THE EXPORT COMPETITIVENESS OF THE NEWLY INDUSTRIALISED EAST ASIAN ECONOMIES: HOW REAL IS THE CHINESE THREAT IN ELECTRONICS?

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ABSTRACT

This paper examines the export performance of China in electronics compared to the east Asian NIEs exporting to the USA, the European Union, and Japan between 1988 and 2001 using a dynamic version of shift-share analysis to overcome some of the inherent drawbacks of the widely-used static shift-share methodology. Our findings suggest that China has now emerged as a serious contender in the export market for electronic goods, but this position has not been a dominant one. For electronics as a whole, the principal gainers after 1995 appear to be newcomers China and Malaysia at the expense of the older Tigers, like Singapore and Hong Kong. To some extent this represents a natural process of 'catch-up'. Moreover, no single NIE has dominated all categories of electronic exports. In the east Asian region, the less developed members of ASEAN would appear to be most at risk in the immediate future since they compete head on with China in lower-end manufacturing and are in danger of being 'leapfrogged' in the value-added chain. The more advanced NIEs are in a better position since they have time to increase value-added before China catches up and may benefit more from the opportunities China offers in terms of production and service complementarities.

Keywords: *Asian NIEs; China; electronics exports; shift-share.*

ABSTRAK

Kajian ini memeriksa pencapaian sektor eksport elektronik negara China ke Amerika Syarikat, Kesatuan Europah dan Jepun berbanding dengan negara-

negara Asia NIE di antara 1988 sehingga 2001. Kajian ini mengunakan analis "dynamic shift-share" kerana kelemahan yang terdapat di dalam analisis "static shift-share" Kajian menunjuk bahawa China telah wujud sebagai pengeksport barang elektronik yang"penting walaupun kedudukannya tidak utama. Selepas tahun 1995, negara China dan Malaysia telah muncul sebagai pengeksport elektronik yang penting setanding dengan Singapura dan Hong Kong, untuk memastikan proses "catch-up". Tiada satupun negara NIE menguasai pengeksport elektronik. Walau bagaimanapun negara-negara ASEAN yang bertaraf rendah pembangunannya menghadapi tentangan hebat daripada China di sektor penggilangan yang bernilai rendah. Tetapi negara-negara yang telah muncul masih mempunyai peluang untuk memperbaiki kedudukan dan menambahkan nilai sektor tersebut sebelum China menutup jarak pengeluaran hasil. Ekonomi negara-negara tersebut akan beruntung selama China memperbesarkan sektor perusahan dan sektor servis.

Kata kunci: *Asia NIE; China; ekspot elektronik; 'shift-share'.*

INTRODUCTION

China has enjoyed remarkable trade growth over the past two decades, with exports expanding by almost 13% per annum on average between 1986 and 2001, and 20% between 1986 and 1995 (International Enterprise Singapore). This coincided with substantial changes in the international landscape since the mid-1980s as globalisation of the world economy led to intense competition in the east Asian region and significant changes in export competitiveness.

These developments have been heightened by the re-entry of China into the global economy in the 1990s, a process begun with domestic reforms in 1978, but catalysed by China's accession to the World Trade Organisation (WTO) in 2002. The result has been an acceleration in the process of dismantling its trade barriers, opening its market up to foreign services, and reducing the weight of state-controlled enterprises in the economy.

The spectre of the 'Chinese threat' has forced other countries in the Asian region to re-assess their own international competitiveness.[1] Whilst some observers point to the opportunities China presents as a market for exports, a source of tourism earnings and indigenous foreign direct investment (FDI), and its potential to act as a 'locomotive' for regional demand and a stabiliser against downswings in global demand, others are less optimistic.

Rapid growth in GDP 0f 9.4% on an annual average basis since 1985 (Table 1) and fast 'catch-up' based on low costs, a seemingly endless

reserve army of underemployed agricultural workers, technicians from the communist era, and a rapidly rising pool of ambitious English-speaking graduates, has transformed China into the workshop of the world, particularly in lower-end manufacturing such as textiles, bicycles, shoes, and furniture. But China is also catching up in electronics which have increased from a negligible base in 1987 to account for 19% of global exports by 2001 (Figure 1). China has been likened to a giant vacuum cleaner 'sucking up' the lion's share of FDI inflows into the developing countries (Figure 2), attracted by rising incomes in its vast home market, especially in the southern Pearl River delta.
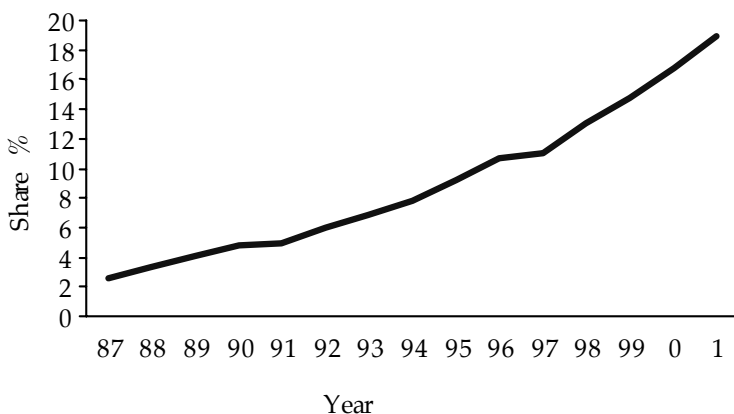

Figure 1

China's share of electronics in total exports 1987 to 2001 (International Enterprise Singapore).
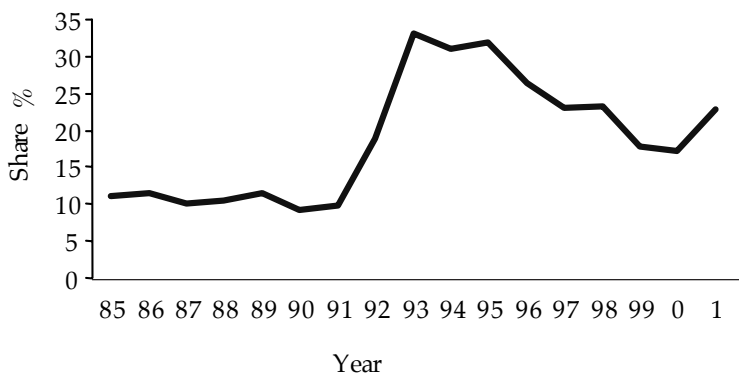

Figure 2

China's share of developing country FDI inflows 1985 to 2001 (ADB, 2002).

At the same time, because of its rising foreign exchange reserves, which were US$169 billion in 2000 (Asian Development Bank, 2002), underpinned by an undervalued currency which has enabled it to maintain a competitive edge in exports, China is accused of neo-mercantilism.

China is also seen as a potential new source of shocks to the Asian region as its excess capacity and low costs translate into enhanced price competition and a fall in profit margins and in the value of manufacturing assets. Using the trade to GDP ratio as a measure of openness to international trade, China is still relatively closed in comparison to the exceptionally open Asian NIEs (Table 1), with a trade to GDP ratio of 44% in 2000, and its ratio of domestic consumption to world consumption is quite small.[2] Yet the impact of China on its neighbours is magnified by the absolute size of its exports and imports which were US$249 billion and $225 billion, respectively, in 2000 (Asian Development Bank, 2002) and the growing interdependence in the Asian region as China becomes more integrated into the local trade matrix as both an export market and source of imports.

How real is the Chinese threat in electronics to the Asian NIEs in the major developed country markets of the world?

This paper uses a dynamic version of shift-share analysis to re-assess China's export performance in electronics exports to the USA, European Union (EU), and Japan in relation to Singapore, Hong Kong, South Korea, Malaysia, and Taiwan, which have become close competitors in these markets. Shift-share is a relatively simple technique with a number of well-documented shortcomings but it has been proven to be a useful descriptive tool for isolating trends in regional performance and for supplying data for policymakers to interpret changes in the industrial structure of their economies.

Although there has been some discussion about the longer-term economic challenge posed by China to Japan, the focus in this paper is on Japan as a major export market for China and the other Asian NIEs. Also, in the absence of easily obtainable and internationally comparable trade data at a more disaggregated level, most comparative studies on the east and south-east Asian economies have been restricted to the one or two-digit standard international trade classification (SITC). By contrast, the present paper looks at five three-digit level categories of electronics, as well as electronics in aggregate.

We begin with some background on China's export performance relative to the NIEs since the mid-1980s. This is followed by a discussion

of the literature and the methodology used in this paper. We complete the paper with our empirical results and some concluding remarks and qualifications.

CHINA AND THE NEWLY INDUSTRIALISED ASIAN ECONOMIES

Although there are a number of ways to group the more successful economies of east and south-east Asia in a rapidly changing world economy, with the exception of China, the other NIEs in this region have generally matured at approximately the same pace from the mid-1980s to the present time and have become increasingly competitive as a group, especially in the markets of the USA, Japan, and the EU.

Some of the economic characteristics of these Asian NIEs are summarised in Table 1. All have undergone a period of rapid economic growth and structural change since the mid-1980s. The rising share of manufacturing output in GDP and corresponding fall in the share of agriculture is an indicator of the extent of industrialisation achieved over this period. The clear exception is Hong Kong, but this is explained by the relocation of much of its manufacturing base across the border into China from the mid-1980s onwards as it de facto re-integrated with the mainland, a process which was accelerated by de jure reunification in 1997. In terms of income per capita, all have achieved a substantial level of economic development.

Table 1
Comparative Indicators for China and the NIEs 1985-2000.

	1985	1990	1995	2000
China:				
GNP per capita (US$)	267	314	574	844
Agriculture/GDP (%)	28	27	21	16
Manufacturing/GDP (%)	39	37	42	44
Trade to GDP (%)	25	32	40	44
Real GDP Growth (%)	1985-9	1990-5	1996-0	1985-0
	8.9	10.7	8.3	9.4
Hong Kong:				
GDP per capita (US$)	6374	13091	23061	24407
Agriculture/GDP (%)	0.5	0.3	0.1	0.1
Manufacturing/GDP (%)	22	18	8	6
Trade to GDP (%)	184	229	279	284
Real GDP Growth (%)	1985-9	1990-5	1996-0	1985-0
	8.6	5.2	3.6	5.8

(continued Table 1)

	1985	1990	1995	2000
South Korea:				
GNP per capita (US$)	2179	5817	10772	8609
Agriculture/GDP (%)	13	9	6	8
Manufacturing/GDP (%)	29	29	29	31
Trade to GDP (percent)	67	54	53	81
Real GDP Growth (%)	1985-9	1990-5	1996-0	1985-00
	9.6	7.7	5.1	7.5
Malaysia:				
GNP per capita (US$)	1891	2376	4033	3531
Agriculture/GDP (%)	20	15	13	9
Manufacturing/GDP (%)	20	24	26	34
Trade to GDP (percent)	84	133	170	201
Real GDP Growth (%)	1985-9	1990-5	1996-0	1985-0
	6.4	9.4	4.9	6.9
Singapore:				
GNP per capita (US$)	6967	15846	24337	24379
Agriculture/GDP (%)	0.9	0.4	0.2	0.1
Manufacturing/GDP (%)	23	27	24	26
Trade to GDP (%)	277	308	292	296
Real GDP Growth (%)	1985-9	1990-5	1996-0	1985-0
	7.8	9.1	6.7	7.9
Taiwan:				
GNP per capita (US$)	3287	8040	12287	13458
Agriculture/GDP (%)	6	4	3	2
Manufacturing/GDP (%)	38	33	28	26
Trade to GDP (%)	82	76	81	93
Real GDP Growth (%)	1985-9	1990-5	1996-0	1985-0
	10.1	6.8	5.8	7.6

Notes: The trade to GDP ratio is exports plus imports in local currency as a ratio of nominal GDP; conversions to US dollars use end of period exchange rates; the ratio of manufacturing to GDP for China includes mining, electricity, gas and water, while for Singapore agriculture includes mining; the real GDP growth rates are calculated from IMF IFS data (1995=100) except for Taiwan which was rebased to 1995 from ADB data;

Sources: Asian Development Bank (2002); International Monetary Fund (2002).

From the trade perspective, the Asian NIEs became increasingly open to international trade and capital flows from the early 1980s with high trade to GDP ratios and adopted similar outward-oriented trade

strategies and moved steadily over time into more technology and capital-intensive exports, especially electronics. During the 1980s and 1990s they also became more interdependent in trade and capital flows as a group and increasingly competed in similar categories of goods and markets. Not surprisingly, the USA, Japan, and the EU are important markets for these countries in electronics, both individually, and as a bloc (Table 2). By 2000, electronics accounted for approximately 70% of Singapore's exports to the USA, Japan and the EU (excluding re-exports), followed by Malaysia (60%), Taiwan (57%), South Korea (41%), China (22%), and Hong Kong (15%).

Table 2
Exports of Electronics by the Asian NIEs to the USA, EU and Japan in 2000.

	752	759	7613	764	776	Electronics
% of exports						
China	5.9	1.6	7.9	4.8	1.3	21.5
South Korea	9.3	8.8	2.8	6.7	13.7	41.3
Malaysia	11.1	14.6	10.5	7.2	16.8	60.2
Singapore	30.7	14.6	1.4	2.9	20.8	70.4
Hong Kong	0.1	2.4	0.0	0.4	11.6	14.5
Taiwan	22.0	13.8	1.2	5.7	14.7	57.4
Total Reference countries	12.5	8.2	5.0	5.4	10.6	41.7

Notes: Exports for Singapore and Hong Kong refer to domestic exports; 752 is disk drives, printers and PCs, 759 is printed circuit boards, 7613 is consumer electronics, 764 is telecommunications equipment, 776 is semiconductors, total electronics includes SITC 752,759,7613,764,776.

Source: International Enterprise Singapore.

Whilst China has not been a traditional competitor of the other NIEs, it is fast becoming one especially in the late 1990s, primarily as a result of its low cost base and surge in inward FDI. In 2000 income per capita for China was only one quarter that of Malaysia, and only 3% of Hong Kong and Singapore (Table 1). The share of agriculture in GDP has fallen substantially since 1985 to about 16% but this is still noticeably higher than the other NIEs, and its manufacturing sector, which is dominated by lower value-added industries, has a higher weight in national income than in the manufacturing-oriented countries of Malaysia and South Korea, and the more service-oriented Taiwan, Hong Kong, and Singapore. Whilst China has become more open to

international trade, on conventional criteria, it is still less open than the other NIEs. However, there are problems in measuring China's trade with the rest of the world because of its re-export trade with Hong Kong (Ho, 1998; Fung & Lau, 1998).

Furthermore, at the start of our sample period (as for Malaysia) China's exports were concentrated mainly on primary products (SITC 012 and 34) and (as for Hong Kong and Taiwan) lower value-added manufactured goods (SITC 689), such as clothing accessories and textiles (Table 3). Nonetheless, China's overall performance and structural transformation in the last decade has been staggering. All the NIEs grew rapidly by world standards in the late 1980s (Table 1), and growth slowed for all after 1996, but China's performance stands above the rest in the 1990s, as the older Tigers began to slow down, particularly Hong Kong and Taiwan. China's share of developing country inward FDI more than doubled in the early 1990s compared to the second half of the 1980s, and accounted for approximately one fifth on average between 1995 and 2000 and almost one half of the flow to Asia (excluding Japan). Japan and India have seen their shares increase since 1985, but all of China's other competitors in the Asian region have seen a fall in shares in the 1995-1999 period compared to 1985-1989 (World Investment Report, 2002).

Rapid growth and industrialisation in the 1990s has thus translated into a deepening and a widening of China's manufacturing base and a shift in focus towards higher value-added exports, such as machinery and equipment (SITC 7), which by 2000 accounted for half of China's total exports (Table 3). China's import and export structure has also changed profoundly (Table 4) as its dependence on Japan for imports declined in favour of the regional partners Hong Kong and South Korea, and the importance of the USA and Europe as export markets increased, largely at the expense of Japan. By 2000 the USA, Japan and the EU together accounted for approximately half of Chinese exports.

As far as electronics specifically is concerned, China's share in total exports to developed country markets is still dwarfed by the other NIEs (Table 2), with the exception of service-oriented Hong Kong. However, in absolute terms, the electronics and information technology industry is now China's largest industry and in terms of turnover China currently ranks third in the world (MTI-TDB, 2001).

There have also been significant changes in the export product-mix in China's electronics industry (Table 5). Not only has there been a significant increase in the importance of electronics as a whole in total exports from a negligible base in 1985, to about 22% by 2000, but

particularly important has been the rise in the share of consumer electronics to almost 8%, and disk drives, printers and PCs to 5.9%. On the other hand, printed circuit boards and semiconductors still only account for 1.6 % and 1.3% respectively.

Table 3
China's Export Structure Compared to the NIEs, 1985 to 2000.

Commodity (% of total exports)	SITC	1985	1990	1995	2000
China	012	23.9	16.9	10.6	7.0
	34	26.5	8.7	3.9	3.2
	5	5.0	6.0	6.1	4.9
	689	41.7	59.4	21.1	33.1
	7	2.8	9.0	58.3	51.8
Hong Kong	012	3.0	3.5	3.6	2.6
	34	0.3	0.4	0.4	0.5
	5	0.9	2.9	3.9	3.5
	689	73.6	68.4	62.6	68.7
	7	21.9	24.9	29.4	24.8
South Korea	012	5.1	4.8	2.8	2.6
	34	3.2	1.1	2.0	5.4
	5	3.1	3.9	7.2	7.9
	689	51.1	50.9	34.7	25.9
	7	37.6	39.3	52.5	58.1
Malaysia	012	23.5	18.8	9.1	4.8
	34	44.4	25.5	13.8	13.3
	5	1.1	1.6	3.0	3.8
	689	12.4	18.5	18.9	15.8
	7	18.6	35.7	55.1	62.5
Singapore	012	10.0	7.4	4.9	3.3
	34	35.8	18.9	8.7	9.9
	5	5.4	6.27	5.9	6.9
	689	15.5	17.2	14.7	12.9
	7	33.0	50.1	65.7	67.4
Taiwan	012	7.5	5.8	5.2	2.5
	34	1.8	0.6	0.7	1.1
	5	2.5	4.1	6.8	6.2
	689	60.3	50.4	39.2	32.6
	7	27.9	39.1	48.1	58.4

Key: 012=Food, live animals, beverages and tobacco, crude materials
34=Mineral fuels, animal, vegetable oils and fats
5=Chemicals
689=Basic manufactures, miscellaneous manufactured goods, unclassified goods
7= Machines, transport equipment
Source: Asian Development Bank (2002).

Table 4

China's Major Export Markets and Sources of Imports 1985 to 2000.

	Exports				**Imports**			
	1985	1990	1995	2000	1985	1990	1995	2000
	(% of exports)				(% of imports)			
USA	8.5	8.5	16.6	26.9	12.2	12.2	12.2	8.7
Japan	22.3	14.7	19.1	14.6	35.7	14.2	21.9	16.6
France	0.8	1.0	1.2	1.8	1.7	3.1	2.0	1.6
Germany	2.7	3.3	3.8	4.1	5.8	5.5	6.1	4.3
Italy	1.1	1.4	1.4	1.6	-	-	- -	
Netherlands	1.2	1.5	2.2	2.3	-	-	- -	
UK	1.3	1.1	1.9	1.9	-	-	- -	
Hong Kong	26.2	43.3	24.2	20.7	11.2	27.1	6.5	17.2
S. Korea	-	0.7	4.5	3.2	-	0.4	7.8	9.2
Malaysia	-	-	-	-	0.5	1.6	1.6	1.9
Singapore	7.5	3.2	2.3	2.0	0.6	1.6	2.6	2.4
Australia	-	-	-	-	2.6	2.5	1.9	1.9
Russia	-	-	-	-	-	-	2.9	2.6

Source: Asian Development Bank (2002).

Table 5

The Composition of China's Exports of Electronics to the USA, Japan and the EU from 1990 to 2000

% of exports	1990	1995	2000
Disk drives, printers, PCs (SITC 752)	0.01	2.03	5.9
Printed circuit boards (SITC 759)	0.12	1.12	1.6
Consumer electronics (SITC 761-3)	0.75	3.75	7.9
Telecommunications equipment (SITC 764)	0.17	2.69	4.8
Semiconductors (SITC 776)	0.06	0.46	1.3
Total electronics	1.11	10.05	21.5

Source: International Enterprise Singapore.

The perception that China is a threat to the NIEs stems largely from its extraordinary growth in exports and rising share in key developed country markets, including electronics. Table 6 shows the growth profile of China's exports compared to the NIEs over three periods: 1985-1989, 1990-1995 and 1996-2000, and changes in market shares for each country as a percentage of the share of the group as a whole.

In the first period, all the Asian NIEs grew fast globally and into the developed country markets. In the second period, China and Malaysia were the star performers, particularly in the US market, but Singapore and South Korea also achieved respectable growth. Only Taiwan and Hong Kong performed poorly in comparison.[3] Export growth slowed dramatically for the group as a whole in the most recent phase on the back of three external shocks. Exports of electronics moderated sharply in 1996 due to a serious supply glut in the global electronics industry. Before the region could fully recover, trade was further disrupted by the Asian financial crisis of 1997 and 1998. After a year of exuberant growth in the international technology sector and the world economy in 2000, east Asia was again hard hit by a major correction in the global information technology market, precipitated by a synchronised slowdown in the US, the EU, and Japan. Taken individually, growth was moderate for South Korea, Malaysia, and Taiwan, but China again performed much better than its competitors, while Hong Kong grew at a negative rate and Singapore managed only 3% globally and a negative 0.5% in the US market.

As far as market shares are concerned, China's performance is equally impressive, increasing its share of the Asian NIEs global exports from 22% in the first period to 30% in the third, and more than doubling its share in the US and total developed country markets to 28% and 32% respectively. Malaysia and Taiwan also increased their shares in global and developed country markets but in a much less spectacular fashion, and Taiwan's shares actually fell between the second and third periods. Singapore's shares remained remarkably stable over the three periods, while South Korea saw a significant decline in the US and Japanese markets from a high initial base and Hong Kong's shares in global and developed markets declined from 14% and 16% in the first period to around 4% in the most recent period.

Has China's rapid export growth and rising share in developed country markets since 1985 been the result of increasing competitiveness? Or does it reflect a natural process of shifting comparative advantage or market diversification, or just several cyclical downturns which reduced the competitiveness of China's more export-oriented competitors? The rest of the paper will look more closely at this phenomenon with the help of shift-share analysis which goes beyond the growth rates and shares in Table 6 to assess China's performance against what might have been expected in comparison with a reference group of competitors and looks specifically at the electronics industry.

Table 6

China's Average Export Growth and Market Shares Compared to the NIEs 1985-2000.

Country	1985-1989		1990-1995		1996-2000	
	Export Share (%)	Export Growth (%)	Export Share (%)	Export Growth (%)	Export Share (%)	Export Growth (%)
China:						
USA	6.5	19.3	14.9	35.9	27.8	16.3
EU	17.3	27.5	18.7	24.0	29.7	15.2
Japan	26.2	12.0	30.4	23.1	42.5	8.5
Total	14.4	15.6	19.9	26.7	32.1	13.0
Global	22.2	19.8	24.2	19.2	30	11.4
HongKong:						
USA	19.1	6.1	9.7	-2.4	5.2	-2.4
EU	21.2	18.3	9.9	-2.9	4.9	-4.0
Japan	4.2	31.6	2.9	-1.0	1.3	-14.5
Total	15.8	11.6	8.0	-2.6	4.1	-4.1
Global	13.6	15.0	7.9	0.7	4.0	-4.5
S. Korea:						
USA	34.9	18.6	23.4	3.1	19.5	10.3
EU	24.9	25.6	19.1	13.3	20.1	7.8
Japan	31.9	32.3	26.4	4.7	20.1	5.5
Total	31.5	23.4	22.6	5.8	19.8	8.0
Global	26.4	20.5	21.9	12.6	22.4	6.9
Malaysia:						
USA	6.3	23.4	10.3	22.1	12.2	5.9
EU	11.5	15.4	11.7	17.7	13.1	5.2
Japan	15.0	2.7	12.5	15.4	12.9	8.4
Total	9.9	12.6	11.2	18.6	12.7	5.9
Global	10.9	13.6	11.8	19.8	12.9	6.2
Singapore:						
USA	12.1	23.3	13.9	12.5	12.9	-0.5
EU	10.3	29.5	13.4	17.4	13.3	1.8
Japan	8.3	13.9	8.0	15.6	7.2	3.5
Total	10.6	22.5	11.9	14.5	11.6	0.6
Global	11.5	18.0	12.2	16.3	11.2	3.0
Taiwan:						
USA	21.1	0.8	27.9	1.7	22.4	5.8
EU	14.8	18.0	20.6	6.3	18.8	8.9
Japan	14.4	14.5	19.6	7.1	15.9	7.3
Total	17.8	6.7	23.4	3.9	19.7	6.6
Global	15.4	11.2	22.1	9.2	19.4	6.3

Country	1985-1989		1990-1995		1996-2000	
	Export Share (%)	Export Growth (%)	Export Share (%)	Export Growth (%)	Export Share (%)	Export Growth (%)
Reference:						
USA	100	33.6	100	8.6	100	7.9
EU	100	32.6	100	17.8	100	8.2
Japan	100	28.6	100	12.1	100	6.6
Total	100	31.6	100	11.1	100	7.5
Global	100	29.1	100	13.5	100	6.9

Notes: The export share numbers are the shares of each country as a percentage of the overall share of the reference group; the total figures refer to the sum of the USA, EU and Japan; for Taiwan the first period averages begin in 1987.

Source: International Enterprise Singapore.

Table 7
China's Average Export Differential by Major Market 1988-2000.

Export Differential US$ millions	1988-1995	1996-2000
Disk drives, Printers, PCs		
USA	-102.63	239.8
Japan	-142.63	-195.8
EU	-102.88	144.8
Total	-370.88	152.8
Printed circuit boards		
USA	-100.75	-217.6
Japan	-40	-294.2
EU	-69	-217.2
Total	-239.13	-706.8
Consumer electronics		
USA	109.88	193.4
Japan	-17.75	2.00
EU	88.88	869.2
Total	203	1045.4
Telecoms equip		
USA	72.25	-73.6
Japan	33.38	88.2
EU	-25.75	202.6
Total	105.25	169.2

(continued Table 7)

Export Differential US$ millions	1988-1995	1996-2000
Semiconductors		
USA	-255.75	-93.4
Japan	-169	-188.8
EU	-168.25	-141.6
Total	-609.63	-386.6
Electronics		
USA	-276.88	48.4
Japan	-361.5	-588.8
EU	-276.75	857.8
Total	-911.75	274.2

Table 8
The NIEs Total Export Differential 1988-2000

Export Differential US$ millions Hong Kong	1988-1995	1996-2000
Disk drives, Printers, PCs	-281.38	-183.8
Printed circuit boards	-126.25	-201.6
Consumer electronics	-137.88	-57
Telecoms equip	-98.25	-115.6
Semiconductors	-154.38	-16.6
Electronics	-798.34	-574.8

Export Differential US$ millions S. Korea	1988-1995	1996-2000
Disk drives, Printers, PCs	-433.34	127.2
Printed circuit boards	-365.75	673.4
Consumer electronics	-251.13	-201.6
Telecoms equip	-17.25	183
Semiconductors	476.38	-417.6
Electronics	-591.25	364.44

Export Differential US$ millions Malaysia	1988-1995	1996-2000
Disk drives, Printers, PCs	-84.5	191.6
Printed circuit boards	120.5	484
Consumer electronics	484.88	-196.4
Telecoms equip	124.88	49.6
Semiconductors	359.63	-103
Electronics	1005.5	2611

(continued Table 8)

Export Differential US$ millions Singapore	1988-1995	1996-2000
Disk drives, Printers, PCs	1099.95	-1059.2
Printed circuit boards	376.75	-423
Consumer electronics	26.38	-392.22
Telecoms equip	23.5	-277.6
Semiconductors	171.88	329.8
Electronics	1698	-1139

Export Differential US$ millions Taiwan	1988-1995	1996-2000
Disk drives, Printers, PCs	121	771
Printed circuit boards	233.63	174
Consumer electronics	-325.25	-198
Telecoms equip	-138.13	-8.4
Semiconductors	-243.88	719.2
Electronics	-403.13	1458

LITERATURE REVIEW

Shift-share has been used extensively to analyse differences between regional and national growth rates in variables such as export growth, employment and productivity (Richardson, 1978; Esteban-Marquillas, 1972; Fothergill & Gudgin, 1979; Haynes & Machunda, 1987; Hayward & Erickson, 1995). Although a useful descriptive tool for isolating trends in regional performance and for supplying data for policymakers to interpret changes in the industrial structure of their economies, it is a technique which needs to be handled with some care.

The primary function of shift-share, in the present context, is to ascertain whether there are any patterns in the time profiles of the export differentials or their constituents across countries and product groups over a reasonable period of time. The choice of time horizon, reference group, and destination market are, therefore, critical. Focusing unduly on individual years 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 and the interpretation of the results will differ if the benchmark group against which a country is being compared is changed or the exports are destined to a different market. Herschede (1991), for example, compared the export performance of

China, the east Asian NIEs (Korea, Taiwan, Hong Kong) and ASEAN (Brunei, Indonesia, Malaysia, Singapore, Philippines, Thailand) in the Japanese market over a five year period between 1982 and 1987 and concluded that ASEAN's relative failure was due as much to the strong performance of the NIEs in the Japanese market as to the emergence of China. Voon (1998), on the other hand, included China in the reference group together with Indonesia, Singapore, Malaysia, Thailand, looked at export competitiveness in the US market over a longer period (1982-1994) and found evidence of some rivalry between China and ASEAN4. Similarly, Singapore did worse in a study by Wilson and Wong (1999) when the reference group is ASEAN4 plus Singapore between 1986 and 1995 than in a later paper by Wilson (2000) over a similar period (1983-1995) when competitors including three other 'older' tigers (Hong Kong, Taiwan, Korea) as well as ASEAN partners Malaysia and Thailand.

A second problem relates to the time dimension used in shift-share analysis. Previous studies using shift-share methods to investigate export competitiveness are comparative static in that they only consider changes in exports between the beginning and the terminal years of the time period under investigation for example, Herschede (1991), DBSBank (1992), Voon (1998) and Wilson and Goh (1998). The standard procedure is to use the industry mix at the start of the period to calculate the industry mix effect over the whole period, or to adopt an arbitrary compromise by averaging over the period in some way. This is perfectly reasonable for capturing the general picture but can be a problem if there are significant changes in industrial structures over time as one would expect for the economies considered in this paper. 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 (Barff & Knight, 1988). 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.

For example, in two comparative static studies of Singapore's export competitiveness compared to the 'dynamic Asian economies' (Malaysia, Thailand, Hong Kong, Taiwan, Korea) between 1983 and 1995 by DBSBank (1992) and Wilson and Goh (1998), Singapore had came across as dominant in all manufacturing categories except in apparel and clothing. But if a dynamic approach is adopted, as in Wilson (2000) for the same sample and period, it is clear that Singapore had begun to lose its competitive lead in all categories of manufacturing except office/data processing machines and organic chemicals by the early 1990s.

In this paper, therefore, dynamic shift-share analysis is used. This variation of shift share allows growth rates and industry mixes to vary over the time period and so takes these factors 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. The results of shift-share analysis are also sensitive to the level of aggregation chosen. Most comparative studies on the east and south-east Asian economies have been restricted to the one or two-digit standard international trade classification (SITC). Whilst this gives us the general picture within very broad categories, it needs to be supplemented by further decomposition to narrow down the range of product categories which constitute a significant proportion of each country's exports and to capture areas of specialisation and unwrap the pattern of concentration or diversification within the product groups themselves. For example, SITC category 75, which incorporates office and data processing machines, incorporates a wide range of electronics and related items, not all of which will be relevant to all competitors. In the Voon (1998) paper referred to above, which is based on a one-digit classification, Singapore's only positive export differential between 1990 and 1994 was in primary products! Of course Singapore's competitors were 'catching-up' in manufactured goods but to get beyond the catch-up effect requires a further penetration into at least the two-digit level in SITC categories 5, 7, and 9. By contrast, we look at five three-digit level categories of electronics, as well as electronics in aggregate.[4]

A final problem concerns the distinction between gross and 'domestic' export data and discrepancies in reported data. For most countries where the import content of exports is relatively small, the use of total export data would be perfectly adequate to capture the contribution that exports make to the domestic economy and differences in absolute size between countries (China's exports are huge in comparison with Singapore and Hong Kong). However, in the case of Singapore, since a substantial part of its trade (particularly with other Asian countries) has historically taken the form of entrepot exports, we use domestic exports instead, which automatically excludes re-exports. This gives a more accurate representation of changes in export competitiveness insofar as it captures the exports that Singapore generates from its own industrial base (Sen, 2000).

A similar problem arises with respect to Hong Kong, which reverted to Chinese sovereignty in 1997. The rather special characteristics of the Hong Kong economy mean that it continues to be treated independently in empirical work on trade. But, since a large proportion 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 itself (Ho, 1998; Fung & Lau, 1998). Again we use domestic exports.

EMPIRICAL ANALYSIS

In the present context, the objective is to compare China's export performance in electronics against a reference group which includes the main Asian NIE competitors using a dynamic version of shift-share analysis. Details on the precise methodology used to calculate the results can be found in Appendix 1. The focus here is on export growth over a period of time where the regions are the competing east Asian NIEs (China, Hong Kong, South Korea, Malaysia, Singapore, Taiwan) and the nation is the combined group of these countries. Shift-share is applied to five three-digit export categories of electronics as well as to aggregate electronics exports for the six reference economies selling to the USA, EU, and Japan between 1988 and 2001. The export data was extracted from the UN Combase online database.

The Export Differential

Table 7 shows China's average export differential (or shift effect) to the three developed country markets for electronics as a whole and by three-digit sub-category over the periods 1988 to 1995 and 1996 to 2000. These differentials capture any difference between China's performance and that part of the total change in exports due to the rate of export growth of the reference group as a whole (the share effect) and are measured in absolute US dollars. A positive differential implies an improvement in competitiveness relative to the reference group as a whole and a negative value constitutes a deterioration in competitiveness.

The results suggest that China has now emerged as a serious contender in electronics exports, especially in consumer electronics, telecommunications equipment and in disk drives, printers and PCs (except in the Japanese market).

However, China's position has not been a dominant one, primarily due to the uneven performance across product categories. In terms of printed circuit boards and semiconductors, which contain some higher end exports, China has not made any significant impact in developed

country markets when measured against the performance of the other NIEs. This is not surprising since China's manufactured exports in general are still relatively concentrated in lower-end categories of products, such as clothing and textiles compared to the other more mature industrialised reference economies. High tech exports, including aerospace, computers, pharmaceuticals, and scientific equipment constituted only 18% of China's manufacturing exports in 2000, substantially less than the other more established manufacturers of Malaysia (58.2%) and South Korea (34.2%) (World Bank, 2002).

Table 8 summarises the shift-share results for the other NIEs. Taking Tables 7 and 8 together for electronics *as a whole*, the principal gainers after 1995 summed across all three export markets appear to be newcomers China and Malaysia at the expense of the older Tigers Hong Kong and Singapore. Hong Kong is clearly no longer a serious contender in any category of electronics, while for Singapore, the loss of competitiveness appears to be more recent. Its overall electronics exports performed well between 1988 and 1995 in all markets compared to the reference economies coinciding with a period when there was substantial foreign investment in the electronics sector and positive spillovers from other economies in the region, which were expanding strongly over this period. These were the "golden" years for Singapore's electronics exports which benefited from first-mover advantage in southeast Asia by switching into higher value-added and capital-intensive electronics exports earlier than her competitors and gaining a significant foothold as an important production and export centre. However, the general trend of positive net shifts for Singapore electronics seems to have reversed around 1996 in all three export markets. In fact, Singapore was the only economy among the reference economies to experience continuous negative export differentials between 1996 and 2001 (Monetary Authority of Singapore, 2002). The only bright spot for Singapore was semiconductor exports which experienced positive average differentials over all periods.

In the cases of South Korea and Taiwan, the results are less clear-cut. For South Korea, a negative differential in electronics prior to 1996 turned positive in the second period but was insufficient to offset the earlier negatives as far as the whole period is concerned. But apart from consumer electronics and semiconductors, there were small positive differentials in the other categories in the second period. Taiwan does well in disk drives, printers, and PCs in both periods and in semiconductors and printed circuit boards in the second period, but closer examination of the data suggests that the positive differentials overall are largely determined by sizeable absolute gains in the Japanese market in the late 1990s. After the 1998 Asian financial crisis, many

Japanese electronics firms began to outsource their manufacturing operations and Taiwanese contract manufacturers were the main beneficiaries.

Although China and Malaysia stood out in terms of overall performance in electronics since the mid-1990s, no single reference economy appears to have dominated all categories of electronics exports. Malaysia and Taiwan (and maybe South Korea) are competitors with China in disk drives, printers, and PCs; Taiwan in consumer electronics (positive differentials from 1996 are offset by a large negative value in 2000); and Malaysia and South Korea in telecommunications equipment. In the higher value-added sectors of semiconductors and printed circuit boards, where so far China has not been so competitive, Singapore, Taiwan and Malaysia dominate the former[5] while Malaysia, South Korea and Taiwan are still the key players in the latter.

Decomposition of the Export Differential

A key feature of shift-share analysis is its ability to identify both the overall pattern of a country's export growth relative to a reference group, and to decompose this performance in terms of its export structure, competitiveness (growth rate), and the interplay between export structure and competitiveness (see Appendix 1). In general, a favourable industrial mix effect (IME) means that a country's share of exports in fast growing industries is larger than the reference group or its share in slow growing industries is smaller. On the other hand, a positive competitive effect (CE) would result if a given sector grows faster than the rate for the group as a whole; and a positive interactive effect (IE) would be indicative of a favourable combination of economic structure and competitiveness.

Appendix 2 decomposes China's average export differential over the two time periods and three developed country markets. China's switch from negative to positive export differentials since the early 1990s, especially in consumer electronics and telecommunications equipment (and to some extent in disk drives, printers, and PCs) has overwhelmingly been driven by a strong CE effect, while the IME has generally been negative. The CE effect was positive in all product categories in the first period and negative only for Japan in printed circuit boards in the second period. The IME was negative in all categories in the first period and positive only for telecommunications equipment in Japan, and consumer electronics in the EU and USA in the second period. This combination of a strong positive CE but a less-

than-optimal industry mix resulted in large and negative IE's for China in the first period, but in the second period some positive interaction effects were beginning to appear in consumer electronics, printed circuit boards, and telecommunications equipment, but they are not very large in magnitude.

However, if China can sustain rapid growth in exports and is able to consolidate its industrial base, China's overall competitiveness can be expected to improve substantially in the future. Its low cost structure, an increasingly skilled workforce, and an influx of technology and management skills associated with large FDI inflows, together with its entry into the WTO, places China in a very favourable position.

CONCLUSION

The object of this paper was to apply dynamic shift-share analysis to examine the export performance of China's electronics sector in relation to a reference group of east Asian NIEs which have become increasingly close competitors in the export markets of the USA, EU, and Japan between 1988 and 2001. Previous studies using shift-share methods have tended to focus on the one or two-digit export classification and have adopted a comparative static perspective. By contrast, the present paper has looked at five three-digit electronics categories, as well as electronics as a whole, adjusted total export data for re-exports where appropriate, and has applied a more methodologically robust 'dynamic' version of the shift-share methodology.

Our findings suggest that China has now emerged as a serious contender in the export market for electronics goods but its position has not been a dominant one. The main gains have been in consumer electronics and telecommunications equipment, and to a lesser extent in disk-drives, printers and PCs, but in printed circuit boards and semiconductors, which contain higher-end products, China has not yet gained a significant stronghold in developed country markets, at least to the extent that the growth in overall exports and increase in market shares might suggest.

Moreover, China's switch from negative to positive export differentials in the overall electronics market since the early 1990s has been largely underpinned by strong export growth rather than a favourable industry mix.[6] Nonetheless, if China can sustain rapid growth in exports and is able consolidate its industrial base, its overall export competitiveness can be expected to improve in the future. Its low cost structure, an

increasingly skilled workforce and an influx of technology and management skills associated with large FDI inflows, together with its entry into the WTO, places China in a very favourable position.

Has China become a serious threat to east Asian competitors in electronics exports?

For electronics as a whole, our results suggest that the principal gainers after 1995 across all three export markets appear to be the relative newcomers China and Malaysia at the expense of the older Tigers: Hong Kong and Singapore, with more ambiguous implications for South Korea and Taiwan. However, no single reference economy seems to have dominated all categories of electronics exports by the second half of the 1990s.

An important question is how long it will take before China catches up in higher value-added production and how successfully the competitors use this breathing space to make the necessary structural adjustments. In the east Asian region, the less developed members of ASEAN would appear to be at most risk in the immediate future since they compete head on with China in lower-end manufacturing and for FDI, and are in danger of being 'leapfrogged' in the value-added chain. China has already overtaken ASEAN as a low cost export production base and attractor of FDI. Much will depend on how quickly wages in China rise with productivity increase. Given a large potential labour supply from the rural sector, it could be some time.

The problem here is not simply higher relative costs in ASEAN but the fact that they are still competing head-on with China both in their domestic markets and in third markets, including lower-end electronics goods. Much will depend on their ability to raise their value-added and find more niches which are complementary to China's manufacturing production rather than competing with it, and to improve the quality of their infrastructure and the transfer of technology from multinational corporations (MNCs). Indonesia, for example, has been trying to establish itself as an attractive offshore base for Singapore's lower-end manufacturing under the umbrella of the 2003 free trade agreement between Singapore and the USA. The past record of Malaysia and Thailand in areas such as the automotive industry suggests that they are better placed than Indonesia and the Philippines, and the least developed members of ASEAN – Vietnam, Cambodia, Laos and Myanmar, but even Malaysia is finding it difficult to broaden its manufacturing base from over-reliance on low cost manufacturing and natural resources, and increase the technology transfer from MNCs.

Notwithstanding political tensions, the Asian tigers with close proximity to China are probably better placed to adjust to China's manufacturing dominance since they are no longer low cost back-end producers competing in commodities, but are already competing in front-end marketing, design, product innovation/differentiation, quality semiconductors, logistics/hub activities, and are integrating more successfully with China and finding complementarities.[7] A large proportion of Taiwan's electronic products are now manufactured in China including those of electronics firm ACER, and South Korean firms, such as Samsung, are also producing in the mainland.

Singapore does not have the advantage of geographic proximity to China but has an impressive record for adjusting to changes in the external environment, is currently nurturing high value-added manufacturing clusters in electronics, chemicals and bio-medical sciences, diversifying its exports to give them a more global dimension, and is continuing to promote itself as a premier financial centre (Peebles & Wilson, 2002).

These conclusions, of course, need to be taken in the context of the limitations of shift-share analysis, as discussed above, and interpreted with care. As growth in the older Asian tigers slows to its medium-term potential, their export performance is also likely to moderate relative to other economies in the region. This is a natural transition and is largely dictated by supply-side considerations. A negative export differential within a broad manufacturing category need not, therefore, signify a loss of competitiveness overall, but rather conceal a natural process of changing comparative advantage or a process of catching-up as rising real wages and productivity 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 which may not be included in the analysis.

Neither is shift-share a mechanistic tool signaling an inevitable process of success or failure to compete in international markets since any adverse movements in export competitiveness relative to the group as a whole can be changed by implementation of appropriate policies, such as trade liberalisation, incentives for inward FDI, or export promotion.

It is also important to bear in mind when assessing the 'Chinese threat' that trade is not a zero sum game akin to a competitive sport since trade between a group of countries usually generates symbiotic benefits

to all concerned depending on the direct and indirect stimuli through mutual imports. Thus whilst the NIEs are export competitors of China, China is simultaneously an important market both for their final goods and for their intermediate exports which are ultimately destined for other markets, as well as a source for tourists and China-registered FDI. Indeed, many of the east Asian economies, such as Singapore and Malaysia, have been major beneficiaries of 'growing neighbours' in the region in the last two decades due to relatively high trade openness and strong trade multiplier linkages with regional economies (Abeysinghe & Wilson, 2002).

Moreover, the strong growth in these countries' exports to China has partly resulted from a strengthening in the production network within the region as they have been increasingly exporting intermediate components, such as semiconductors and disk drives, to other Asian countries which then assemble them into end products such as PCs and telecommunications equipment. MNCs typically decentralise their electronics production within the region in order to capitalise on the comparative advantage of each country. Higher-end intermediate electronics components (typically semiconductors), are produced in one country and are then shipped to the other Asian countries for assembly into final products for export to the developed country markets. Thus, whilst Singapore, for example, has seen a decline in the growth of its overall exports in recent years, this has been offset to some extent by a rise in the importance of intermediate exports of electronics components or re-exports to countries in the east Asian region, including China (Monetary Authority of Singapore, 2002).

END NOTES

[1] The concept of competitiveness is an illusive one with its origins in the business literature analysis of corporate strategy, where trade is a 'zero sum game' in terms of the quest for increased market share.

Standard trade theory, on the other hand (for example, Krugman 1994) is adamant that in an equilibrium setting all countries gain from trade. But if the equilibrium assumptions are relaxed then the picture is more complex and competitive advantage can then be created by national policies. For a discussion of these issues, see Lall and Albaladejo (2004).

[2] Of course the trade to GDP ratio is only a crude proxy for trade openness as are export growth and increases in export market shares. China's export growth rate declined over the 1990s for manufactured products (reflecting the slowdown in world trade) but its export structure shifted significantly towards medium and high technology products. This evolution of export structures which are increasingly similar to its competitors might suggest that China is becoming more of a threat. See Lall and Albaledejo (2004) and Lall and Weiss (2005).

[3] This may significantly understate Taiwan's performance compared to the other NIEs insofar as it's electronics industry began relocating out significantly after 1985 and directly to China from 1991, helped by the integrated operations of markets, government investment in R&D and high-tech human capital and 'trust'. This helped to transform Taiwan's information hardware industry into one of high volume, low margin production and into a global service provider. See Rasiah and Yeo (2005).

[4] Even within the 3-digit classification one cannot distinguish between firms which are engaged in assembly-type activities based on simple capacitors and resistors and the assembly of more sophisticated microprocessors. We are grateful for an anonymous referee for pointing this out.

[5] Malaysia's differentials after 1995 were overwhelmingly positive in semiconductors but the averages were turned negative by a very sizeable fall in 2000.

[6] It is interesting that in Herschede's (1991) earlier and broader shift-share analysis of China, ASEAN and the NIEs, China's less impressive performance compared to the NIEs was also based on a weaker industry mix effect.

[7] Lall and Albaladejo (2004) found that China's gains in export market share in the 1990s compared to her neighbours in east Asia were mainly in low technology products and differed by country. The mature tigers, such as Singapore, Korea and Taiwan, suffered most, particularly in low technology goods, but were already losing

competitiveness in these goods and they benefited significantly from China's role as an engine of growth and from complementarities. These are not guaranteed in the future unless they can keep their technological edge over China. The main threat is to the less technologically advanced new tigers, such as Thailand and Malaysia, that have much higher wages than China but lack the domestic capabilities to keep ahead of it.

REFERENCES

Abeysinghe, T., & Wilson, P. (2002). International competitiveness. In M. K. Chng, W. T. Hui, A. T. Koh, K. L. Lim, & B. Rao. (Eds.), *The Singapore Economy in the 21st Century: Issues and Strategies.* Singapore: McGraw-Hill.

Asian Development Bank (ADB), (2002). *Key indicators of developing Asian and Pacific countries 2002*. Manila: Asian Development Bank.

Barff, R., & Knight, P. III. (1988). Dynamic shift-share analysis. *Growth and Change, 19* (2), 1-9.

DBSBank, (1992). Singapore's export competitiveness vis a vis other dynamic Asian Economies. *Singapore Briefing*, No. 29. Singapore: Economic Research Department, DBSBank.

Esteban-Marquillas, J. M. (1972). Shift-and-share analysis revisited. *Regional and Urban Economics*, 2 (3), 249-261.

Fothergill, S., & Gudgin, G. (1979). In defense of shift-share. *Urban Studies*, 16 (3), 309-19.

Fung, K. C., & Lau, L. J. (1998). The China-United States bilateral trade balance: How big is it really? *Pacific Economic Review*, 3 (1), 33-47.

Haynes, K., & Machunda, Z. (1987). Considerations in extending shift-share analysis. *Growth and Change, 18* (2), 69-78.

Hayward, D., & Erickson, R. (1995). The North American trade of U.S. states: A comparative analysis of industrial shipments, 1938-91. *International Regional Science Review, 18* (1), 1-31.

Herschede, F. (1991). Competition among ASEAN, China, and the East Asian NICs - a shift-share analysis. *ASEAN Economic Bulletin*, 7 (3), 290-306.

Ho, L. S. (1998). Country-of-origin rules: Its origin, nature, and directions for reform. *Pacific Economic Review, 3* (2), 161-166.

International Enterprise Singapore (formerly the Singapore Trade Development Board). Retrieved from www.ie.gov.sg.

International Monetary Fund, (2002). *International Financial Statistics*. Washington DC.: The International Monetary Fund.

Krugman, P. (1994). Competitiveness: A dangerous obsession. *Foreign Affairs*, *73* (2), 28-44.

Lall, S., & Albaladejo, M. (2004). China's competitive performance: A threat to East Asian Manufactured Exports? *World Development, 32* (9), 1441-1466.

Lall, S., & Weiss, J. (2005). *China's competitive threat to Latin America: An analysis for 1990-2002.* University of Oxford, Queen Elizabeth House Working Paper, 120.

Monetary Authority of Singapore, (2002). *Assessing Singapore's export competitiveness* through dynamic *shift-share analysis*. Economic Policy Department, Monetary Authority of Singapore, Occasional Paper No. 23.

MTI-TDB (2001). *Highlights of Singapore's 2000 trade rankings by the World Trade Organisation*. Ministry of Trade and Development (Economics Division) and Trade Development Board (Research and Statistics Unit).

Peebles, G., & Wilson, P. (2002). *Economic growth and development in Singapore: Past and future.* Cheltenham, UK: Edward Elgar.

Rasiah, R., & Yeo, L. (2005). Learning and innovation: The role of market, government and trust in the information hardware industry in Taiwan. *International Journal of Technology and Globalisation*, *1* (3-4), 400-432.

Richardson, H. (1978). The state of regional economics: A survey article. *International Regional Science Review*, *3* (1), 1-48.

Sen, R. (2000). Analysing international trade data in a small open economy: The case of Singapore. *ASEAN Economic Bulletin*, *17* (1), April.

Voon, J. P. (1998). Export competition of China and ASEAN in the US market. *Asean Economic Bulletin*, *14* (3), 273-292.

Wilson, P., & Goh, K. H. A. (1998). The export competitiveness of dynamic Asian economies, 1986-93: A shift-share analysis. *Journal of the Asia Pacific Economy, 3* (2), 237-250.

Wilson, P., & Wong, Y. M. (1999). The export competitiveness of ASEAN economies 1986-95. ASEAN *Economic Bulletin*, *16* (2), 208-229.

Wilson, P. (2000). The export competitiveness of dynamic Asian economies 1983-1995: A dynamic shift-share approach. *Journal of Economic Studies, 27* (6), 541-565.

World Bank (2002). World development indicators database. Retrieved from http://www.worldbank.org/data/.

World Investment Report (2002). UNCTAD. http://www.unctad.org.

APPENDIX 1: THE SHIFT SHARE FORMULA

The particular version of shift-share analysis used here is based on Wilson (2000) and utilises the national growth rate methodology of Richardson (1978) and Esteban-Marquillas (1972) but combines it with the dynamic version of shift-share of Barff and Knight (1988).

Let e=exports, i=export category, j=a competing country, then the change in exports of category i of competing economy j to a specific destination de_{ij} is given by the share effect s_{ij}, the industry mix effect m_{ij}, the competitive effect c_{ij} and the interactive effect a_{ij}:

$$de_{ij} = s_{ij} + m_{ij} + c_{ij} + a_{ij}$$

In other words, each sector of each country has a standard growth component given by s_{ij} to which must be added the positive and negative contribution due to factors associated specifically with each country $(m_{ij} + c_{ij} + a_{ij})$

s_{ij} represents the change in exports which would have occurred if the structure of exports in the competing economy had followed the reference group (homothetic exports e'_{ij}) and its export category had grown (r_{ij}) at the corresponding group rate r_{i0}:

$$s_{ij} = e'_{ij} r_{i0} \quad \text{where } e'_{ij} = e_{i0} \cdot e_{0j} / e_{00}$$

$\quad\quad\quad$ e_{i0} = exports of i from the reference group 0
$\quad\quad\quad$ e_{0j} = total exports from the competing economy
$\quad\quad\quad$ e_{00} = total exports from the reference group

If $e_{ij} - e'_{ij}$ is positive the individual country is specialised relative to the group and vice versa if it is negative. Hence any difference between the actual changes in exports in sector i of country j and the share effect s_{ij} represents the net shift or shift effect or export differential ed_{ij} ascribed to the specific characteristics of the individual economy and is measured in absolute US dollar values.

$$ed_{ij} = de_{ij} - s_{ij} = de_{ij} - e'_{ij} r_{i0} = e_{ij} r_{ij} - e'_{ij} r_{i0}$$

A positive value for the export differential implies an improvement in competitiveness relative to the reference group and a negative value constitutes a deterioration in competitiveness. The export differential is in turn accounted for by the three additive components m_{ij}, c_{ij} and a_{ij}.

The industry mix effect m_{ij} shows how much of the export differential is due to a divergence between the competing economy's economic structure compared to the reference group. It will be positive if a country's share of exports in fast growing industries is larger than the reference group or its share in slow growing industries is smaller. On the other hand, the mix effect will be unfavourable if the economy is dominated by relatively slow growing industries or it has a dearth of fast growing ones.

$$m_{ij} = r_{i0} (e_{ij} - e'_{ij})$$

The competitive effect c_{ij} shows how much of the export differential is due to a difference between the export growth rate of the competing economy and the group, or in other words, 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 it has a competitive advantage in that product category.

$$c_{ij} = e'_{ij} (r_{ij} - r_{i0})$$

Finally, the interactive effect a_{ij} shows how much of the export differential is attributable to a combination of the industry mix effect and the competitive effect or economic structure and competitiveness. It indicates whether the country is specialised in those sectors in which it also enjoys a competitive advantage and will take on a positive value if either the competing economy specialised on exports in which it has a competitive advantage or produces little of the exports in which it has no such advantage.

$$a_{ij} = (e_{ij} - e'_{ij}) (r_{ij} - r_{i0}).$$

APPENDIX 2: CHINA'S AVERAGE EXPORT DIFFERENTIAL DECOMPOSED 1988-2000

China 1988-1995	Industry mix effect	Competitive effect	Interactive effect	Differential
Disk drives, Printers, PCs				
USA	-166.75	151.78	-1453.63	-102.63
Japan	-155.5	3412.25	-3489.25	-142.63
EU	-154.13	2652.5	-2601.25	-102.88
Total	-512.63	5171	-5030.25	-370.88

Printed circuit boards				
USA	-114	136.38	-123.13	-100.75
Japan	-47.5	108.75	-101.13	-40
EU	-85	1386.38	1370.25	-69
Total	-278.13	498.88	-459.88	-239.13

Consumer electronics				
USA	-16	445.13	-319.13	109.88
Japan	-40.25	131.5	-109	-17.75
EU	-17.25	524.75	-418.5	88.88
Total	-58.5	1147.75	-885.88	203

Telecoms equip				
USA	-11.48	433.75	-350	72.25
Japan	-20.63	203.13	-149.13	33.38
EU	-55	603	-573.5	-25.75
Total	-72.25	1090.13	-912.38	105.25

Semiconductors				
USA	-263.89	462	-453.75	-255.75
Japan	-202.5	463.38	-455.25	-169
EU	-171.25	386.13	-383.13	-168.25
Total	-631.19	1059	-1036.75	-609.63

Electronics				
USA	-511.75	2182.12	-1947	-276.88
Japan	-432.75	763.75	-692.88	-361.5
EU	-446.75	2093.75	-1923.75	-276.75
Total	1438.25	5706.63	-5179.75	-911.75

China 1996-2000	Industry mix effect	Competitive effect	Interactive effect	Differential
Disk drives, Printers, PCs				
USA	-277.4	1732	-1215.2	239.8
Japan	-222.6	187	-160.2	-195.8
EU	-244.6	114.22	-752.4	144.8
Total	-758.6	3227.6	-2315.5	152.8

Printed circuit boards				
USA	-245.4	215.2	-187	-217.6
Japan	-239.4	-119	64	-294.2
EU	-228.8	67.2	-55.6	-217.2
Total	-740.8	221.2	-187.2	-706.8

Consumer electronics				
USA	38.3	137.2	17.8	193.4
Japan	-7.2	23.4	-14.14	2.00
EU	46.8	753.4	68.8	869.2
Total	51.2	1001.4	-7.00	1045.4

Telecoms equip				
USA	-85.4	15.6	-3.6	-73.6
Japan	18.6	42.25	1.98	88.2
EU	-45.6	361.4	-113.2	202.6
Total	-103	329.2	-57	169.2

Semiconductors				
USA	-159.8	1500.06	-1432.2	-93.4
Japan	-267.6	731.2	-652.4	-188.8
EU	-200.8	954.6	-895.4	-141.6
Total	-605.8	3163.6	-2944.2	-386.6

Electronics				
USA	-822.2	2588	-1717.2	48.4
Japan	-653.8	282.2	-217	-588.8
EU	-878.8	4143.2	-2406.4	857.8
Total	-2458.2	7628.6	-4896	274.2