporate profits were squeezed. Chart 6.1 shows that the profits of US electronics firms peaked in the period 1995 to 1997, and started trending down since the Asian crisis in 1998.

Chart 6.1
US Corporate Profits- Electronics Industry



Source: CEIC

Although Singapore’s domestic exports to developed markets have borne the brunt of the changes...

6.5 Against the backdrop of this more competitive environment, Singapore’s electronics sector appears to have been the worst hit among the reference economies. Nevertheless, Singapore continues to play an

important role in the regional electronics production network, even as new sources of growth within manufacturing are also emerging.

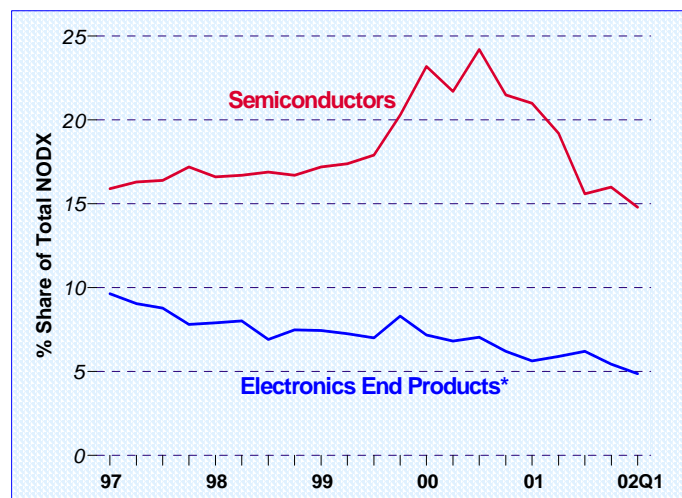
...Singapore is exporting more intermediate electronics products to East Asia...

6.6 MNCs typically decentralise their electronics production within the region in order to capitalise on the comparative advantage of each country. Increasingly, Singapore is taking on the role of producing higher-end intermediate electronics components (typically semiconductors), which are then shipped to the other East Asian countries for assembly into final products for export to the developed markets. This is consistent with our findings in Section V that while Singapore has gained some competitive advantage in semiconductors, Korea appears to carve out a niche for telecommunication equipment, Taiwan in PCs and Malaysia and China in consumer electronics.

6.7 Indeed, the share of semiconductors in domestic exports has increased steadily over recent years,¹⁴ while the share of end-products such as telecommunication equipment has been declining. (Chart 6.2) This is broadly in line with the previous study on shift-share analysis (MAS, 1998b), which pointed to the growing importance of Asian economies as export market.

¹⁴ The fall in 2001 is due to a cyclical decline in the global electronics market. With semiconductors accounting for the bulk of the new investments in the domestic electronics industry, the share of semiconductor in total domestic exports should increase in the long term.

Chart 6.2
Export Product Profile of Semiconductors and End Products



* Comprises PCs, telecommunication equipment and consumer electronics

6.8 While the other reference economies are deemed to be Singapore's export competitors, they are at the same time among Singapore's top ten domestic export markets. The export shares of these markets in Singapore's exports have been increasing steadily through the 1990s, generally enjoying much higher export growth as compared to the developed markets. (Table 6.2) This is also consistent with the findings in Section II that East Asia's share of Singapore's non-oil domestic exports has generally been increasing in recent years.

Table 6.2
Singapore's Top Ten Markets for Domestic Exports (%)*

Country	1985-1990		1991-1995		1996-2001	
	Export Share	Export Growth	Export Share	Export Growth	Export Share	Export Growth
US	29.8	15.9	25.2	7.9	23.4	-0.9
EU	14.2	25.0	16.6	9.0	16.9	2.7
Malaysia	8.7	7.6	11.8	23.5	12.7	3.3
Japan	10.1	10.9	8.3	9.1	8.1	4.3
Hong Kong	6.7	16.2	8.3	14.5	8.5	4.3
Taiwan	2.7	35.5	3.6	11.4	4.3	9.7
China	2.5	27.3	2.1	27.9	3.6	15.2
Thailand	5.4	29.3	5.6	1.1	3.7	-1.7
Korea	1.7	29.6	2.3	14.4	2.7	12.2
Australia	3.0	6.2	2.3	6.2	2.4	8.8

* Ranked according to export share in 2001.

...as confirmed by estimates of the RCA index

6.9 The shift in Singapore's electronic exports towards higher-end components is confirmed by the Revealed Comparative Advantage (RCA) index. The RCA index of a product j is a ratio of the export of the product as a share of country i 's total exports, to the corresponding share of world exports in the product:

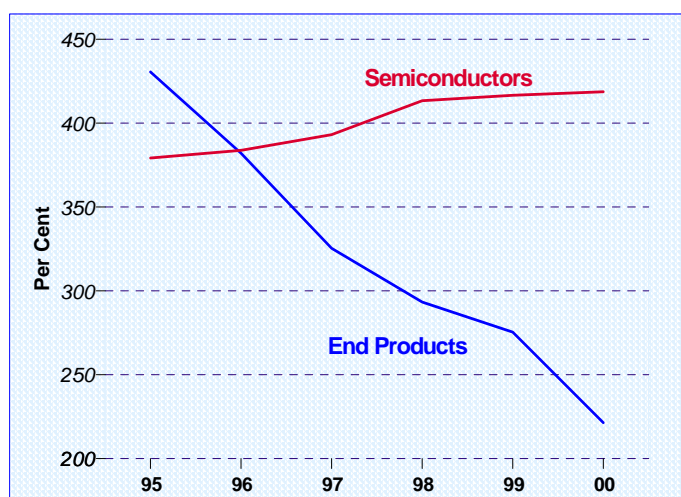
$$RCA_{ij} = [x_{ij} / x_i] / [x_{wj} / x_w] * 100$$

Where : x_{ij} and x_{wj} represent the value of product j exported by country i and the world respectively;

x_i and x_w are total exports by country i and the world respectively.

6.10 The RCA index indicates whether a country has a comparative advantage in the manufacture of the product. Chart 6.3 shows that Singapore's RCA index for end-use products has generally been falling, while that for semiconductors has increased over the past five years.

Chart 6.3
Singapore's RCA Index for Semiconductors and End Products



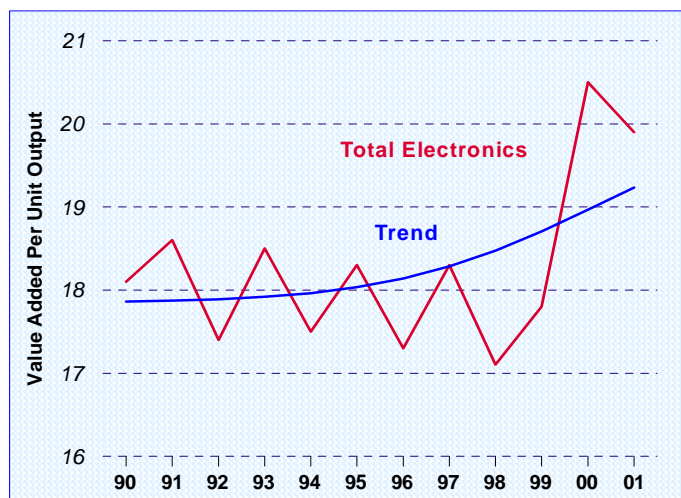
Focus on intermediate electronics products may underestimate their contribution

6.11 However, countries specialising in these intermediate components will have a lower overall export value for their products than those specialising in final products. This is because the cost of final goods (which has incorporated the components costs) is generally higher than the cost of components.¹⁵ For instance, a finished computer on average would be valued at around \$1,000, while a DRAM chip would only amount to less than \$10. Thus, Singapore's lower net shifts in more recent years may actually be indicative of the lower export values due to the increasing export focus towards intermediate electronics products. While our export values would tend to be "underestimated", the shift towards higher end products would contribute more to the domestic economy as compared to a domestic manufacturing base producing mainly end products. In particular, the value-added (VA)¹⁶ per unit of component output was on average 20%, which was higher than that of finished goods, of 17% over 1988 to 2000. Hence, the shift towards electronics components in Singapore's manufacturing structure has in fact, supported the rise in the value-added per unit of output for our electronics industry in more recent years. (Chart 6.4)

¹⁵ Electronics components comprise SITC 759, SITC 776 and part of SITC 752.

¹⁶ Value-added of exports measures their contribution to the Singapore GDP.

Chart 6.4
Value-added Content of Domestic Electronics Industry



Source: EDB

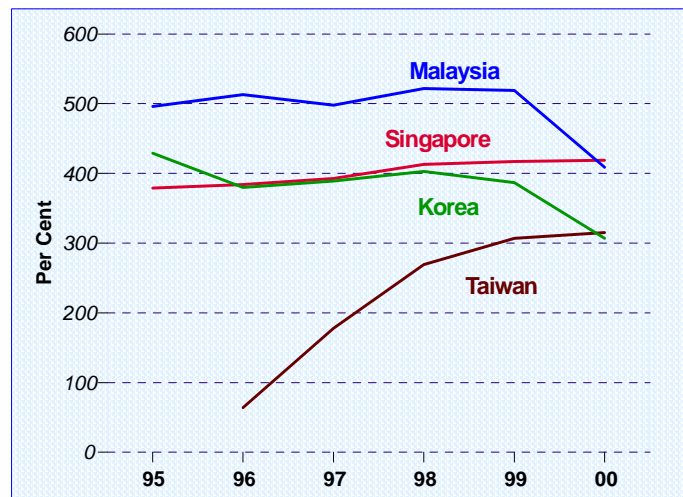
6.12 A comparison with the other reference economies shows that Singapore is ahead in her share of electronic components in exports. (Table 6.3) This high composition of components is also similar to that found in the leading industrialised countries, such as US and Japan, where exports are generally at the higher end of the value-added chain. Nevertheless, Singapore continues to face increasingly intense competition, with many regional economies also beginning to shift their focus away from producing finished electronics goods in favour of higher value-added electronic components. For instance, many Asian countries are moving into the production of semiconductors. In particular, Taiwan, Korea and Malaysia have been strengthening their domestic semiconductor industry, as shown by the increase in their respective RCA indices in Chart 6.5. Apart from semiconductors (SITC 776), the export performance of other electronic components-related categories such as printed circuit boards (SITC 759) and to a certain extent disk drives, printers and PCs (SITC 752) also reflect the current more competitive environment, with generally negative net shifts after 1996.

Table 6.3
Singapore's Share of Components & Finished Goods in Electronics Exports (%)

Country	Share of Components	Share of Finished Goods
Asian countries:		
Singapore ^{1/}	83.3	16.7
Malaysia	67.9	32.1
Korea	59.5	40.5
Taiwan	67.7	32.3
Hong Kong ^{1/}	98.5	1.5
China	49.6	50.4
Developed countries:		
US	67.6	32.4
EU	62.5	37.5
Japan	69.7	30.3

^{1/} Singapore and Hong Kong's figures refer to domestic exports

Chart 6.5
RCA Index for Semiconductors



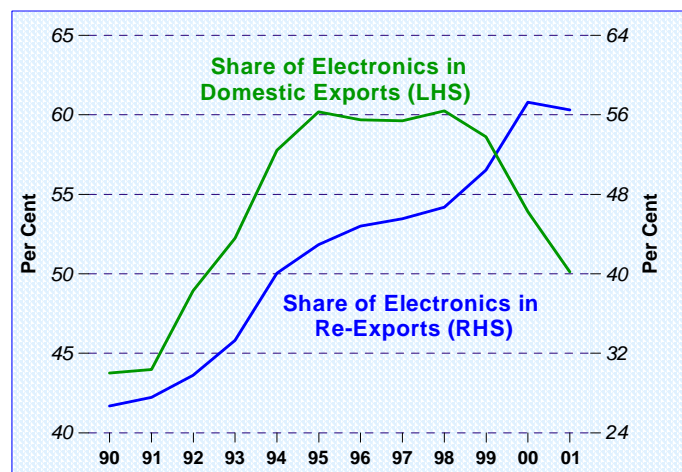
Note: The 1995 data for Taiwan is unavailable.

Singapore is also a service hub in the regional supply chain

6.13 Singapore's role in the regional production chain is shifting from that of a manufacturing centre to a regional headquarters providing services to manufacturers in the region. Some Singapore-based manufacturers who have outsourced significant portions of their production to ASEAN countries in recent years, have retained their headquarter operations here. This is reflected in the increase in the share of re-exports in Singapore's total exports, which was discussed in Section II.

6.14 Indeed, while electronics dominated Singapore's domestic exports in the earlier years, it has somewhat diminished in importance in the last few years. The share initially rose from 44% in 1990 to a high of around 60% in the mid-1990s, before falling off to around 50% in 2001. (Chart 6.6) The decline in the late 1990s reflected the recent weakness in the domestic electronics sector as well as the initiatives to diversify into non-electronic exports. Despite this shift in focus away from electronics exports in the domestic industrial base, the share of electronics products in total re-exports rose by 2.2 times between 1990 and 2001 from 26% to 56%. With the increasing dominance of electronics products in re-exports, Singapore appears to have been able to carve out a role as a service centre for linking the important electronics production activities within the region. It is thus imperative that efforts to attract global electronics companies to set up their manufacturing headquarters here continue so as to further build up Singapore's role as a service hub, while the inevitable relocation of lower-end manufacturing industries takes place over time.

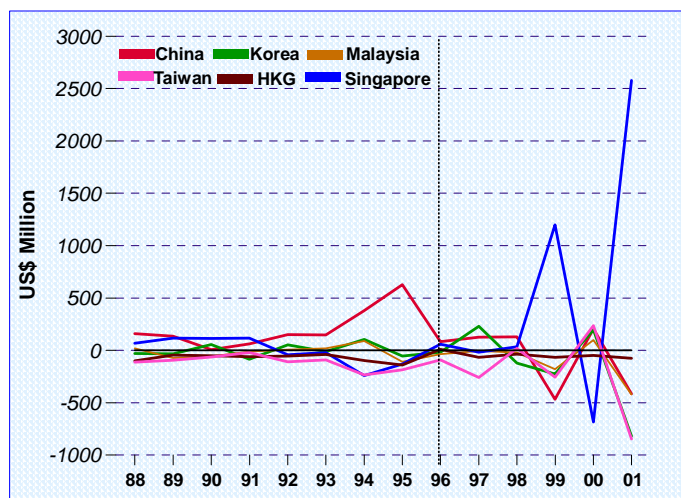
Chart 6.6
Share of Electronics in Re-Exports and Domestic Exports



...while chemicals is emerging as a potential new source of export growth

6.15 The chemicals sector has been promoted heavily with the objective of diversifying Singapore's export basket. The chemicals industry is a fairly young industry, with the biomedical and petrochemical industry taking off only in the late 1990s. Furthermore, Singapore's chemical exports tend to be volatile due to its small size and infancy, resulting in swings between high and low growth rates. This has also resulted in sharp swings in their net shifts. (Chart 6.7) In 2001, for example, the net shift surged on the back of capacity expansions of pharmaceutical plants in Singapore. As the petrochemicals industry becomes more mature and deepens its inter-linkages with related downstream petrochemical plants, the chemicals cluster as a whole is expected to represent a more important and steadier source of export earnings in the future.

Chart 6.7
Net Shifts in Chemical Exports to the US, Japan and EU Markets



A final word on international competitiveness...

6.16 The international exchange of goods and services between nations is not a zero-sum game. The theory of comparative advantage, which asserts that because trade allows each nation to specialise in, and export, those products it produces relatively cheaply, establishes that trade can make all nations better off.

6.17 As growth in the Singapore economy slows to its medium-term potential, her export performance is also likely to moderate relative to that of some of the regional economies. However, this is a natural transition to the medium-term sustainable growth path of the economy and is largely dictated by supply-side considerations.

6.18 Nevertheless, the Economic Review Committee (ERC) has recognised the need to broaden Singapore's export base. Within manufacturing, the country is already actively nurturing the biomedical sector and the Committee is also looking into new opportunities in the services sectors and has identified several new areas of growth that Singapore could develop. These include info-communication services, healthcare, education, tourism and financial services.

Appendix

Decomposition of Net Shift in Export Market

This appendix provides a mathematical exposition of the shift-share technique in analysing export market competition. Consider a home country's export of commodity i to market j at time t , X_t^{ij} , and the reference economies' like exports with the $\hat{\ }^j$ sign, viz. \hat{X}_t^{ij} . We can express the change in the home country's exports between two periods t and $(t-1)$ as :

$$\begin{aligned}
 X_t^{ij} - X_{t-1}^{ij} = & \\
 & X_{t-1}^j \cdot \frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} - 1 \right) \\
 & + X_{t-1}^j \cdot \left\{ \left(\frac{X_{t-1}^{ij}}{X_{t-1}^j} \right) - \left(\frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \right) \right\} \left\{ \frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} - 1 \right\} \\
 & + X_{t-1}^j \cdot \frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \cdot \left\{ \left(\frac{X_t^{ij}}{X_{t-1}^{ij}} \right) - \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} \right) \right\} \\
 & + X_{t-1}^j \cdot \left\{ \left(\frac{X_{t-1}^{ij}}{X_{t-1}^j} \right) - \left(\frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \right) \right\} \left\{ \left(\frac{X_t^{ij}}{X_{t-1}^{ij}} \right) - \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} \right) \right\}
 \end{aligned}$$

Summing across all commodities, the growth or change in size of export market j ,

$$\begin{aligned}
 [X_t^j - X_{t-1}^j] - X_{t-1}^j \cdot \sum_i \frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} - 1 \right) = & \\
 X_{t-1}^j \cdot \sum_i \left\{ \left(\frac{X_{t-1}^{ij}}{X_{t-1}^j} \right) - \left(\frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \right) \right\} \left\{ \frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} - 1 \right\} & \Rightarrow \text{Industry mix effect} \\
 + X_{t-1}^j \cdot \sum_i \frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \cdot \left\{ \left(\frac{X_t^{ij}}{X_{t-1}^{ij}} \right) - \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} \right) \right\} & \Rightarrow \text{Competitive effect} \\
 + X_{t-1}^j \cdot \sum_i \left\{ \left(\frac{X_{t-1}^{ij}}{X_{t-1}^j} \right) - \left(\frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \right) \right\} \left\{ \left(\frac{X_t^{ij}}{X_{t-1}^{ij}} \right) - \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} \right) \right\} & \Rightarrow \text{Interaction effect}
 \end{aligned}$$

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