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China's Competitive Performance: A Threat to East Asian Manufactured Exports?

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Summary. — We examine China's competitive threat to East Asian neighbors in the 1990s, benchmarking performance by technology and market. Market share losses are mainly in low-technology products; Japan is the most vulnerable market. China and its neighbors are raising high-technology exports in tandem: international production systems here are leading to complementarity rather than confrontation. In direct trade with its neighbors, China is acting as an engine of export growth, with imports outpacing exports. This may change, however, as China climbs the value chain and takes over activities that have driven East Asian export growth even within integrated production systems.

Key words — China, East asia, trade, export competitiveness, technological categories

1. INTRODUCTION

Concern about China's competitive threat is widespread (in developed economies such as the United States as well as developing ones such as the Mexico), but is strongest in East and Southeast Asia. China's burgeoning exports—backed by cheap and productive labor, a large stock of technical manpower, huge and diversified industrial sector, attractiveness to foreign investors, use of industrial policy, and, now, freer access to world markets under World Trade Organization (WTO)—lead to apocalyptic visions of export losses. [1] China is most threatening to neighbors that rely primarily on low wages for their export advantage. As it upgrades its export structure, however the more advanced economies (Singapore, Hong Kong, Korea and Taiwan) also fear for their competitiveness. The current hollowing out of their low-end manufacturing may soon extend to complex production, design, development and related services. Domestic markets are also threatened by China, but so far most attention seems to have been on exports.

Offsetting this threat are the promise of the dynamic Chinese market (WTO accession is only one of several initiatives to liberalize regional trade) and the potential for collaborating with it to export to the rest of the world. Trade with East Asia is flourishing. China imports from the region are growing faster than its exports, not only of resources but also of manufactures. Its advanced neighbors are selling it consumer goods, intermediates and machinery and using it as a base for processing exports to the rest of the world. Less-advanced countries are being knit with it into multinational production networks. Multinational companies (MNCs) now account for around half of Chinese exports (and much more of its

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high technology exports, UNCTAD, 2002) and are incorporating China into global systems (''fragmentation'' and ''segmentation'' are used to describe this phenomenon.) [2] along with earlier entrants, so promoting regional trade. China's own enterprises are specializing with respect to regional counterparts and so raising intraindustry trade in differentiated products.

It is difficult to assess whether such complementarities between China and regional economies offset its competitive threat. The dynamics and complexity of the interactions make it impossible to quantify the outcome, even to predict its broad directions. [3] The main issue is not so much as direct competition between China and its neighbors—this is clearly growing—but how the latter's specialization changes in response. If the neighbors, most with higher wages than China, can upgrade into more advanced activities enough to justify their wage premium as China moves into their present activities, they can continue with rapid export growth. If they cannot, they risk export deceleration: a shift to primary products (most of which grow slower than the manufactures that have driven their export growth recently). Or they may be forced to specialize in lower value-added segments of manufactures as China moves rapidly up the technology and quality ladder. [4]

The outcome depends, in other words, on the growth of technological and other capabilities in China *vis à vis* its neighbors, with China having the advantages of lower wages, larger domestic scale, more industrial depth, larger pools of skills and a government willing to use its market size to bargain for greater technology transfer and local linkages. As the East Asian countries differ widely in their industrial capabilities (Lall, 2001a; Lall & Albaladejo, 2002), they face different kinds and intensity of competitive threat from China. The organization of the production system also matters: independent local firms in the region are likely to compete more directly with China than MNC affiliates belonging to an integrated system, which can allow them to adjust more gradually.

In this paper we map China's relative export performance by technology levels and main destinations to assess where its competitive threat is most intense. We focus on the export performance of major East Asian countries [5] in third markets as well as on trade with China. We focus on 1990–2000 because this is when China's export growth accelerates and diversifies significantly and when foreign direct investment inflows become significant (China's FDI boom dates from 1992). The global production networks that account for such a large part of its export performance are a phenomenon of the 1990s (Lall *et al.*, 2004; Lemoine & Unal-Kesenci, 2002). We end the analysis in 2000 rather than 2001 because there was a trade recession in 2001. Global exports fell by 4% (WTO, 2002) and the decline was particularly marked in electronics, which comprise over two-thirds of East Asian exports (and which tend to lead business cycles down as well as up). As we are interested in longer term trends rather than short-term cycles, we considered that 2000 data met our purposes better. At the time of the analysis, 2002 data were not available for all the countries covered.

2. ANALYTICAL FRAMEWORK

The concept of ''competitiveness,'' while widely used, remains controversial (Lall, 2001b). It comes from the business literature, where it forms the basis for corporate strategic analysis. Companies compete for markets and resources, measure competitiveness by relative market shares or profitability, and use competitiveness strategy to improve their performance. National competitiveness is assumed to be similar: economies compete with each other, measure competitive performance by trade performance, and can effectively mount competitiveness strategy. This may be meaningful for specific activities: the United States, for instance, has become ''less competitive'' in making textiles and ''more competitive'' in making computers. But is it meaningful to say that the United States is becoming less or more competitive as a whole?

Krugman (1994) argues that it is not. To him, ''competitiveness is a meaningless word when applied to national economies. And the obsession with competitiveness is both wrong and dangerous'' (p. 44). Krugman is right that ''international trade is not a zero-sum game'' and that in a general equilibrium setting all participants benefit (p. 34). To focus on the rise or fall of particular activities is partial and misleading. Declining US competitiveness in textiles does not mean that the US *economy* is less competitive: the decline reflects its changing endowments and is a necessary shift to new areas of comparative advantage.

Standard trade theory applies only where its assumptions hold: with perfect competition and information, no uncertainty, full factor mobility (within countries), equal access to technology, no scale or agglomeration economies, no externalities and no learning costs, there is indeed no way to define national competitiveness. But, if the assumptions are made more realistic, the outcome is quite different (Lall, 2001b). With oligopolistic markets, externalities, differentiated products, scale and agglomeration economies, costly and uncertain learning processes, technological lags and so on, it cannot be assumed that free trade optimizes allocation. In this setting, history, learning, size and externalities matter, and policies can make a significant difference. Competitive advantages can then be created by national strategies to exploit static advantages and create new advantages, and they can be preserved by appropriate policies given threats from new competitors with lower wages and other advantages (as in the present case).

There is no accepted technique for analyzing an "export threat." In the business literature, the common measure is relative market shares, and we rely on this measure for most in this paper: there is a "competitive threat" if China gains export market share and the other country loses, the intensity of the threat given by the extent of the relative change. We disaggregate exports according to technological categories to gain a deeper understanding of the changes, grouping products into four main categories (following Lall, 2000): RB (resource based), LT (low technology), MT (medium technology) and HT (high technology). [6] These categories are disaggregated into nine subcategories for some analysis.

This classification is useful in that it provides a basis for hypothesizing where China's competitive threat is likely to emerge based on its factor endowments (broadly defined) relative to its neighbors. Thus, China's main advantage may be expected to be in low-cost labor, giving it a strong advantage in low-technology products. Countries such as Malaysia, Indonesia and possibly Thailand are better endowed in terms of natural resources. Singapore, Korea and Taiwan are stronger in terms of technology (Malaysia is also ahead in R&D spending). [7] Moreover, since different technology groups show systematically different growth rates in recent years, structural change in export patterns allows us to assess export growth potential for each country.

We assess the potential for China's competitive threat for each country by assessing the extent to which their export structures resemble that of China over time and the degree of overlap within each technological category. The analysis is done first for the world as a whole and then for major export markets: the United States, Japan and Europe.

There are three drawbacks to this analysis. First, the technological categories are very broad and do not take shifts over time into account. Second, it cannot be assumed, given market imperfections, externalities and policy interventions, that endowments are reflected in export patterns. Moreover, subsidies, quotas and bilateral agreements may affect the outcome. Moreover, it is difficult to assess national "endowments" and export-oriented FDI can change export patterns without corresponding changes in endowments (Arndt & Kierzkowski, 2001). Inferences thus have to be drawn with great care.

Third, and possibly most important for this paper, is that it is difficult to infer *causal relationships* from relative export and market share data to the competitive impact of Chinese entry. This problem cannot be resolved at the levels of aggregation used here (it may be possible to trace competitive impacts directly at the level of specific products). One partial solution is to examine *combinations of market share changes* for China and neighbors to infer the direction of the impact (Table 1). [8]

There are *five* combinations of outcomes according to world market share (WMS) changes:

(a) *Partial threat:* Both China and its neighbor raise WMS but China grows faster than its neighbor, raising the possibility that its growth is retarding the growth of the other. The threat is partial because of its ambiguous nature: China may be complementing its neighbors' exports in integrated systems.
(b) *No threat:* Both parties gain market share, with China growing slower than its neighbor. Again, it is possible that Chinese entry boosts export growth by the neighbor.
(c) *Direct threat:* China gains market share and its neighbor loses. This is the most direct indicator of a competitive threat, though again there is a caveat. Chinese exports may be undertaken by firms relocating from the neighbor losing market share: its enterprises extend their competitive advantage and benefit the home country by promoting

Table 1. *Matrix of competitive interactions between China and East Asian neighbors in exports*

		Chinese export market shares	
		Rising	Falling
Neighbors' export market shares	Rising	(A) No ostensible competitive threat from China, unless the Chinese growth is faster, and may hold back the growth of regional exports	(B) No competitive threat from China in period under consideration. The threat is reverse, from the region to China
	Falling	(C) Possible competitive threat from China, unless regional market shares were declining in the absence of Chinese entry and China allows high wage countries to extend their competitive advantage by placing operations there	(D) No ostensible competitive threat from China. Both parties lose competitive advantage in export markets

exports of intermediates and related design and marketing activities and remitting dividends.

(d) *China under threat:* China loses market share and its neighbor gains.

(e) *Mutual withdrawal:* Both China and its neighbor lose market share, with neither apparently posing a threat to the other, and suggesting a loss of competitiveness for the region as a whole.

Finally, we examine patterns of intraregional trade (this time including Japan for some calculations) to assess better the systemic integration of China into East Asian production networks. This allows us to evaluate whether China's threat in the rest of world is offset by its direct imports from its neighbors.

3. BACKGROUND ON CHINESE EXPORT PERFORMANCE

Chinese manufactured exports grew by 16.9% per annum over 1990–2000, compared to 6.4% for the world, 12.0% for all developing countries and 10.3% for the rest of East Asia. Its share of world manufactured exports rose from 1.7% to 4.4% over the decade. [9] By 2002, China accounted for 5.1% of world merchandise exports and was the world's fifth largest exporter (after the United States, Germany, Japan and France). China's share of developing world manufactured exports rose from 11% to 20% over the 1990s and of East Asia excluding China from 18.7% to 41.8%. Its export gains spanned the entire technological spectrum, and were largest in the complex products that have driven export growth in the rest of East Asia. Table 2 shows China's merchandise exports in the 1990s.

This export surge is likely to continue. China has "spare capacity" in that its per capita exports are still relatively small, [10] wages are much lower than in its main neighbors and it has large reserves of cheap and disciplined labor (though drawing it into exports will involve the cost of building links with the interior). [11] More importantly, its advantages are not confined to cheap labor, but are upgrading rapidly. China is investing heavily in technology and advanced skills; for example, the share of the relevant age group enrolled in tertiary education rose from 9% in 1997 to 13% in 2000 (UNESCO website). It is exploiting its market size to realize scale economies beyond the reach of many neighbors and using its diverse industrial base to deepen local content. It is drawing in export-oriented foreign direct investment (FDI) rapidly, using its market attractions to induce investors to raise local research and development (R&D) and linkages. Till now it has been able to impose performance requirements of the type banned under WTO rules.

WTO accession may constrain China's ability to use industrial policy (Nolan, 2001) but it will also open up new export opportunities, particularly in textiles and garments. [12] Accession may also enhance its domestic competitiveness: it will improve the investment climate for FDI, make imported inputs cheaper (for enterprises outside special export regimes) and induce faster restructuring of domestic enterprises (Ianchovichina *et al.*, 2003; Lemoine & Unal-Kesenci, 2002).

China's export growth rate declined over the 1990s and halved for manufactured products

Table 2. *China's exports in the 1990s*

	Values (current US$ million)			Growth rates p.a. (%)		
	1990	1995	2000	1990–1995 (%)	1995–2000 (%)	1990–2000 (%)
Total exports	60,805.5	147,634.5	247,579.2	19.4	10.9	15.1
Primary	12,762.1	14,850.5	18,332.1	3.1	4.3	3.7
Manufactured	48,043.4	132,784.0	229,247.0	22.6	11.5	16.9
Resource based	6,849.7	16,495.9	21,814.0	19.22	5.8	12.3
Agro-based	2,895.9	7,780.0	9,422.5	21.9	3.9	12.5
Mineral-based	3,953.7	8,715.9	12,391.5	17.1	7.3	12.1
Low technology	24,934.0	69,037.3	102,860.3	22.6	8.3	15.2
Fashion cluster	18,318.2	45,778.4	63,908.1	20.1	6.9	13.3
Other LT	6,615.7	23,258.9	38,952.2	28.6	10.9	19.4
Medium technology	12,939.6	27,859.7	48,566.1	16.6	11.8	14.1
Automotive	3,762.5	1,669.5	4,270.0	−15.0	20.7	1.3
Process	3,307.0	10,706.7	14,240.3	26.5	5.9	15.7
Engineering	5,870.2	15,483.5	30,055.7	21.4	14.2	17.7
High technology	3,320.1	19,391.1	56,006.7	42.3	23.6	32.7
Electronic	2,278.5	16,037.4	49,689.6	47.7	25.4	36.1
Other HT	1,041.6	3,353.7	6,317.1	26.4	13.5	19.8

Source : Calculated from the UN Comtrade data.

(reflecting the slowdown in world trade), but remained high. Within LT products, the "fashion cluster" (textiles, clothing and footwear) comprised the largest group, but the export structure shifted significantly towards medium and high technology products (Figure 1). The machinery sector (MT engineering and HT electronics) was the fastest growing activity. The automotive sector lost ground but this is likely to be temporary; the industry is expanding and improving—once domestic demand is satisfied it is likely to enter exports.

Table 3 shows the technology structure of Chinese and neighbors' manufactured exports.

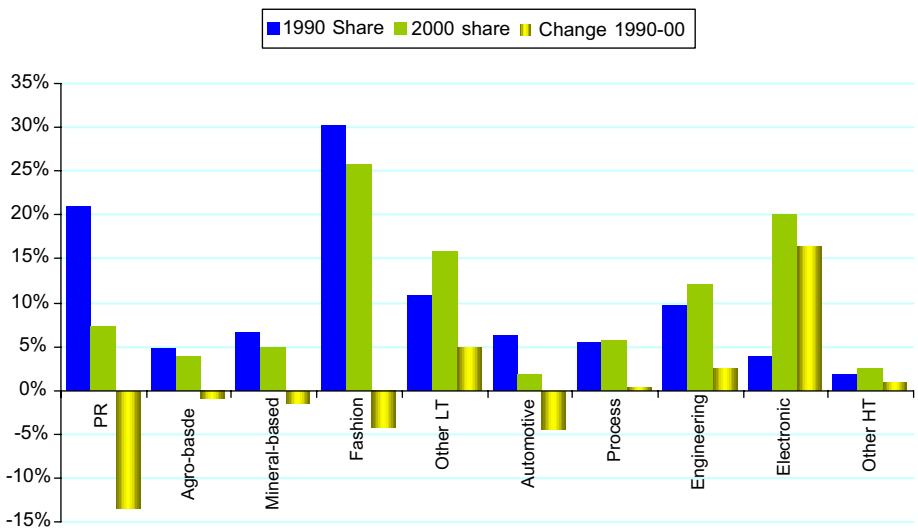

Figure 1. *Structure of Chinese exports, 1990–2000 (calculated from UN Comtrade data).*

Table 3. *Technology structure of manufactured exports by China and its East Asian neighbors*[a]

	China		Korea		Taiwan		Singapore		Hong Kong		Malaysia		Thailand		Indonesia		Philippines	
	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)
RB	14.3	9.5	7.1	11.7	6.9	4.4	27.8	14.9	4.2	4.5	31.9	13.1	24.2	18.4	54.2	33.7	37.6	6.5
LT	51.9	44.9	40.0	17.1	41.3	23.8	9.6	6.5	55.5	58.9	14.8	9.6	40.1	21.5	32.6	31.3	33.7	11.9
MT	26.9	21.2	31.3	34.0	26.1	25.5	23.4	17.4	19.5	9.4	18.0	17.8	15.1	23.8	11.3	17.5	12.9	11.6
HT	6.9	24.4	21.6	37.1	25.7	46.3	39.1	61.2	20.8	27.2	35.3	59.4	20.6	36.3	1.9	17.4	15.8	70.0
"Simple"	66.2	54.4	47.1	28.8	48.2	28.2	37.4	21.4	59.7	63.4	46.7	22.7	64.3	39.9	86.8	65.0	71.3	18.4
"Complex"	33.8	45.6	52.9	71.1	51.8	71.8	62.5	78.6	40.3	36.6	53.3	77.2	35.7	60.1	13.2	34.9	28.7	81.6

Source: UN Comtrade database.

[a] "Simple" products are RB + LT, "complex" products are MT + HT.

The structure upgrades in all economies except for Hong Kong, where there is an increase in the share of LT products. The highest share of simple products, however, is in Indonesia, while the highest share of complex products is in the Philippines, the former because of the weight of RB products and the latter because of a jump in HT (semiconductor) exports. The share of MT is a better indicator than HT of technological depth, since the latter may represent electronics assembly without much local value added. By this measure, Korea has the deepest manufacturing sector and Hong Kong the least. There is also evidence that in the HT category, the greatest local depth is in the mature Tigers (Korea and Taiwan, followed at some distance by Singapore) and the least in the Philippines (see Lall, 2001a, for analyses of various East Asian economies).

China starts with a high share of LT but moves rapidly into complex products, in particular HT. A large part of this is assembly but there is considerable deepening of local content (mainly from FDI in component supplying industries, as international suppliers follow their principals into China) (Lemoine & Unal-Kesenci, 2002; Sturgeon & Lester, 2002). Competent local suppliers are emerging in HT, and the government is, as noted, pressing multinational corporations (MNCs) to raise local R&D.

4. PRELIMINARY INDICATORS OF THE COMPETITIVE THREAT

One indicator of China's competitive threat is the relative evolution of export structures: greater similarity would indicate that China is entering similar specialization and so posing a greater threat. At the broad level, it does appear that the Chinese export structure is rapidly coming to resemble that of its neighbors. [13] While its labor costs are lower, there is a diversity of competitive products emerging from more advanced sectors and from assembly in its special economic zones. But most neighbors have a much higher share of HT products in 2000 than China.

A more detailed comparison of export structures for all 230 products at the SITC three-digit level shows similarities more clearly. Table 4 presents the correlation coefficients between Chinese and regional export structures over time. In 2000, the Chinese export structure was most similar to that of Taiwan in 1990, with significant similarities also to Korea and Hong Kong in 1990. The most similar structures in 2000 were those of Hong Kong, Taiwan and Thailand, the least similar those of Indonesia and the Philippines. In general there was a rise in the correlation coefficients with most countries during 1990–2000, the exceptions being Hong Kong and Indonesia. Again, the implication is that the competitive threat from China was likely to be growing.

Table 4. *Correlation between Chinese and regional export structures (three-digit)*

	China 1990	China 2000
Korea 1990	0.380	0.643
Korea 2000	0.074	0.429
Taiwan 1990	0.341	0.832
Taiwan 2000	0.052	0.527
Singapore 1990	0.101	0.420
Singapore 2000	0.016	0.414
Hong Kong 1990	0.560	0.672
Hong Kong 2000	0.487	0.538
Malaysia 1990	0.278	0.243
Malaysia 2000	0.067	0.442
Thailand 1990	0.300	0.523
Thailand 2000	0.134	0.512
Indonesia 1990	0.382	0.074
Indonesia 2000	0.379	0.330
Philippines 1990	0.228	0.379
Philippines 2000	0.025	0.329

Such similarities however only show the *potential* for competition, they do not demonstrate that competition actually exists. The product categories are still broad and may include products that do not compete with each other. [14] Even if the products were comparable, it is possible that countries specialize in differentiated versions. Even in the same product, countries may complement each other by performing different functions within an integrated production system.

5. RELATIVE MARKET SHARES

Figure 2 shows the results of benchmarking China's export shares in global or other markets against its neighbors for all manufactures (changes by technological category come later). Figure 2 also provides other data besides

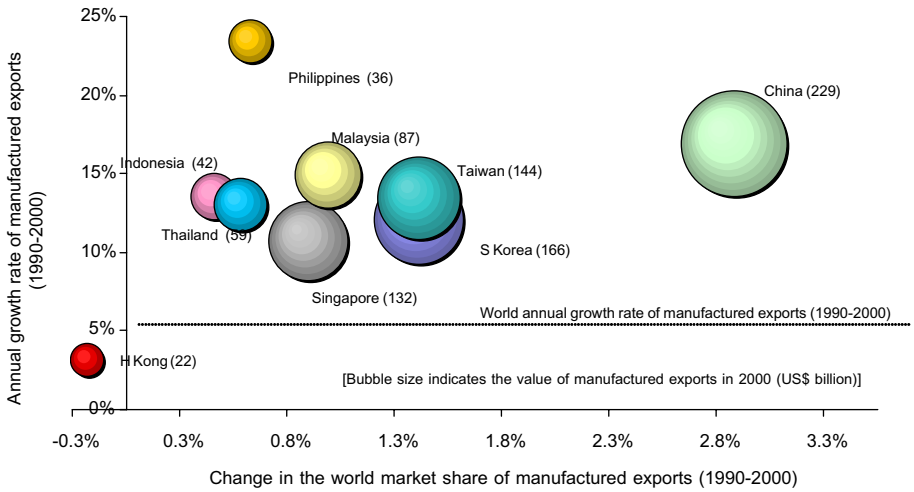

Figure 2. *Changes in world market shares and growth rates of manufactured exports by East Asia (1990–2000) (Calculated from UN Comtrade data).*

market share, showing the value of manufactured exports and growth rates for the 1990s. The world growth rate is shown for comparison.

Exports by all East Asian countries except Hong Kong grow faster than the world average (Hong Kong data are for its own exports, not re-exports). China is now the largest exporter in the region, followed by Korea, Taiwan and Singapore, [15] and second fastest growing one (after the Philippines). Because of its size, China has the largest increase in world market share. Since most other countries also raise market shares it does not appear at first sight that China has eroded their competitiveness. However, they may have grown faster in China's absence, but this cannot be assessed without setting up a plausible counterfactual.

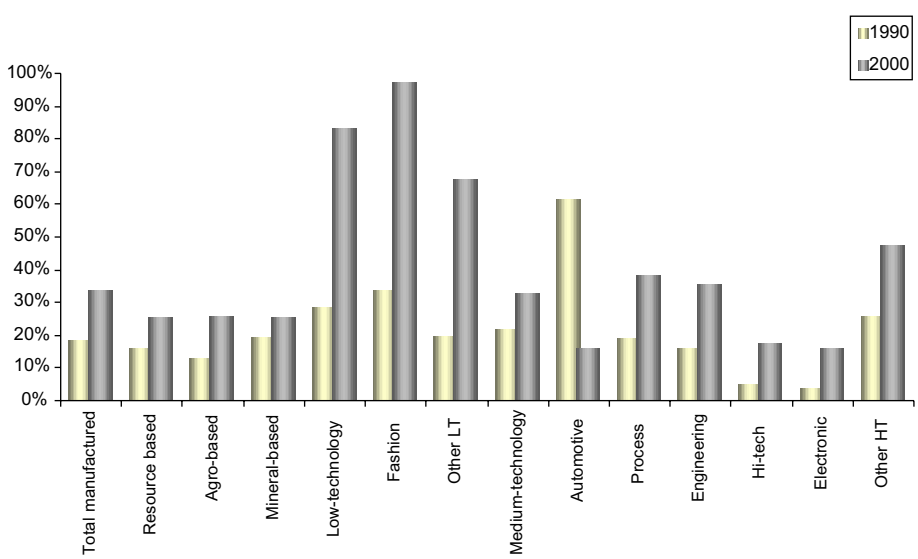

Figure 3. *Chinese exports as share of exports by rest of East Asia (calculated from UN Comtrade data).*

This is difficult, even with general equilibrium modeling, because of the need for simplifying assumptions on structural factors such as technological capabilities, the development of skills, the sourcing strategies of MNCs and so on.

Figure 3 shows how the relative size of Chinese exports by technology categories and subcategories. China's presence is strongest in LT; it is overwhelming in the "fashion cluster" (textiles, clothing and footwear) but also dominant in other LT products (toys, sports goods, simple metal products). It is relatively strong in MT products, particularly process industries and engineering, but low in automotives (the only group where its share falls over time). It is low in HT products, particularly electronics, but rising rapidly; it is stronger in "other HT" (mainly pharmaceuticals).

Table 5 shows world market share changes by technology in 1990 and 2000. Noteworthy features of the table are as follows.

—China is the largest RB exporter in the region (and in the developing world), Korea second and Indonesia third. Singapore is also a significant player, based on its petrochemical facilities, but is losing market share rapidly.

—China dominates LT exports by 2000, though in 1990 it was at the same level as Korea and smaller than Taiwan. Taiwan and Korea remain major exporters of low-technology products, but, expectedly in view of their high wages, have lost market shares. The composition of their LT exports has changed as they move increasingly into heavier products such as textiles for processing (into apparel) in China. Hong Kong remains an important exporter, but is the only country to suffer a decline in absolute export values (again, this refers to its own exports).

—China is the largest gainer in market shares in MT, with its 2000 export values just behind Korea and ahead of Taiwan. In some ways, this is the most impressive aspect of China's export prowess. MT products come from complex, heavy industry and competitiveness is not based on cheap labor or assembly as on broad industrial capabilities. The bulk of China's MT exports in 2000 consists of engineering products ($30 out of $48 billion), with diverse goods such as electrical relays and switches ($3.4 billion), household electrical products ($4.5 billion), radios ($3.0 billion), gramophone and recording machines ($2.9 billion), sanitary, heating and plumbing equipment ($2.2 billion) and others. The 18% growth rate of engineering exports over the decade suggests a massive upgrading of local enterprises (including state-owned firms, Nolan, 2001) and the entry of multinational producers.

—By 2000 China is the fourth largest HT exporter in the region, coming after Singapore, Taiwan and Korea. But the Singapore figure includes re-exports, and reducing it by 40% (the average of re-exports to national exports) takes it to fifth place, behind China and Malaysia. China is the biggest gainer in market share in HT during the decade and overtakes longer-established exporters such as Malaysia, Thailand and the Philippines. All East Asian countries, however with the exception of Hong Kong, grow faster than the world rate.

Thus, there is *broad-based export expansion* by China spanning the entire technological spectrum. It has a massive presence *in low-technology products* but its *growth* is fastest in the HT products that have driven much of recent East Asian exports.

6. MARKET SHARE CHANGES IN MAJOR DEVELOPED COUNTRY MARKETS

We now analyze market shares by finer classifications of product and markets, focusing on Japan, the United States and West Europe (Appendix A, Table 9). In terms of value, the most important market for China in 2000 is the United States ($49 billion), followed by Japan ($36 billion) and West Europe ($38 billion). But, the rest of the world is almost as large as these together ($106 billion in 2000) and within this the rest of East Asia is larger than any major OECD market by itself ($74.6 billion). The competitive position of each country is analyzed in terms of market shares in 1990 and 2000. The annex table shows the following:

Total manufactured exports: China does best in Japan, followed at some distance by the United States. In common with most neighbors, its market share gain is weakest in West Europe. Korea loses market shares in both Japan and United States, while Taiwan

Table 5. *World market shares by technology*

	China		Korea		Taiwan		Singapore		Hong Kong		Malaysia		Thailand		Indonesia		Philippines	
	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)	1990 (%)	2000 (%)
Resource-based	1.3	2.5	0.8	2.3	0.8	0.7	2.6	1.3	0.2	0.1	1.3	1.3	0.8	1.3	1.2	1.7	0.3	0.3
Low-technology	4.9	12.0	4.9	3.3	5.2	4.0	0.9	1.0	3.0	1.5	0.6	1.0	1.4	1.5	0.8	1.6	0.3	0.5
Medium-technology	1.2	2.7	1.8	3.2	1.6	2.1	1.1	0.9	0.5	0.1	0.4	0.9	0.2	0.8	0.1	0.4	0.1	0.2
High-technology	0.7	4.1	2.8	4.5	3.4	4.9	4.0	5.9	1.2	0.4	1.6	3.7	0.7	1.5	0.0	0.5	0.1	1.9
All mfrs	1.9	4.7	2.1	3.4	1.6	3.0	1.9	2.7	0.6	0.5	0.8	1.8	0.7	1.2	0.5	0.7	0.2	0.7

Source: Calculated from UN Comtrade database.

loses only in the United States. Hong Kong loses market shares in all markets, particularly in the United States and Japan. Like Taiwan, Singapore loses only in the United States. The "new Tigers" gain share in all markets. With the exception of Indonesia, with a rather tepid performance, the others all gain most share in the Japanese market.

RB: China leads the region in market share increases, with a pattern similar to that for total exports. Korea, however, gains significantly in Japan in contrast to Taiwan and Singapore, which lose shares; the latter two also lose in the United States. Thailand gains in Japan while Indonesia and the Philippines lose in the United States.

LT: China's massive gains are again concentrated in Japan. The four mature Tigers suffer losses in market share, but Singapore sees an increase in Japanese market share. The best overall performance among the "new Tigers" is by Indonesia.

MT: While the Chinese pattern of success recurs, the "new Tigers" make significant gains in Japan and Korea incurs a significant loss. Taiwan and Singapore suffer losses in the United States market.

HT: Taiwan diverges from Korea in its performance in Japan, the former showing the second largest gain (after China) and the latter the largest loss. In the United States, the situation is reversed, with Singapore joining Taiwan in losing market shares. Among the new Tigers, Malaysia and the Philippines are the big gainers in Japan, but the other two also benefit significantly. The Philippines is the second largest winner in the group in the United States market.

In sum, China's main market share gains in the developed world are concentrated in Japan though the United States accounts for a larger dollar value of export growth. This is also true of its neighbors with the exceptions of Korea and Indonesia (Hong Kong being an all-round loser). To the extent that market share changes are *causally related* to China's export surge, it would seem that the *mature Tigers suffer the most* from Chinese competition. The largest loss is in LT, which is to be expected but does not take into account the growth of LT exports by Korea and Taiwan to China (for processing for export to other markets). The relatively low gains by the new Tigers in LT may also reflect Chinese competition, without the offsetting increase in intermediate exports to China.

7. MATRIX OF COMPETITIVE EFFECTS

This exercise indicates the direction of possible competitive effects by comparing relative market share changes. It does not, however, take account of complementarities between countries, either by integration into MNC systems or by the shift of export activities from losing countries to China. There is another complication: *complementarity within MNC systems need not exclude direct competition in the longer term*. While MNCs can contain and manage competition between affiliates, they cannot prevent a shift to more economical sites over the long term. There is likely to be intense competition between affiliates for exports and higher value functions. This competition may include local suppliers or subcontractors that compete for larger sales (or to become exporters themselves). [16] If China captures larger shares of integrated MNC activity over time and add greater value, the gains from complementarity will shift in its favor, eroding competitiveness in neighbors. Moreover, as it moves up the technology ladder, it can also adversely affect activities in the more advanced Tigers: their "hollowing out" can spread from low-end manufacturing to all advanced functions.

It is not possible to capture such nuances here; however, the competitive matrix does provide useful information. Disaggregating competitive effects by technology adds further insights on effects on neighbors at different levels of development. For instance, China's export threat in LT activities is likely to benefit the more industrially advanced neighbors that are losing their wage advantage but to damage less industrialized ones that cannot move into design, marketing or intermediate manufacture while re-locating facilities in China. A threat in high-technology activities is likely to be more complementary to all neighbors, high and low wage, but the threat of shifts within integrated systems is likely to be stronger countries without advanced capabilities.

Table 6 shows the values of exports by East Asian economies according to the nature of the threat revealed by market share comparisons. There are significant differences across countries in the magnitude of the Chinese threat. There is a *general decline in the share of exports under direct threat from China* and *a rise in the share under partial threat*. The exception is Malaysia where the direct threat grows over time. Hong Kong is the most severely

Table 6. *China's potential competitive threat to East Asia: matrix of world market share (WMS) changes, 1990–2000*[a] *(US$ million and percentages)*

	Singapore		Hong Kong		Taiwan		Korea		Malaysia		Thailand		Indonesia		Philippines	
Category	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Values																
Partial threat	17,366.6	54,779.9	472.7	1,933.6	17,213.1	50,343.3	16,820.1	47,730.6	13,980.2	54,996.7	9,487.3	41,282.2	5,814.4	29,794.0	1,711.4	16,675.0
No threat	6,630.3	43,416.1	0.1	138.6	10,779.0	58,300.2	12,201.2	71,945.8	3,686.8	4,825.3	1,714.3	10,653.4	1,445.8	6,581.9	403.5	16,797.3
Direct threat	25,340.1	31,821.5	27,037.5	19,984.0	36,169.4	33,933.2	33,099.3	44,622.1	3,160.7	27,888.4	9,102.7	10,116.4	9,478.4	12,306.5	1,922.8	2,182.2
China under threat	1,192.2	4,605.2	34.6	103.6	2,002.3	5,073.0	1,126.8	4,962.6	6,561.3	6,178.3	1,466.2	4,104.6	1,437.2	5,501.4	367.0	1,361.3
Mutual withdrawal	1,175.3	948.5	519.1	311.6	672.4	607.7	1,372.6	1,144.8	1,915.3	3,436.6	941.4	893.3	7,373.2	7,514.6	1,178.8	901.3
	51,704.4	135,571.1	28,064.0	22,471.4	66,836.1	148,257.4	64,620.1	170,405.9	29,304.2	97,325.3	22,711.9	67,050.0	25,549.0	61,698.4	5,583.6	37,917.2
Distribution																
Partial threat	33.6%	40.4%	1.7%	8.6%	25.8%	34.0%	26.0%	28.0%	47.7%	56.5%	41.8%	61.6%	22.8%	48.3%	30.7%	44.0%
No threat	12.8%	32.0%	0.0%	0.6%	16.1%	39.3%	18.9%	42.2%	12.6%	5.0%	7.5%	15.9%	5.7%	10.7%	7.2%	44.3%
Direct threat	49.0%	23.5%	96.3%	88.9%	54.1%	22.9%	51.2%	26.2%	10.8%	28.7%	40.1%	15.1%	37.1%	19.9%	34.4%	5.8%
China under threat	2.3%	3.4%	0.1%	0.5%	3.0%	3.4%	1.7%	2.9%	22.4%	6.3%	6.5%	6.1%	5.6%	8.9%	6.6%	3.6%
Mutual withdrawal	2.3%	0.7%	1.8%	1.4%	1.0%	0.4%	2.1%	0.7%	6.5%	3.5%	4.1%	1.3%	28.9%	12.2%	21.1%	2.4%

[a] Categories: *Partial threat:* Both parties gain world market shares (WMS) but China gains more than regional neighbor; *No threat:* Both parties gain WMS but China gains less than regional neighbor; *Maximum threat:* China gains WMS and neighbor loses; *China under threat:* China loses WMS and neighbor gains; *Mutual withdrawal:* Both China and neighbor lose WMS.

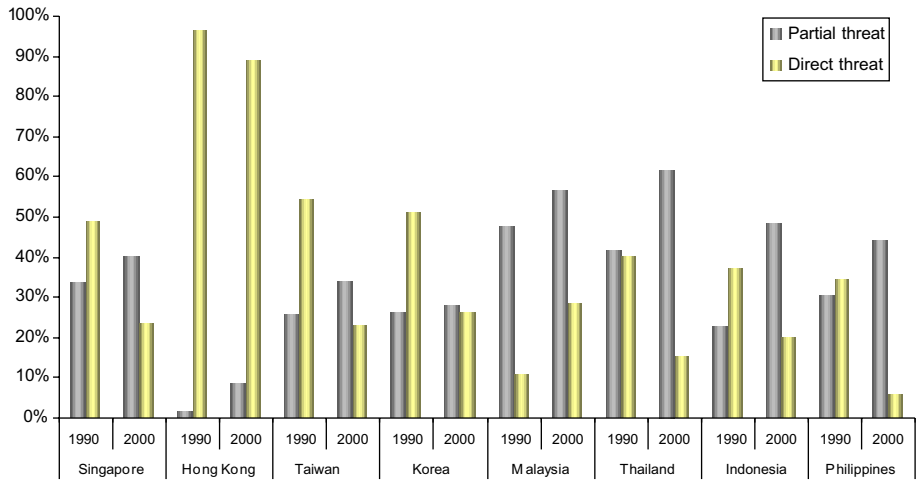

Figure 4. *Shares of exports under direct or partial threat by China, 1999–2000 (calculated from UN Comtrade data).*

threatened in direct terms, with China taking market share from Hong Kong in most of the products it exports: a clear sign that the latter is losing its former *entrepot* role as exporters in China establish direct links overseas. Hong Kong has already shifted most of its labor-intensive operations to China, and the data here probably illustrate the last stages of its adjustment. Malaysia and Korea follow some distance behind, but in very different product segments from Hong Kong (below). The least threatened economy has been the Philippines; most of its exports, in the HT category, grew faster than China's. Figure 4 shows the shares of total exports by each in the partial and direct threat categories in 1990 and 2000.

The "no threat" category, where both sides gain market share and China gains less than its neighbor, is very large (one-third or more) for the mature Tigers apart from Hong Kong and the Philippines. The share of this category is relatively small (5–6%) in Malaysia and Thailand, supporting the general impression that these economies, with high wages but highly dependent on MNC dominated assembly activities, have most to fear from China. The Philippines may also fall into this category as China builds up its semiconductor export capability in the near future.

The "China under threat" category, where China loses market share and the other country gains, is fairly small but growing for the mature Tigers. It is larger for the new Tigers but falling except for Indonesia. The "mutual withdrawal" category, where both sides lose market share, is also fairly small and falling; Indonesia, where it is 12% of total manufactured exports, is again the exception.

The technology composition of *manufactured exports under "direct threat"* is shown in Appendix A, Table 10. There are, as expected, major differences in the competitive impact by technology.

RB: Indonesia is the most threatened (with veneers and plywood the most affected) and Hong Kong the least. Singapore (refined petroleum), Korea (petrochemicals) and the Philippines (wood products and preserved fruits) also have significant threatened exports in this category. There are, however, differences between the countries. Indonesia suffers a drop in export values of veneers and plywood while Singapore and the Philippines suffer only a loss of market share (with rising export values). China is a much smaller exporter in these products than its neighbors, so the relative loss of the latter does not accrue only to China—there are players in other regions involved that the analysis does not capture.

LT: The threat is greatest for Hong Kong, Taiwan, the Philippines and Thailand (over 50% of the total threat), with Korea following (nearly 40%). In Hong Kong, the main products are in the textile and clothing industry; in Taiwan, they include textile products along with toys, metal products and metal sheets; in the Philippines,

furniture and clothing; in Thailand, footwear, textiles, clothing and jewelry and in Korea, textiles and clothing as well as metal sheets. Unlike RB, China is a much bigger exporter than its neighbors of textile and clothing products and toys. Thus, its growth in market share is likely to *cause* the decline in the others'. As noted, however, the mature Tiger economies are increasingly using China to process their LT exports like apparel and toys, so their loss of market share to China is not very damaging. Less advanced neighbors, also assembly sites for richer countries, are more affected by the shift of operations to China. Surprisingly, Indonesia is the least affected in the group despite being a major LT exporter; it may specialize in different products from China or its low wages (relative to neighbors) may have allowed it to maintain market share. Malaysia and Singapore are also little affected in this category: they have low LT exports and, as higher wage economies, may already have re-structured into higher value products.

MT: No neighbor is strongly affected by China here apart from Malaysia (37% of threatened exports) and Korea (27%). The main product affected in both is radio receivers: Malaysian exports declined from $3.5 billion in 1995 to $2.6 billion in 2000 and Korea's from $1.4 billion in 1990 to $0.6 billion in 2000, while China's rose from $1.4 billion in 1990 to $3.0 billion. Taiwan and Singapore have smaller losses (below 20% of threatened exports). In Taiwan, the main product involved is man-made fibers (where the absolute value of exports continues to grow), where China is emerging as a major exporter. In Singapore, the products are (again) radios as well as recording equipment, household electrical appliances and synthetic fibers; China is a major competitor in each of these products.

HT: Malaysia is the only country facing a major threat: 77% of its vulnerable exports are in HT (worth $21 billion, or 41.5% of its total HT exports). The main products are data processing equipment and parts and accessories, where China is now a major exporter, larger than Malaysia in equipment (SITC code 752) but much smaller in parts and accessories (SITC code 759). Singapore, another major electronics exporter, is less exposed (24% of threatened exports); the threat is mainly in telecommunications equipment and parts, with China now exporting over double its values. Thailand, Indonesia and the Philippines are not exposed in any HT product.

The analysis suggests that LT exports suffer most from Chinese expansion, but that the impact is broader and differs by country. Threatened exports need not be products in which China's neighbors have declining exports—their loss of market shares may or may not involve lower export values. Moreover, the loss of share may not only be to China: the competitive impact of China depends on its relative size as an exporter and is significant only where it is a large player; otherwise, the loss is to other players. Exploring these ramifications would involve more detailed analysis by product and for other regions.

8. CHINA'S TRADE WITH NEIGHBORS

Table 7 shows share of the East Asian region in Chinese exports and imports, Table 8 the values of its bilateral trade with each neighbor and the region, and Appendix A, Table 11 the values and growth rates of exports and imports of its intraregional trade.

Some noteworthy points about such trade are:

—The region is the single largest trading partner for China, accounting for over twice the share of exports sold to the United States and over five times that sold to West Europe.

—The importance of the region for Chinese exports has diminished over 1990s while for imports it has grown substantially.

—The role of Hong Kong as its main trading partner (but mainly as an *entrepôt*) has declined dramatically, in exports from 51% to 18%, and in imports from 30% to 5%. The main Asian destination for exports is now Japan and the main source of imports the other mature Tigers (Singapore, Korea and Taiwan).

—The "new Tigers" (Indonesia, Malaysia, the Philippines and Thailand) are still relatively small trading partners for China, but their role has grown in both exports and imports. Malaysia has emerged as the largest trading partner of this group, the Philippines is the smallest. China's imports from these countries have grown particularly rapidly.

Table 7. *Share of East Asia in total Chinese exports and imports, 1990 and 2000*

		Exports 1990 (%)	Exports 2000 (%)	Imports 1990 (%)	Imports 2000 (%)
Japan	Total	9.4	15.8	15.9	22.3
	RB	19.0	24.7	8.9	11.2
	LT	9.4	18.0	16.7	22.3
	MT	5.3	9.7	16.2	28.2
	HT	4.8	13.6	20.5	22.5
Korea, Taiwan & Singapore	Total	4.7	7.9	7.8	28.1
	RB	13.4	11.8	12.8	20.9
	LT	2.5	4.8	9.7	36.0
	MT	4.7	10.1	6.5	34.5
	HT	2.8	10.2	4.6	22.5
Hong Kong	Total	50.6	18.1	29.8	5.0
	RB	27.7	12.3	7.7	2.4
	LT	49.4	18.4	53.6	9.0
	MT	63.9	14.8	29.0	4.0
	HT	55.4	22.7	22.7	5.5
New Tigers	Total	2.4	3.3	1.9	6.6
	RB	3.8	5.0	7.8	10.5
	LT	1.5	1.6	0.6	2.6
	MT	3.3	4.5	1.3	3.7
	HT	2.6	4.8	0.1	9.0
Total East Asia	Total	67.0	45.2	55.4	62.0
	RB	63.8	53.9	37.1	45.1
	LT	62.8	42.8	80.6	69.9
	MT	77.2	39.2	53.0	70.4
	HT	65.6	51.3	47.9	59.5

—The highest value of China's regional trade (exports plus imports) in 2000 was with Japan, followed by the mature Tigers. The fastest growth of such trade over the 1990s was with the mature Tigers.

—By technology, HT products were the largest and fastest growing category in total intra-regional trade. Since most HT trade is likely to be part of MNC integrated systems, complementarities between China and its neighbors in this segment are more significant than direct competition. The largest deficit was in MT products, driven by Chinese imports of equipment and intermediates.

—The region absorbs over half of China's exports of RB and HT products and provides 60% or more of its imports of LT, MT and HT products. As may be expected from the configuration of relative wages, Japan takes the largest share of LT exports and the new Tigers the smallest.

—In terms of imports, Japan and the mature Tigers (without Hong Kong) play the most important roles, but there is a sharp rise in Chinese purchases of HT products from the new Tigers.

Over 1990–2000, China turned a significant trade surplus with the region into a large deficit. If Hong Kong is excluded, its initial deficit grew some 10 times larger over the decade. By 2000, China was importing more from every neighbor (apart from Hong Kong and Singapore) than it was exporting to it. A large part of China's growth in regional trade involves, as noted above, the exchange of products and components for export processing aimed at other regions. [17] The bulk comes from the more advanced economies such as Japan, Korea and Taiwan (Singapore also provides HT imports but is significantly smaller). But, such trade also increasingly involves the new Tigers, particularly those with well-established electronics

Table 8. *China's net trade (exports minus imports) with East Asia in the 1990s (US$ million)*

		1990	2000
Japan	Total	−2,874.6	−3,531.6
	RB	702.3	1,858.0
	LT	827.0	12,665.4
	MT	−3,097.9	−11,414.2
	HT	−1,306.1	−6,640.8
Korea, Taiwan and Singapore	Total	−1,351.8	−31,991.8
	RB	66.2	−3,999.1
	LT	−266.7	−4,546.0
	MT	−917.2	−14,836.3
	HT	−234.2	−8,610.5
Hong Kong	Total	10,534.9	32,584.8
	RB	1,383.0	1,932.8
	LT	7,441.2	16,533.8
	MT	1,496.7	4,909.7
	HT	214.1	9,208.4
New Tigers	Total	270.3	−4,215.5
	RB	−259.2	−2,217.8
	LT	327.6	981.7
	MT	125.9	72.9
	HT	76.2	−3,052.2
Total East Asia	Total	6,578.8	−7,154.1
	RB	1,892.3	−2,426.1
	LT	8,329.1	25,634.9
	MT	−2,392.5	−21,267.9
	HT	−1,250.0	−9,095.1
Total East Asia excluding Hong Kong	Total	−3,956.1	−39,738.9
	RB	509.3	−4,358.9
	LT	887.9	9,101.1
	MT	−3,889.2	−26,177.6
	HT	−1,464.1	−18,303.5

industries like Malaysia (HT imports from Malaysia are now larger than from Singapore).

This reinforces the findings of other studies. Lemoine and Unal-Kesenci (2002) find, using Chinese data for different trade regimes, that four-fifths of its HT exports—electronics, precision instruments and other machinery—consist of "processing trade" (in special zones that allow duty free import of components for exports, with no local sales). Such processing trade has also played an important role in other exports such as apparel, chemicals, shoes, wood products and transport equipment. In 2000, "processing trade" accounted for around 53% of total Chinese exports.

In direct trade, therefore, China acts *more as an engine of export growth than as a competitive threat to most of its neighbors* (Hong Kong excepted). It is difficult to predict if this will continue. While China will import more as it grows, how this will affect its regional trade balances depends on its neighbors' *patterns of specialization* with respect to China and their *competitiveness with respect to other exporters* to China. Those that enhance their skills, technological capabilities, supply chains, infrastructure and marketing faster than China can maintain their exports to it and resist inroads by Chinese exports to their domestic markets. Those that cannot will be forced into lower value-added activities and may suffer deteriorating trade balances with China. Similarly, those that keep ahead of competitors from other regions can win larger shares of its market; proximity and familiarity will help but only to a certain extent. Participation in integrated

MNC systems—a large part of current trade surpluses with China—will not prevent shifts driven by changing competitive advantages; the common governance of MNCs can ease the adjustment but not prevent it. Needless to say, economies that "adjust downwards" to Chinese expansion will also lose export markets in third countries as well as in China. The past may not be a reliable guide to the future when underlying structural factors are subject to rapid change.

9. CONCLUSIONS

China's export surge has raised grave concerns in the region. While some of the apocalyptic predictions are overdone, it is possible that rapid export growth by such a massive entrant will adversely affects export growth by its neighbors. This analysis suggests that the outcome is complex. For a start, the rise in China's exports is matched by that in its imports—within the region its import growth outpaces its export growth. With appropriate re-structuring to match new competitive needs, its neighbors should be able to maintain high rates of export growth.

There are two main drivers of regional exports to China. The first is the drive to meet its burgeoning demand for imported products: primary products and resource-based manufactures that it cannot produce, capital goods and intermediates for domestic-oriented production and more sophisticated consumer goods than its industry can currently provide. The second is the drive to meet the needs of its export industries. This has two components: "processing" activity in special economic zones that use imported inputs for export activities, and other exporters that also need imports. Processing activity is increasingly organized as part of integrated production systems, particularly its high technology segments, though some domestic-oriented industries are also being plugged into this system as they realize scale and learning economies and become globally competitive. Both drivers are likely to continue into the foreseeable future, though their composition will change as Chinese and regional capabilities develop.

China's main market share gains in 1990s in developed countries were in Japan (though the United States accounted for larger values of export growth). In the developing neighbors, the mature Tigers suffered most, particularly in low-technology products. The new Tigers have also been affected by China's expansion of LT exports, resulting in low-market share gains rather than in losses of share. But, if we take into account the fact that the mature Tigers were already losing competitiveness in LT products, and that a significant part of Chinese exports of such products is handled by their enterprises and uses inputs made by them, their competitive loss appears much smaller. In fact, compared to a counterfactual where they lost to LT producers elsewhere, they are net gainers.

The main threat is to the less technologically advanced new Tigers that have much higher wages than China but lack the domestic capabilities to keep ahead of it in many areas where the latter poses a competitive challenge. They have low LT exports to China and face its LT exports in third markets. The abolition of the MFA will exacerbate the threat in textiles and apparel and it is not clear that they can move the quality, design and marketing scale sufficiently to retain a large niche here. The same applies to other LT products like footwear, toys and the like. The comparison of market share changes shows, however, that the impact differs greatly by country. In LT, for instance, Thailand and Philippines seem much more affected in the 1990s than Indonesia.

China's threat in medium-technology products is also growing. Over time it is likely to mount a serious competitive challenge in products such as automobiles, machinery and simple electronics. Here the challenge will be equally to the new and the mature Tigers. In HT products the data suggest complementarity rather than competition between China and its neighbors. The region is being woven into a complex network of export production by leading electronics MNCs (and their first-tier suppliers and contract manufacturers). China is acting as an engine of growth for exports by region as a whole, sucking in imports from its neighbors to export to third countries or to feed into its neighbors' export activities.

Complementarities may not, however, continue to grow. China will compete fiercely within the integrated systems for larger exports, more sophisticated products and more valuable functions. It is not clear from the trade data which functions are being placed where, and how they are likely to evolve, but it is clear that only countries able to keep a technological edge over China will benefit. But there is an

important strategic consideration that can limit the competitive impact of China—even if it is a more economical site than its neighbors. Global companies may not be prepared to rely on China (or any other country for that matter) for critical inputs beyond a certain threshold of risk. The threshold may vary by product and company, but risk diversification will impose it at some level.

In sum, the competitive threat of China is not as large as its export surge suggests, nor is it negligible. How great it is, and how much cost it inflicts, depend on the activity and the ability of its neighbors to develop new capabilities. The threat is largest in low technology products for countries that still depend on such products; however, it also exists for countries in high-technology production systems that rely on low-end functions. It is least for countries that develop new capabilities (including not just skills and technologies but also infrastructure, institutions and governance structures) to overcome their wage disadvantage *vis à vis* China.

NOTES

1. For instance, according to *The Economist* (2003), "[China] is already by far the biggest garment exporter in the world, with average wages in the industry of 40 cents an hour—less than a third of, say, Mexico's. Now that China belongs to the World Trade Organization, moreover, it will benefit from an agreement to eliminate quotas completely by 2005. As a result, according to estimates by the World Bank, China's share of world garment exports will increase from about 20% today to 50% by the end of the decade. Shoes, semiconductors and televisions are expected to follow. China already makes over half of the world's shoes, and Malaysia frets over the exodus of electronics factories from Penang... to Guangdong and the Yangtze delta... Comparisons are made with Manchester during the Industrial Revolution. China, it is said, is becoming the "workshop of the world." Andy Xie, an economist with Morgan Stanley in Hong Kong, reckons that by 2005 China's exports could have exceeded those of Japan. He also thinks that China has a lot to do with deflation in other countries, because it causes price wars and pushes down profit margins of companies elsewhere. China's industrialization, he says, "devalues manufacturing assets outside China." The local media in the East Asian region regularly carries such dire predictions.

2. See, for instance, Arndt and Kierzkowski (2001) and Dicken (1999). Fragmentation in East Asia is explored by Borrus, Ernst, and Haggard (2000), Ernst (2000), Ernst and Kim (2002), Lemoine and Unal-Kesenci (2002), and Ng and Yeats (1999). For a comparison of fragmentation in electronics and automobiles in East Asia and Latin America see Lall, Albaladejo, and Zhang (2004) and on clothing and apparel see Gereffi (1999).

3. Most studies analyze the impact of China's WTO accession on its neighbors rather than its competitive threat to their exports, but several do touch on this aspect as part of the assessment. See, for instance, Chae and Han (2002), Ianchovichina, Suthiwart-Narueput, and Zhao (2003), Ianchovichina and Martin (2001), Lall and Albaladejo (2002), Li (2002), Rasiah (2002) and Shafaeddin (2002). A few attempts have been made to quantify the effects using computable general equilibrium (CGE) models, for example by Ianchovichina *et al.* (2003). Their quantitative results must, however, be treated with considerable caution; they are based on several simplifying and static assumptions on demand and supply elasticities, technological change, structural shifts, factor movements, production efficiency and so on.

4. On Malaysia see Siew-Yean (2001).

5. "East Asia" here covers eight countries: the four mature Tiger economies (Hong Kong, Singapore, Korea and Taiwan) and the four "new Tigers" (Malaysia, Thailand, Philippines and Indonesia).

6. The classification is based on export data at the three digit levels, SITC Rev 2. Lall (2000) provides the detailed list of products under each category. *Resource-based* products include processed foods, tobacco and wood products, refined petroleum products, dyes, leather, precious stones and organic chemicals. They may be simple and labor-intensive (e.g., simple processed leather) or capital, scale and skill-intensive (e.g., petroleum refining). Competitive advantage here generally (but not always) arises from the availability of natural resources. *Low technology* products include textiles, garments, footwear, other leather products, toys, simple metal products, simple plastics, furniture and glassware. These products have stable, well-diffused technologies largely embodied in capital equipment, with low R&D expenditures and skill requirements, and low economies of scale. Labor costs tend to be a major element of cost and products to be undifferentiated, at least in the mass-produced (nonfashion) end of the scale. There is an important "high end" in LT where design, brands and

quality matter more than price; high wages are not a competitive disadvantage here. *Medium technology* products are heavy industrial goods such as automobiles, industrial chemicals, machinery and standard electrical and electronic products. They have complex but not fast-changing technologies, with moderate R&D expenditure but advanced engineering and design and large scales of production. Barriers to entry tend to be high, not only because of large capital requirements, but also because of strong "learning" effects in operation, design, and, in certain products, product differentiation. *High-technology products* include complex electrical and electronic products, aerospace, precision instruments, fine chemicals and pharmaceuticals. The most innovative ones call for large R&D investments, advanced technology infrastructures and close interactions between firms, universities and research institutions. But, many HT activities, particularly electronics, have simple assembly processes where low wages are an important competitive factor. The high value-to-weight ratio of these products allows discrete processes to be segmented and located across long distances. In general, low-technology industries spend less than 1% of sales on R&D, medium-technology ones between 1% and 4% and high technology ones over 4%.

7. Lall and Albaladejo (2002) show that its educational enrolment rates at tertiary levels are significantly lower than all other major East Asian countries. In terms of technological effort, its R&D spending per unit of manufacturing value added was lower than all its neighbors except for Hong Kong, Thailand and the Philippines, though the absolute value of enterprise financed R&D was higher than all countries except for Korea and Taiwan (UNIDO, 2002). Its per capita FDI was also quite low, though again the absolute value of FDI inflows was very large. Its ICT infrastructure was weaker than all countries except for the Philippines and Indonesia. On Chinese technology also see Dahlman and Aubert (2001).

8. Ianchovichina *et al.* (2003) use a different methodology to analyze the impact of Chinese accession to the WTO (they do not consider the Chinese competitive threat before the accession). For four ASEAN countries, Indonesia, Thailand, Cambodia and Lao PDR, they look at "key exports" to particular markets (United States and Japan). They pick at the SITC five-digits level products that form a significant share of imports by the selected market in which China also has a large market share and distinguish products whose unit values are close together. This approach permits a more detailed analysis—though perhaps too detailed to capture product competition at a realistic level—but does not take account of dynamic market share changes that this paper considers the essential criterion of competitive threat.

9. China's share of global export market grew even faster after 2000 (not covered here). In 2001, China's total exports grew by 7% (WTO, 2003), when global exports fell by 4%, exports by "developing Asia" fell by 7% and by leading "IT traders" in Asia fell by 13%. Merchandise exports by other developing regions also fell in 2001: Latin America declined 3%, Middle East 7% and Africa 6%. At the country level, all major exporters in East Asia apart from China recorded falls: Hong Kong (domestic exports) 15%, Korea 13%, Taiwan 17%, Singapore (domestic exports) 16%, Malaysia 10%, Thailand 7%, Philippines 16% and Indonesia 9%. In 2002, when world trade grew by 4%, China's merchandise exports rose by a massive 22%, compared to 6% for all developing countries, 10% for developing Asia and 7% for Asian "IT traders" (WTO, 2002).

10. Thus, in 2000, per capita manufactured exports in China came to $185, as compared to $20,003 in Singapore (after deducting re-exports), $3,607 in Korea, $6,582 in Taiwan, $4,117 in Malaysia, $944 in Thailand and $488 in the Philippines. China was, however, well ahead of India with $38.

11. Most labor reserves are in the interior provinces of the country, but there are also some in the coastal areas where workers are being made redundant by re-structuring state-owned enterprises. Tapping both would require large investments, say in physical infrastructure, training (and retraining) and institution building.

12. China will not gain immediately from the abolition of multi-fiber arrangement (MFA) quotas in 2005, as it is subject to special transition arrangements in US and EU markets up to 2007 (Ianchovichina *et al.*, 2003). Other exports will also not gain much from WTO accession as they already enter developed country markets on equal terms with competitors; the main exception is Mexico, with the preferential treatment it receives under NAFTA. NAFTA privileges should also decline over time as tariffs come down for the trading bloc. A substantial part of Chinese exports (around 55% in 2000) that operates under the duty-free regime will not gain from liberalization (Lemoine & Unal-Kesenci, 2002).

13. By contrast, the structure of South Asian exports (dominated by India, the economy most similar to China in Asia) is relatively stagnant. Thus, in 1990, 67.7% of South Asian exports consisted of RB and LT products (compared to 66.2% for China); by 2000 the figure had risen to 70.3% while for China it had fallen to 54.4%.

14. A more detailed analysis (at the five-digit level) by Ianchovichina *et al.* (2003) gives similar results to ours.

These authors find a trend for the Chinese structure to grow generally more similar to those of four countries (Cambodia, Lao PDR, Indonesia and Thailand), with the exception of Indonesia. Interestingly, their correlation coefficients for the two countries in common with our analysis (Indonesia and Thailand) are not very different: in 1999 they find a correlation of 0.302 with Indonesia and 0.491 with Thailand, while we get 0.330 and 0.512 respectively in 2000.

15. The UN trade data for Singapore include its re-exports, though they exclude them for Hong Kong. Trade figures from the Singapore government show that around 40% of total exports consists of re-exports, but we have not adjusted the figures here because of the lack of product level data for subsequent analysis.

16. In an interesting paper on global value chains and local suppliers in East Asia, Sturgeon and Lester (2002) argue that integrated production systems are becoming more "open," relying increasingly on unrelated but tightly linked suppliers to provide larger ranges of products and services. A major development is the rise of contract manufacturers that undertake the entire procurement, manufacturing and logistical functions for lead firms, which then specialize in the design, R&D and marketing functions, a trend that has gone furthest in the electronics industry. The competitive challenge for newly industrializing countries is then to foster the growth of large suppliers and contract manufacturers; in East Asia, only the three mature Tigers have the technological capabilities but China is likely to emerge in this arena soon.

17. These imports are largely by foreign affiliates, which accounted for 70% of "processing" exports in 2000, up from 46% in 1994, according to Lemoine and Unal-Kesenci (2002), pp. 13–14. Around 80% of imports used in "processing" trade come from the region: Hong Kong, Korea and Taiwan (41%), Japan (25%) and other East Asian countries (14%), p. 22.

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APPENDIX A

See Tables 9–11.

Table 9. *Market shares of China and East Asian neighbors in imports by main markets*

Importer	Tech category	China			Korea			Taiwan			Singapore		
		1990 (%)	2000 (%)	Change (%)	1990 (%)	2000 (%)	Change (%)	1990 (%)	2000 (%)	Change (%)	1990 (%)	2000 (%)	Change (%)
Japan	RB	2.50	8.86	6.36	3.01	8.26	5.25	2.29	1.17	−1.12	4.55	2.07	−2.48
	LT	8.62	34.95	26.32	19.93	7.71	−12.22	9.58	4.93	−4.65	0.88	3.14	2.26
	MT	2.32	8.90	6.57	5.88	5.40	−0.48	4.86	4.82	−0.04	2.06	2.66	0.60
	HT	0.66	8.96	8.30	9.26	8.10	−1.16	5.07	11.28	6.21	3.75	6.50	2.76
	All manufactures	3.37	14.37	11.00	8.22	7.48	−0.74	4.86	6.14	1.28	3.09	3.91	0.83
USA	RB	0.44	1.73	1.29	0.78	1.41	0.63	1.34	0.46	−0.88	0.79	0.54	−0.25
	LT	3.03	11.87	8.83	9.78	2.91	−6.87	11.34	4.47	−6.87	1.30	0.65	−0.65
	MT	0.19	2.43	2.24	3.08	3.00	−0.08	2.62	1.82	−0.80	0.98	0.54	−0.44
	HT	0.34	4.02	3.68	5.43	6.17	0.73	6.81	6.03	−0.78	8.86	6.59	−2.26
	All manufactures	0.90	4.75	3.85	4.63	3.63	−1.00	5.18	3.36	−1.82	2.59	2.27	−0.33
W. Europe	RB	0.31	0.88	0.57	0.15	0.28	0.13	0.18	0.11	−0.07	0.27	0.54	0.27
	LT	1.01	4.14	3.13	1.51	0.87	−0.64	1.38	1.26	−0.12	0.34	0.29	−0.05
	MT	0.12	1.24	1.12	0.63	1.47	0.84	0.51	0.63	0.12	0.38	0.24	−0.13
	HT	0.17	2.18	2.01	1.03	2.06	1.03	2.04	2.75	0.72	1.74	2.91	1.17
	All manufactures	0.37	1.96	1.59	0.79	1.28	0.49	0.90	1.19	0.29	0.59	0.99	0.40
	Exporter	Hong Kong			Malaysia			Thailand			Indonesia		
Japan	RB	0.27	0.09	−0.19	2.93	2.88	−0.05	1.46	2.79	1.33	4.90	5.01	0.10
	LT	3.36	0.45	−2.91	0.62	1.54	0.91	2.80	3.11	0.31	1.40	2.06	0.65
	MT	0.70	0.09	−0.61	0.80	3.14	2.33	1.56	3.71	2.15	0.44	1.47	1.04
	HT	0.78	0.33	−0.45	3.00	6.61	3.62	1.48	3.45	1.96	0.16	1.45	1.29
	All manufactures	1.09	0.25	−0.84	1.99	3.91	1.93	1.76	3.27	1.51	2.32	2.44	0.12

USA	RB	0.14	0.07	−0.07	0.31	0.53	0.22	1.22	1.17	−0.05	0.85	0.61	−0.24
	LT	6.00	2.52	−3.48	0.93	1.02	0.08	2.07	2.15	0.07	1.16	1.92	0.76
	MT	0.71	0.07	−0.64	0.42	0.85	0.42	0.40	0.45	0.05	0.03	0.25	0.21
	HT	1.82	0.35	−1.47	3.21	4.67	1.46	1.43	1.72	0.29	0.05	0.36	0.31
	All manufactures	2.01	0.66	−1.35	1.07	1.91	0.84	1.13	1.27	0.14	0.43	0.68	0.25
W. Europe	RB	0.02	0.02	0.00	0.36	0.32	−0.05	0.35	0.37	0.02	0.27	0.63	0.36
	LT	1.45	0.76	−0.68	0.28	0.41	0.13	0.77	0.77	0.01	0.46	1.05	0.59
	MT	0.24	0.02	−0.21	0.17	0.38	0.21	0.07	0.35	0.28	0.06	0.15	0.09
	HT	0.55	0.26	−0.29	0.48	1.58	1.10	0.28	0.74	0.46	0.02	0.20	0.18
	All manufactures	0.51	0.22	−0.29	0.29	0.68	0.39	0.32	0.53	0.21	0.19	0.43	0.24

	Exporter	Philippines		
Japan	RB	0.99	1.01	0.02
	LT	0.38	0.63	0.25
	MT	0.38	1.85	1.47
	HT	0.27	3.78	3.51
	All manufactures	0.60	2.04	1.45
USA	RB	0.56	0.32	−0.24
	LT	0.81	1.33	0.52
	MT	0.12	0.31	0.19
	HT	0.39	2.32	1.93
	All manufactures	0.41	1.09	0.68
W. Europe	RB	0.14	0.09	−0.05
	LT	0.13	0.17	0.03
	MT	0.01	0.10	0.09
	HT	0.06	1.04	0.98
	All manufactures	0.07	0.35	0.27

Table 10. *Technology breakdown of manufactured exports directly threatened by China ($ m. and %) (Products in which East Asian countries lost world market shares and China gained in 1990–2000)*

Country and product	Values		Distribution	
	1990	2000	1990 (%)	2000 (%)
Korea				
RB	2,669.9	16,715.0	9.5	30.7
LT	17,394.3	21,743.3	61.6	39.9
MT	6,660.2	14,432.1	23.6	26.5
HT	1,507.2	1,583.3	5.3	2.9
Total	28,231.7	54,473.6	100.0	100.0
Taiwan				
RB	3,034.5	4,797.0	10.8	10.8
LT	18,583.2	27,130.3	66.4	60.9
MT	5,030.0	11,763.3	18.0	26.4
HT	1,353.8	851.2	4.8	1.9
Total	28,001.7	44,541.9	100.0	100.0
Singapore				
RB	11,605.0	15,262.8	48.8	49.4
LT	3,367.3	3,915.3	14.2	12.7
MT	4,659.1	4,329.6	19.6	14.0
HT	4,162.0	7,365.9	17.5	23.9
Total	23,793.4	30,873.6	100.0	100.0
HongKong				
RB	893.4	509.1	3.3	2.6
LT	15,143.7	12,581.1	56.4	63.5
MT	5,140.8	1,714.1	19.1	8.6
HT	5,675.2	5,016.6	21.1	25.3
Total	26,853.1	19,820.8	100.0	100.0
Malaysia				
RB	522.0	1,315.2	16.2	4.7
LT	756.5	1,930.1	23.5	6.9
MT	1,203.5	3,088.2	37.3	11.1
HT	743.0	21,463.7	23.0	77.2
Total	3,225.0	27,797.2	100.0	100.0
Thailand				
RB	1,469.2	1,288.9	22.1	16.7
LT	4,384.6	5,127.2	65.9	66.5
MT	794.8	1,294.2	12.0	16.8
HT	–	–	0.0	0.0
Total	6,648.6	7,710.3	100.0	100.0
Indonesia				
RB	4,332.7	4,390.4	87.5	89.0
LT	265.4	193.9	5.4	3.9
MT	354.7	347.1	7.2	7.0
HT	–	–	0.0	0.0
Total	4,952.9	4,931.4	100.0	100.0
Philippines				
RB	626.7	485.3	40.9	28.8
LT	700.5	1,081.6	45.7	64.2
MT	204.3	118.6	13.3	7.0
HT	–	–	0.0	0.0
Total	1,531.5	1,685.5	100.0	100.0

Table 11. *China's trade with neighbors ($million and %)*

Trading partner	Category	Exports		Imports		Net Trade		Growth rate (1990–2000)	
		1990	2000	1990	2000	1990	2000	Exports (%)	Imports (%)
Korea	Total	649.9	8,541.8	671.4	22,025.0	−21.5	−13,483.2	29.4	41.8
	RB	281.5	1,436.7	89.7	4,285.5	191.7	−2,848.8	17.7	47.2
	LT	148.7	2,778.3	171.9	4,575.6	−23.2	−1,797.3	34.0	38.8
	MT	207.3	2,122.5	289.6	7,712.3	−82.3	−5,589.8	26.2	38.8
	HT	12.4	2,204.3	120.1	5,451.6	−107.7	−3,247.3	67.9	46.5
Taiwan	Total	230.9	4,253.4	2,115.5	23,248.6	−1,884.6	−18,995.2	33.8	27.1
	RB	44.2	368.3	222.7	1,318.5	−178.5	−950.2	23.6	19.5
	LT	66.2	1,081.1	690.0	4,692.6	−623.8	−3,611.5	32.2	21.1
	MT	105.1	1,539.1	1,036.2	10,484.6	−931.1	−8,945.5	30.8	26.0
	HT	15.4	1,265.0	166.7	6,752.9	−151.3	−5,488.0	55.4	44.8
Singapore	Total	1,357.1	5,349.1	802.8	4,862.5	554.3	486.6	14.7	19.7
	RB	594.1	775.4	541.1	975.5	53.0	−200.1	2.7	6.1
	LT	403.9	1,088.7	23.5	225.8	380.3	862.8	10.4	25.4
	MT	293.5	1,262.3	197.3	1,563.3	96.2	−301.0	15.7	23.0
	HT	65.5	2,222.7	40.7	2,097.9	24.8	124.8	42.3	48.3
Hong Kong	Total	24,308.5	41,506.9	13,773.6	8,922.2	10,534.9	32,584.8	5.5	−4.2
	RB	1,894.3	2,689.6	511.3	756.8	1,383.0	1,932.8	3.6	4.0
	LT	12,306.7	18,906.0	4,865.5	2,372.2	7,441.2	16,533.8	4.4	−6.9
	MT	8,267.4	7,176.8	6,770.7	2,267.1	1,496.7	4,909.7	−1.4	−10.4
	HT	1,840.1	12,734.5	1,626.0	3,526.1	214.1	9,208.4	21.3	8.0
Indonesia	Total	192.3	2,283.7	157.1	2,373.9	35.2	−90.2	28.1	31.2
	RB	54.9	397.6	34.2	1,703.9	20.7	−1,306.2	21.9	47.8
	LT	17.2	510.2	4.4	218.4	12.8	291.9	40.4	47.8
	MT	99.4	921.4	118.0	106.5	−18.6	814.9	24.9	−1.0
	HT	20.8	454.4	0.5	345.2	20.3	109.3	36.1	92.3
Malaysia	Total	237.3	2,144.8	520.8	4,638.1	−283.5	−2,493.4	24.6	24.4
	RB	55.0	256.0	405.5	929.4	−350.5	−673.4	16.6	8.6
	LT	86.2	471.9	14.8	175.1	71.5	296.8	18.5	28.0
	MT	79.9	442.8	94.7	820.3	−14.8	−377.5	18.7	24.1
	HT	16.3	974.0	5.9	2,713.3	10.4	−1,739.3	50.5	84.6
Philippines	Total	112.8	1,273.1	62.4	1,433.4	50.4	−160.3	27.4	36.8
	RB	40.5	183.2	31.3	110.2	9.2	73.0	16.3	13.4
	LT	25.6	381.3	4.7	12.7	20.8	368.7	31.0	10.5
	MT	35.0	274.2	25.9	126.0	9.1	148.2	22.9	17.1
	HT	11.7	434.3	0.3	1,184.5	11.3	−750.2	43.5	128.9
Thailand	Total	613.3	1,931.3	145.1	3,403.0	468.2	−1,471.6	12.2	37.1
	RB	108.7	255.4	47.3	566.6	61.4	−311.2	8.9	28.2
	LT	250.0	309.0	27.5	284.7	222.5	24.3	2.1	26.3
	MT	217.1	568.6	66.9	1,081.3	150.2	−512.7	10.1	32.1
	HT	37.5	798.4	3.4	1,470.4	34.2	−672.0	35.8	83.5
Developing East Asia (above eight countries)	Total	27,702.1	67,284.1	18,248.7	70,906.7	9,453.4	−3,622.5	9.3	14.5
	RB	3,073.2	6,362.2	1,883.1	10,646.4	1,190.0	−4,284.1	7.5	18.9
	LT	13,304.5	25,526.5	5,802.3	12,557.1	7,502.1	12,969.5	6.7	8.0
	MT	9,304.7	14,307.7	8,599.3	24,161.4	705.4	−9,853.7	4.4	10.9
	HT	2,019.7	21,087.6	1,963.6	23,541.9	56.1	−2,454.3	26.4	28.2

(*Continued next page*)

Table 11—*continued*

Trading partner	Category	Exports		Imports		Net Trade		Growth rate (1990–2000)	
		1990	2000	1990	2000	1990	2000	Exports (%)	Imports (%)
Japan	Total	4,492.4	36,277.9	7,367.0	39,809.5	−2,874.6	−3,531.6	23.2	18.4
	RB	1,299.4	5,389.0	597.1	3,530.9	702.3	1,858.0	15.3	19.4
	LT	2,343.0	18,527.8	1,516.0	5,862.4	827.0	12,665.4	23.0	14.5
	MT	690.8	4,718.4	3,788.6	16,132.6	−3,097.9	−11,414.2	21.2	15.6
	HT	159.2	7,642.7	1,465.3	14,283.5	−1,306.1	−6,640.8	47.3	25.6