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The Rise of China and Asia's Flying-Geese Pattern of Economic Development: An Empirical Analysis Based on US Import Statistics

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Abstract

Although manufactured goods have come to make up the bulk of China's fast expanding exports, the country's competitiveness still lies in low-value-added products. Reflecting this, Chinese exports do not directly compete with Japanese exports; rather, they complement each other. China's export structure also lags behind Asia's newly industrializing economies (NIEs) and major members of the Association of Southeast Asian Nations (ASEAN).

Based on a comparison of the trade structures among Asian nations, we find that they are broadly in line with their respective levels of economic development. In short, there is no evidence showing that the flying-geese formation has been disrupted by the emergence of China. Even in China's fast-growing IT-product sector, the country's export competitiveness still lags far behind not only Japan, but also other Asian countries. There is a clear division of labor between Japan and China, with the former specializing in high-value-added products and the latter in low-value-added products. There is little overlap, especially in the high-value-added categories.

In the new economy, human capital is the single most important asset. It is unrealistic to expect the Chinese economy to leapfrog because China is unlikely to greatly improve the educational level of the entire nation in a short period. Instead, economic development can only be a step-by-step process.

Keywords: flying-geese, comparative advantage, information technology, export structure, competitiveness, complementarity, Sino-Japanese relations

JEL Classification: F14

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1 Introduction

Since shifting to a policy of reform and door opening in the late 1970s, China has been undergoing a period of high economic growth while at the same time increasing its presence in the Asian economy. Riding the wave of the IT revolution in recent years, the country has been gaining international competitiveness not only in labor-intensive products, but also in some IT products, which are supposed to be high-tech. This has given rise to the perception that the flying-geese model, which has so far been useful for grasping dynamic changes in the regional division of labor, is no longer applicable. In its place, the view that China may soon join the ranks of advanced nations by skipping the long industrial development process that is usually required has gained popularity.

Based on this leapfrogging scenario, more and more people in Japan now believe that China is already competing strongly with Japan in international markets. They also tend to look at the rise of China as a threat. Such fears assume that the export structure of China, with its growing strength in IT products, has advanced to a level nearly on par with that of Japan. Evidence for these assumptions, however, is mainly drawn from isolated cases rather than being based upon a systematic international comparison. One of the reasons for this is that while there are indicators to evaluate the international competitiveness of individual products and industries, an index to evaluate the level of advancement of the export structure of each country has yet to be developed.

Here, we propose a method to measure the level of advancement of each country's export structure based on the weighted average of the level of sophistication (value added) of the products composing it. In addition to manufactured exports as a whole, we will also take a closer look at the exports of IT products. Import statistics of the US, the biggest market for products exported from Asian countries, will be used as a proxy for the global exports of these countries. In addition to an international comparison based on the latest data, we will also focus upon changes in China's export structure relative to its Asian neighbors since 1990.

2 The Debate Over the Flying-Geese Pattern of Economic Development

The expansion of economic dynamism from Japan to the Asian NIEs and then further to ASEAN countries and China has come to be known as the flying-geese pattern. Countries specialize in the export of products in which they enjoy a comparative advantage commensurate with their levels of development, and at the same time they seek to upgrade their industrial structures through augmenting their endowment of capital and technology. Foreign direct investment from the more advanced countries to the less developed ones, through relocating industries from the former to the latter, plays a dominant role in sustaining this process.

The flying-geese model was first used to describe the life cycles of industries in the course of economic development (Akamatsu, 1962), with the focus on specific industries in specific countries. Subsequently, it has been extended to study the dynamic changes in the industrial structure (that is, the rise and fall of different industries) in specific countries, and further to the shift of industries from one country to another.

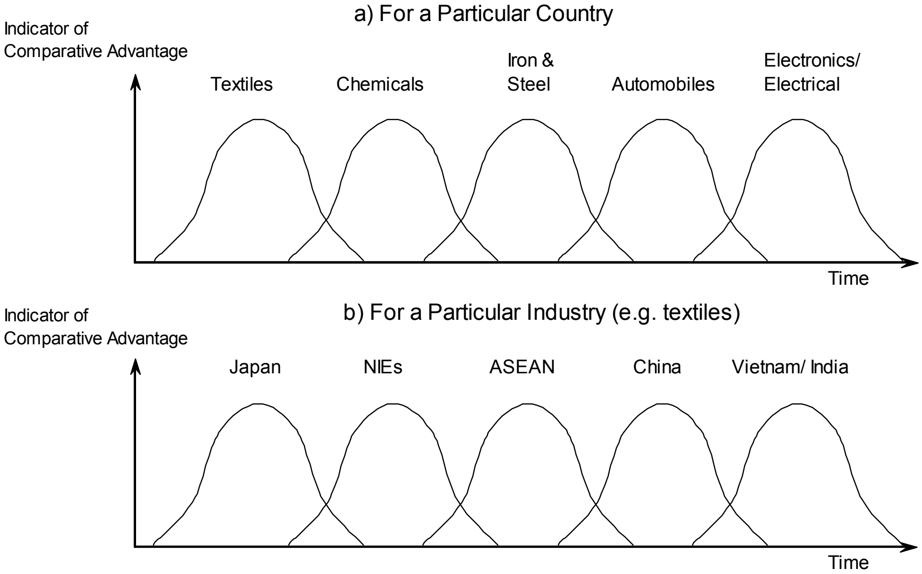
The life cycle of a specific industry can be traced by following the time path of an indicator of competitiveness. This usually takes the form of an inverted V-shaped curve, showing that competitiveness first improves and then deteriorates over time (Figure 1).

Capital accumulation (including the inflow of foreign direct investment) and forward and backward linkages with other industries has the effect of changing the comparative advantage of the country concerned and usually leads to an upgrading of the industrial structure. This can be represented by a series of V-shaped curves depicting the competitiveness of emerging industries, which are usually more technology-intensive than the preceding ones. A typical sequence seen among Asian countries is the shift from the textiles industry to the chemicals industry, and then further to the steel industry, the automobile industry, and the electronics/electrical industry.

When extended to the context of an open economy, the flying-geese model is used to describe the shifting of industries from more advanced countries to countries catching up from behind. This is shown in Part b of Figure 1, with the inverted V-shaped curves now representing the same industry in different countries (instead of different industries in the same country). A typical example is the shifting of textile production from Japan to the Asian NIEs and further to the ASEAN countries and China.

By contrast, the 2001 *White Paper on International Trade* published by Japan's Ministry of Economy, Trade and Industry has suggested that, owing to the emergence of China in East Asia, there has been some disruption in the conventional orderly catch-up process of the flying-geese pattern led by Japan, followed by the NIEs, ASEAN members, and China. It argues that, through receiving direct foreign investment, China has been gaining competitiveness not only in labor-intensive products, but also IT and other technology-intensive products. As a result, the complementary international division of labor according to the level of economic development has given way to stiffer competition, including in high-tech industries. In the long-term, such increased competition could bring overall benefits to the regional economy by improving productivity. In the short-term, however, increasing competition between China and ASEAN members could have negative repercussions on the latter, as illustrated by the 1997-98 Asian financial crisis.

Figure 1. Asia's Flying-Geese Pattern of Economic Development



3 Progress by Asian Countries in Advancing Their Export Structures

This section examines the relative position of China in Asia's flying-geese formation. The analysis will be based on an index showing the level of sophistication of the export structure for each major Asian country, to be derived in a two-step procedure as follows.

First, based on the assumption that high-value-added products are likely to be exported from high-income countries, while low-value-added products are likely to be exported from low-income countries, a product sophistication index is obtained for each export item as the weighted average of the per capita GDP of its exporters, using their respective shares of global exports as weights.

Suppose Japan, Korea, and China were the only countries exporting semiconductors and their respective shares of the global export market were 70 percent, 20 percent, and 10 percent, and if the per capita GDP were $40,000 in Japan, $10,000 in Korea, and $1,000 in China, then the product sophistication index for semiconductors would be 40,000 x 70% + 10,000 x 20% + $1,000 x 10% = $30,100. (In this case, the weights for all other countries were assumed to be zero). Thus, although semiconductors were produced in many countries, exports came from countries with an average per capita GDP of around $30,000.

By contrast, in the case of TVs, if the share of each country were 70 percent for China, 20 percent for Korea, and 10 percent for Japan, the sophistication index for TVs would only be $40,000 x 10% + $10,000 x 20% + $1,000 x 70% = $6,700. Thus, it would be reasonable to assume that semiconductors have a higher added value than TVs. The same calculation is then repeated for all products to derive their respective sophistication indexes.(1) In Figure 2, which shows the share distributions for socks, TVs, and semiconductors among exporters at different per capita GDP levels, the product sophistication index for each product category is given by the mean of the corresponding distribution.

The second procedure involves calculating a country sophistication index for each country to measure the level of advancement of its export structure, based on the assumption that the larger the share of high-value-added products in the country's exports, the more advanced its export structure. In the actual calculation, as many as 10,000 manufactured goods are included, but as an illustration, consider a country exporting only three items, representing high-tech products, medium-tech products, and low-tech products: semiconductors (with a product sophistication index of $30,100), TVs ($6,700), and socks ($2,000). Assume that the export structure of country A is as follows: semiconductors, 50 percent; TVs, 30 percent; and socks, 20 percent. The weighted average ($30,100 x 50% + $6,700 x 30% + $2,000 x 20% = $17,460) provides an indicator of the level of advancement of the export structure for country A. For country B whose exports are composed of 10 percent semiconductors, 20 percent TVs and 70 percent socks, its country sophistication index is then calculated as $30,100 x 10% + $6,700 x 20% + $2,000 x 70% = $5750. These indicators show that country A has a more advanced export structure than country B.

Figure 3 helps to explain the second calculation procedure. Export items from low-tech products to high-tech products are aligned along the horizontal axis along with the product sophistication index derived from the first procedure. The share of each product in the total exports of the country concerned is plotted on the vertical axis; together they form a distribution pattern that adds up to 100 percent.(2) The country sophistication index corresponds to the expected value of this distribution.

Using this framework of analysis, it is possible to evaluate the level of advancement of the export structure in Asian countries. US imports are used as a proxy for global exports because of the difficulty in obtaining consistent and comprehensive export statistics for each category of product for all countries of the world. For the product classification, the ten-digit HS (international harmonized system) commodity classification is used, and we limit our analysis to manufactured goods (approximately 10,000 product categories). When calculating the product sophistication index for each export item, we need data for the volume of exports as well as per capita income for all its exporters (in some instances, as many as 200 countries). To reveal historical trends, country sophistication indexes are calculated for 1990, 1995, and 2000.

Figure 2. Calculation of Product Sophistication Indexes

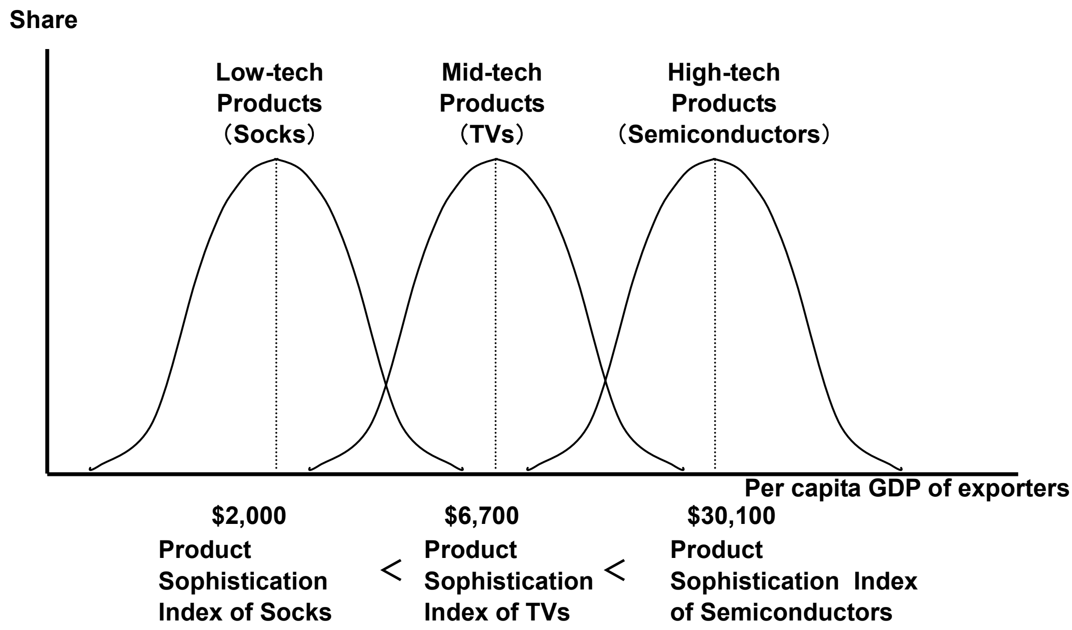
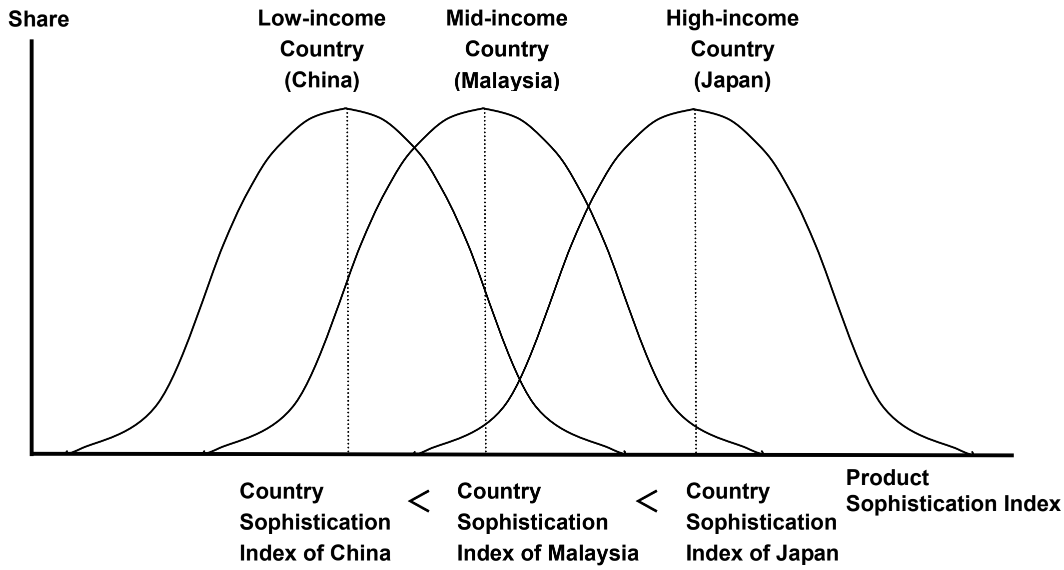


Figure 3. Calculation of Country Sophistication Indexes

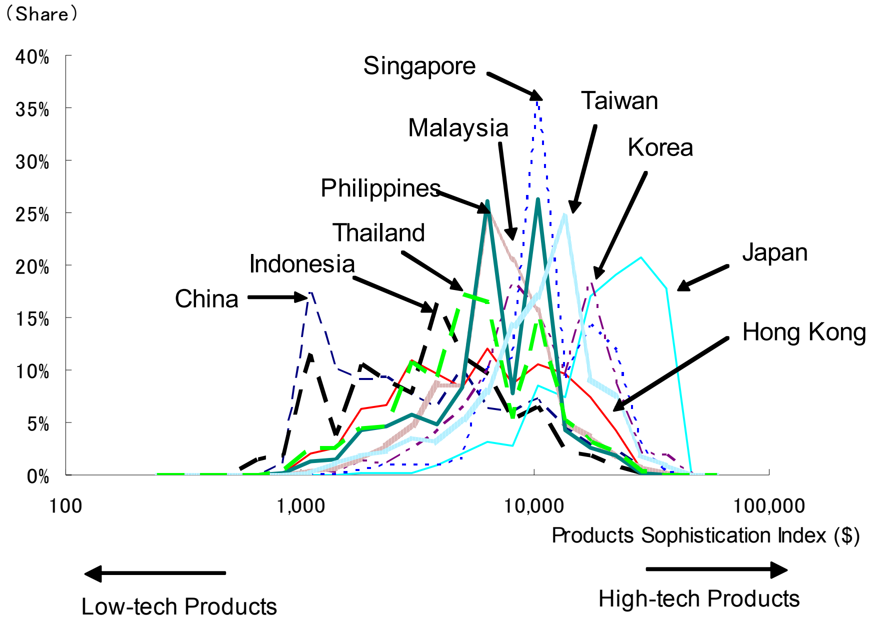


Our analysis confirms that the levels of advancement of the export structures of major Asian economies are broadly in line with their development stages (Figure 4). Even though Japan has gone through a "lost decade," it still has the most advanced export structure of all Asian countries. Meanwhile, China is still flying at the rear of the formation. Although it is true that the Asian NIEs and the ASEAN countries are tightly grouped in the middle, the traditional flying-geese pattern has remained intact.

The country sophistication index can be standardized to facilitate international comparisons by taking into consideration the global average and the standard deviation of the global distribution of exports among products at different levels of sophistication. This is similar to standardized scores (known as *hensachi*) widely used in Japan to compare the results of candidates in entrance examinations for Japanese universities. By design, a country with a sophistication index equal to the global average is assigned a standardized score of 50. The standardized score rises in proportion to a country's sophistication index. Specifically, a country whose sophistication index is one (two) standard deviation(s) above the global average would have a standardized score 10 (20) points higher than the average. Symmetrically, a country whose sophistication index is one (two) standard deviation(s) below the global average would have a standardized score 10 (20) points lower.

Although China's standardized score has risen from 31.1 in 1990 to 33.5 in 1995, and still higher to 36.2 in 2000, it is still far from the world average of 50, and ranks as the lowest in Asia (Table 1). This observation does not support the assertion that China's export structure has become totally out of line with its level of economic development, let alone that it has approached the sophistication level of Japan.

Figure 4. The Flying-Geese Pattern of Asian Exports (In Terms of Exports to the United States)



Source: Calculated by the author based on U.S. Department of Commerce, *U.S. Imports History.*

Table 1. Standardized Scores of Asian Exports to the US
(World Exports to the US=50)

		1990	1995	2000
Japan		55.2	56.5	56.6
NIEs	Hong Kong	41.4	43.0	42.9
	Korea	43.2	49.4	49.0
	Singapore	48.8	52.5	50.4
	Taiwan	44.2	47.6	48.5
ASEAN	Indonesia	31.1	35.1	36.5
	Malaysia	40.6	45.4	44.5
	Philippines	35.0	39.8	43.5
	Thailand	40.4	42.9	41.7
China		31.1	33.5	36.2

Source: Calculated by the author based on U.S. Department of Commerce, *U.S. Imports History.*

4 Complementary Relationship Between Japan and China

Based on the framework described above, the recent economic relations between Japan and China can be explained in terms of Figure 5. The horizontal axis represents the level of sophistication of export items as discussed earlier, and the vertical axis represents the volume of exports (instead of share) corresponding to export items at different levels of sophistication A country's exports can then be represented by a distribution among products at different levels of sophistication ranging from low-tech products to high-tech products. The distribution for Japan's exports is expected to be larger than that of China, reflecting its larger volume. It should also be located more to the right, reflecting the fact that high-tech products make up a larger portion of Japan's total exports. The extent of the part of the two distributions that overlap one another (C in Figure 5)—as a proportion of each country's total exports (A for China and B for Japan)—serves as an indicator of the degree of competition between the two countries. The greater the area of overlap between the two distributions as a percentage of Japanese exports (that is, C/B), the more China is a competitor of Japan. Conversely, the smaller the overlap, the more likely that China has an export structure complementary to that of Japan.(3) For China, it degree of competition with Japan is given by C/A.

There is no question that the volume of exports from Japan is larger than that from China, and that Japan's export structure is more advanced than that of China. However, there has been rising concern in Japan that the distribution representing China is expanding rapidly and moving fast to the right. In contrast, the Japanese distribution has been static and the prospect for restarting the engine of growth has remained dim. Against this background, many people in Japan have come to believe that China has already become a strong competitor for Japan, and that in the near future Japan will be eclipsed by China. The China threat rhetoric is merely an expression of this fear.

Although the total amount of exports from China has been increasing, labor-intensive products still feature largely in the export structure and the level of competition with Japan today is not necessarily high. It is clear that the export structures of China and Japan are complementary to, rather than competing with, each other—just as the big difference in their levels of economic development would lead one to expect (Figure 6). Based on the framework laid down in Figure 5, our estimates show that China and Japan were competitors in only about 16.3 percent of their exports to the United States in value terms in 2000, although the percentage has been growing over time (from 3.0% in 1990 and 8.3% in 1995.)

Figure 5. Competition Between China and Japan

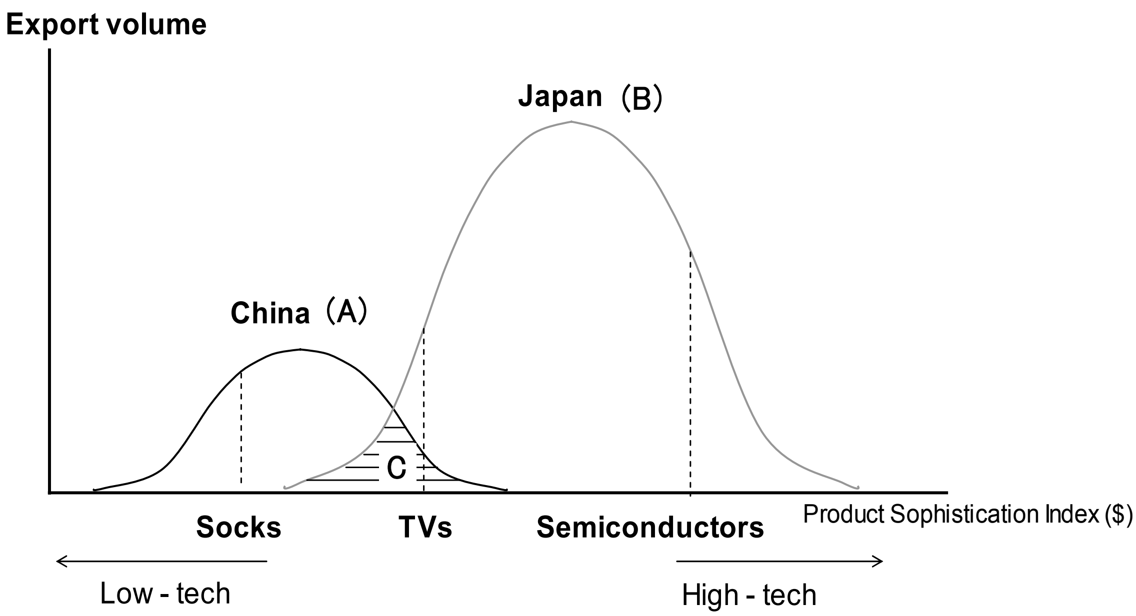
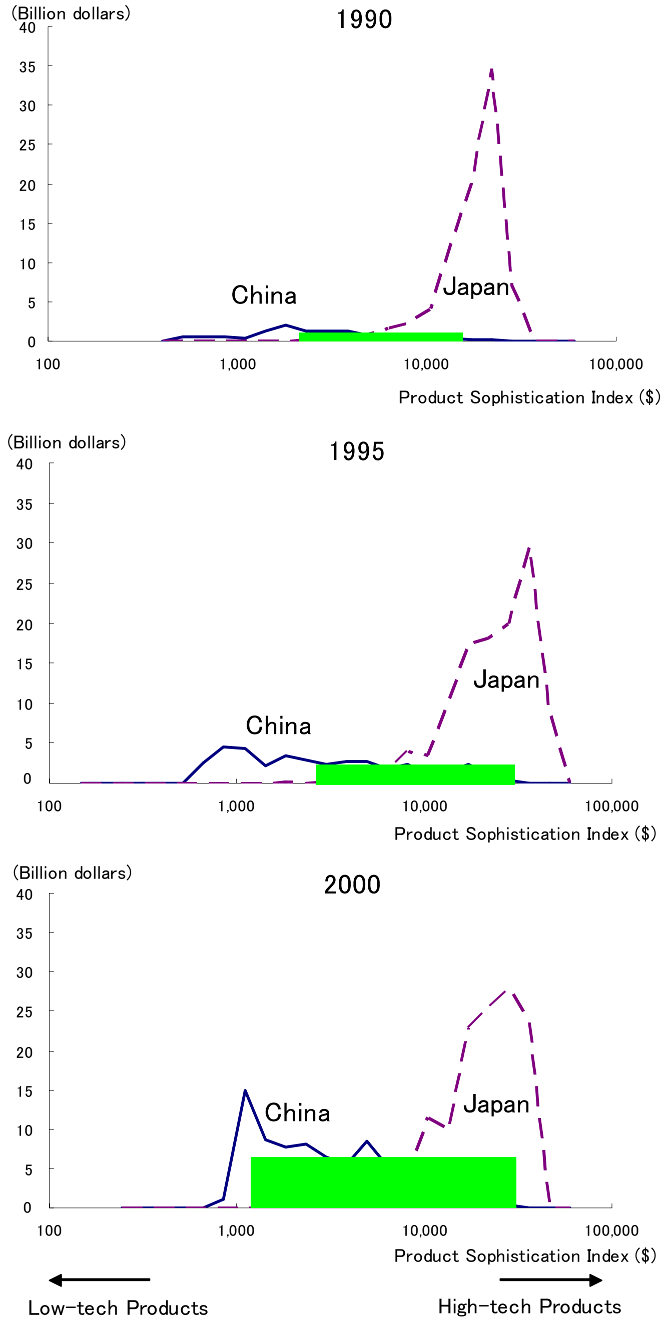


Figure 6. Competition Between China and Japan in the US Market



Source: Calculated by the author based on U.S. Department of Commerce, *U.S. Imports History.*

These results show merely the extent to which products exported from Japan and China overlap. Two additional factors have to be considered to evaluate more accurately the degree of competition between the two countries. First of all, even though certain products are classified in the same category, in many cases Japan specializes in products for an upscale market and China specializes in low-priced products. TVs are a typical case in point, and the price tag for high-definition TVs exported by Japan is many times higher than that for the standard TVs made in China. Chinese exports also include many more imported parts and components than Japanese exports. The imported content of products exported from China is estimated to be over 50 percent, and this percentage is expected to be higher for high-value-added products than for low-value-added ones.

Thus, the degree of actual competition between Japan and China is likely to be even lower than what the result of the calculations would indicate. In addition, competition between Japan and China exists only in relatively low-value-added products, in which Japan no longer enjoys any comparative advantage.

For the sake of comparison, we have also calculated the level of competition with China for other major Asian economies. Our estimates show that the ASEAN countries, whose income levels are still low, tend to compete more with China than the Asian NIEs, which are at a more advanced stage of economic development (Table 2).

Table 2. Asian Competition with China in the US Market

	1990	1995	2000
Japan	3.0%	8.3%	16.3%
South Korea	24.0%	27.1%	37.5%
Taiwan	26.7%	38.7%	48.5%
Hong Kong	42.5%	50.5%	55.9%
Singapore	14.8%	19.2%	35.8%
Indonesia	85.3%	85.5%	82.8%
Malaysia	37.1%	38.9%	48.7%
Philippines	46.3%	47.8%	46.1%
Thailand	42.2%	56.3%	65.4%

Source: Calculated by the author based on U.S. Department of Commerce, *U.S. Imports History.*

5 China's Export Competitiveness in IT Products

Let us now take a closer look the export performance of China and other Asian countries in IT products, again in the US market. Following the Japan External Trade Organization classification, IT products covered here include eight categories: (1) computers and peripherals; (2) office equipment; (3) telecommunications equipment; (4) semiconductors and other electronic parts; (5) miscellaneous electronic components; (6) video equipment; (7) audio equipment; and (8) measuring and testing devices (JETRO, 2001).

The imports of IT products into the US in 2000 stood at $252.9 billion, about 3.3 times more than the $76.2 billion of 1990. Two thirds of these imports came from East Asian countries including Japan, NIEs, ASEAN and China. Reflecting the shift of production from advanced nations like Japan and NIEs to the latecomers like ASEAN countries and China, the share of the latter group has been rising at the expense of the former group (Table 3).

Especially in recent years, IT products from China have been gaining international competitiveness. The value of IT products exported from China to the US increased dramatically from $1.5 billion in 1990 to $26.2 billion in 2000. This is also reflected in the rise of the share of IT products in Chinese exports to the US from 9.9 percent to 26.2 percent. At the same time, China's share of US imports of IT products rose from 2.0 percent to 10.3 percent.

By contrast, although the value of Japan's exports of IT products to the US rose from $28.3 billion in 1990 to $44.4 billion in 2000, its share in this sector of the US import market declined from 37.1 percent to 17.6 percent. This decline reflects the shift by Japanese companies away from "Made in Japan" towards "Made by Japan" in a strategy that relies more and more upon overseas direct investment and original equipment manufacturing (OEM) contracts. This share reduction is largely the result of this Japanese advance into China and ASEAN countries, with goods produced in overseas subsidiaries now expanding their share in the US import market at the expense of exports from Japan.

Has China made a leap forward or, as so many gloomy forecasters have said, are ASEAN countries losing out in competition with China for IT goods? Our analysis shows that the ASEAN countries are actually doing quite well in the US market. The five major ASEAN countries—Indonesia, Malaysia, Thailand, Singapore and the Philippines—rapidly expanded their exports of IT products to the United States from $5.5 billion in 1990 to $38.0 billion in 2000. IT products accounted for 57.4 percent of the total exports to the US from these ASEAN countries in 2000, up from 31.8 percent a decade ago. At the same time, ASEAN's share of IT products in the US import market doubled from 7.2 percent to 15 percent.

The major advance in China's IT industry is also apparent from its improving revealed comparative advantage (RCA) index (Table 4). For a specific product, China's RCA index is obtained by dividing China's share of total exports (to the United States in our case) by its share of total global exports (to the US). If the share of China's total exports (to the US) is larger than its share of total global exports (to the US), China's RCA index for that product is greater than one, indicating that China has a comparative advantage in that product.

Table 3. US Imports of IT Products from Asia and the World

(Million $)

		year	JAPAN	CHINA	NIEs	ASEAN	WORLD
1	Computers and peripherals	1990	8,725	53	9,059	735	23,259
		2000	14,430	10,013	28,479	14,037	88,047
2	Office equipment	1990	2,094	60	500	52	3,264
		2000	1,211	740	315	303	3,200
3	Telecommunications equipment	1990	1,965	350	1,515	499	5,916
		2000	3,921	2,926	5,526	2,747	35,104
4	Semiconductors and other electronic parts	1990	3,758	5	3,944	2,582	12,967
		2000	8,793	776	17,325	13,564	49,223
5	Miscellaneous electronic parts	1990	3,439	185	2,413	277	12,293
		2000	5,958	4,497	5,131	1,957	33,492
6	Video equipment	1990	4,788	113	1,306	629	8,037
		2000	5,525	2,724	1,623	3,258	18,738
7	Audio equipment	1990	2,216	674	1,351	694	5,881
		2000	1,329	3,706	854	1,834	10,661
8	Measuring and testing devices	1990	1,282	70	321	27	4,603
		2000	3,225	784	677	307	14,429
	IT products	1990	28,267	1,509	20,409	5,494	76,222
		2000	44,392	26,167	59,931	38,007	252,893
	Manufactured goods	1990	84,007	11,967	53,698	11,804	340,931
		2000	134,336	86,456	103,836	55,597	885,022
	All goods	1990	89,655	15,224	60,487	17,292	495,260
		2000	146,479	100,018	111,438	66,255	1,218,022

Source: Calculated by the author based on U.S. Department of Commerce, *U.S. Imports History.*

Table 4. RCA Indexes for Asian IT Exports to the US

		year	JAPAN	CHINA	NIEs	ASEAN
1	Computers and peripherals	1990	2.07	0.07	3.19	0.90
		2000	1.36	1.38	3.54	2.93
2	Office equipment	1990	3.54	0.60	1.26	0.46
		2000	3.15	2.82	1.08	1.74
3	Telecommunications equipment	1990	1.84	1.92	2.10	2.41
		2000	0.93	1.02	1.72	1.44
4	Semiconductors and other electronic parts	1990	1.60	0.01	2.49	5.70
		2000	1.49	0.19	3.85	5.07
5	Miscellaneous electronic parts	1990	1.55	0.49	1.61	0.65
		2000	1.48	1.63	1.67	1.07
6	Video equipment	1990	3.29	0.46	1.33	2.24
		2000	2.45	1.77	0.95	3.20
7	Audio equipment	1990	2.08	3.73	1.88	3.38
		2000	1.04	4.23	0.88	3.16
8	Measuring and testing devices	1990	1.54	0.49	0.57	0.17
		2000	1.86	0.66	0.51	0.39
	IT products	1990	2.05	0.64	2.19	2.06
		2000	1.46	1.26	2.59	2.76
	Manufactured goods	1990	1.36	1.14	1.29	0.99
		2000	1.26	1.19	1.28	1.15

Source: Calculated by the author based on U.S. Department of Commerce, *U.S. Imports History.*

The RCA index for China's IT products improved from 0.64 in 1990 to 1.26 in 2000. In some sectors there has been remarkable progress, particularly in computers and peripheral devices (rising from 0.07 to 1.38), office equipment (up from 0.60 to 2.82), and video equipment (from 0.46 to 1.77). Nevertheless, the level of improvement in the RCA index has only been marginal for IT products that embody high added value, such as semiconductors and other electronic parts (increasing from 0.01 to 0.19), and measuring and testing devices (from 0.49 to 0.66).

Although China's competitiveness in IT products has improved rapidly over time, it still lags behind Japan, NIEs, ASEAN, and other countries in Asia. At 1.26, China's RCA index for IT products is still lower than the 2.76 for ASEAN, 2.59 for NIEs and 1.46 for Japan (figures are for 2000, the latest available). In individual categories, furthermore, although China is more competitive than ASEAN countries in office equipment and miscellaneous electronic parts, audio equipment, measuring and testing devices, it is less competitive in computers and peripheral devices, telecommunications equipment, semiconductors and other electronic parts, and video equipment.

While an RCA-based analysis seems to indicate favorable trends for China in terms of the competitiveness of individual Chinese IT products, this is not a valid way to make an assessment of China's exports of IT products as a whole. The simple reason for this is that there are diverse IT products, from high-value-added to low-value-added products. To take this into consideration, we use the same method as in Section III to calculate the standardized score for exports of IT products from China and other Asian countries. In addition to treating IT products as a group, we also take a closer look at the eight major categories. Our result shows that although the standardized score for Chinese IT products as a group rose from 33.9 in 1990 to 40.7 in 2000, this figure is still a long way from the world average of 50 (Table 5). Among major East Asian countries, China actually ranks second from the bottom, one rank above Indonesia. This reflects the fact that, although the export of IT products from China has rapidly expanded, most of this activity has been concentrated in products with low added value. It is easy to see how Japan, without exception, has a great lead over China across each of the eight IT product categories.

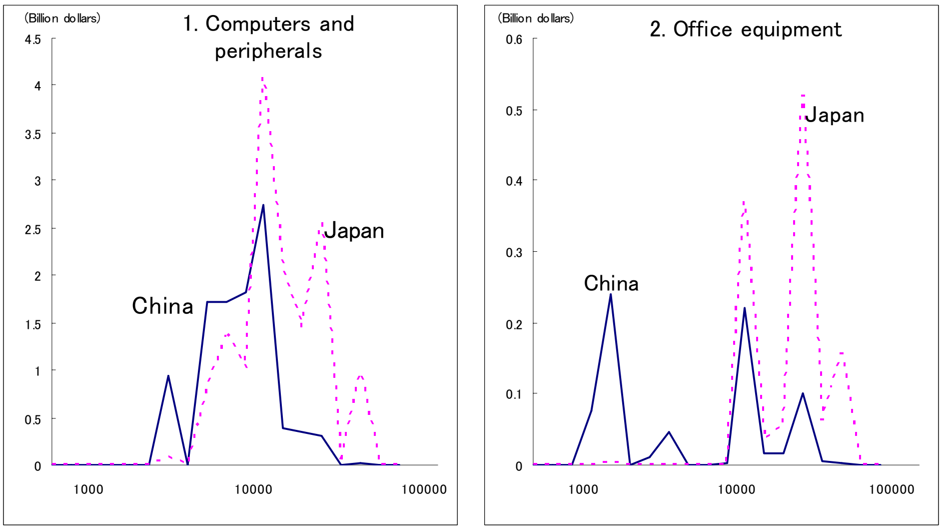
Table 5. Standardized Scores of Asian Exports of IT Products to the US

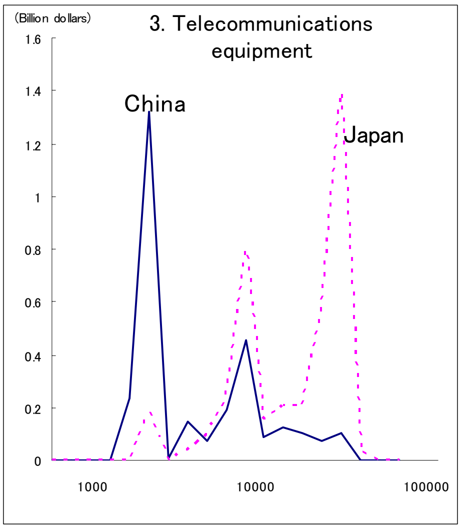
	Category		Japan	Korea	Taiwan	Hong Kong	Singapore	Indonesia	Malaysia	Philippines	Thailand	China
1	Computers and peripherals	1990	54.8	41.1	43.4	45.5	48.6	43.1	41.3	47.5	46.2	44.8
		2000	55.9	47.7	52.9	46.2	52.4	41.9	46.1	47.2	44.3	44.3
2	Office equipment	1990	53.2	37.6	35.2	47.3	41.8	53.0	24.2	54.4	24.2	28.0
		2000	56.2	51.9	41.7	48.3	49.5	36.9	38.4	52.3	48.1	42.4
3	Telecommunications equipment	1990	54.7	47.5	45.2	48.8	50.1	45.5	37.5	34.9	41.6	34.8
		2000	53.8	47.3	47.5	42.2	47.8	41.2	40.0	38.4	40.5	36.0
4	Semiconductors and other electronic parts	1990	55.1	49.0	47.6	46.2	49.7	47.3	43.1	42.4	45.3	38.7
		2000	54.6	51.2	49.9	46.6	52.9	47.0	43.7	43.9	44.2	47.3
5	Miscellaneous electronic parts	1990	52.9	49.4	49.8	50.6	44.6	50.8	44.2	47.8	44.4	48.5
		2000	56.4	52.3	51.7	47.8	53.4	44.1	47.6	39.0	42.0	41.7
6	Video equipment	1990	55.6	47.8	42.2	49.6	41.0	52.4	41.6	44.5	48.0	35.9
		2000	58.9	51.2	57.9	43.9	49.3	37.4	46.1	49.0	42.8	43.9
7	Audio equipment	1990	56.2	48.2	47.0	43.9	48.0	42.8	43.6	40.1	41.0	41.1
		2000	56.6	53.7	52.7	48.0	52.1	48.2	48.5	40.8	52.1	42.8
8	Measuring and testing devices	1990	52.3	44.2	43.9	45.5	46.8	38.9	33.2	50.6	43.7	36.9
		2000	54.2	46.3	43.0	40.9	52.0	33.7	44.8	36.8	41.8	39.2
	IT products	1990	54.5	46.2	47.4	48.6	49.8	44.0	38.8	39.5	46.0	33.9
		2000	55.5	49.7	51.3	47.0	51.8	38.7	44.7	45.9	44.0	40.7

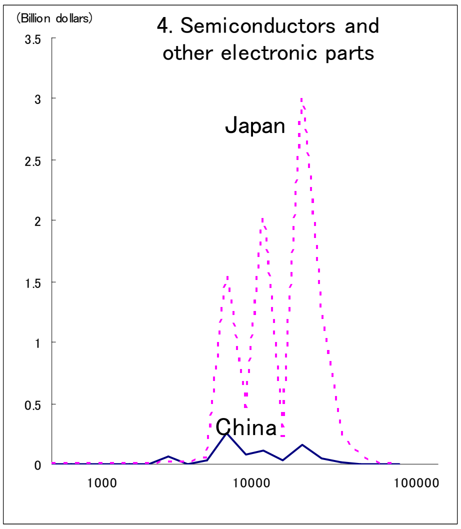
Source: Calculated by the author based on U.S. Department of Commerce, *U.S. Imports History.*

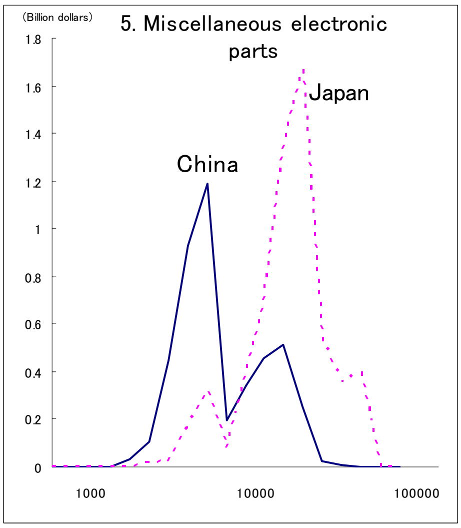
Next, let us examine the extent of competition between Japan and China in IT products in the same way as we have just done for the entire range of manufactured goods above. In terms of the overlap between the two countries' exports to the U.S market, Japan's level of competition with China in IT products increased from 3.5 percent in 1990 to 31.8 percent in 2000, with the level of competition with China increasing in all of the eight major IT sectors. A closer look at the data, however, clearly shows that Japan occupies the market niche for high-value-added products and China the niche for low-value-added products. It is apparent that there is hardly any competition (that is, overlap) in high-value-added products between the two countries (Figure 7).

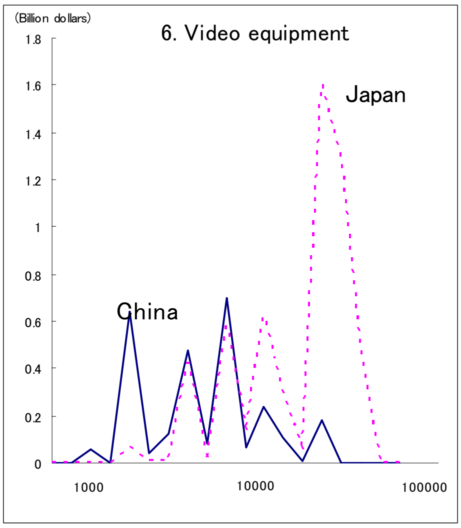
Figure 7. Competition Between China and Japan IT Products in the US Market

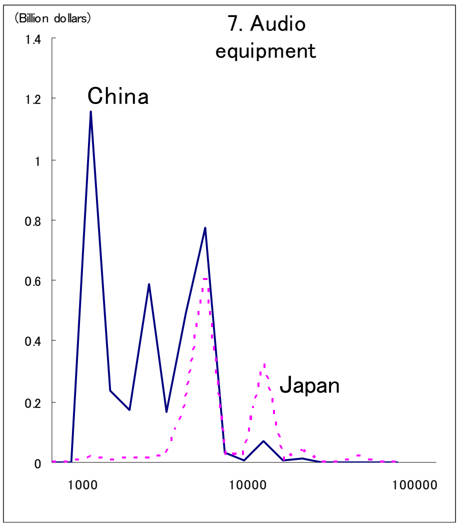


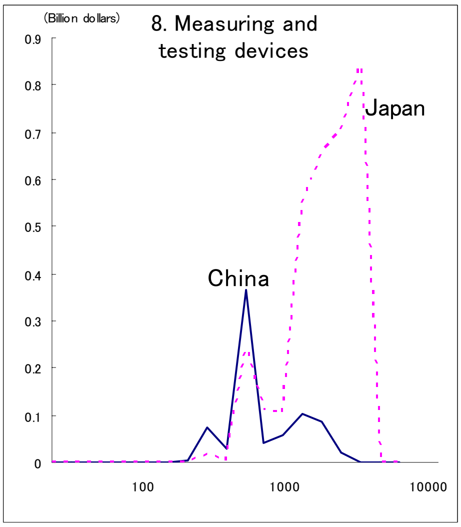

(Billion dollars)
3. Telecommunications equipment
China
Japan
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1000
10000
100000


(Billion dollars)
4. Semiconductors and other electronic parts
Japan
China
3.5
3
2.5
2
1.5
1
0.5
0
1000
10000
100000


(Billion dollars)
5. Miscellaneous electronic parts
Japan
China
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1000
10000
100000


(Billion dollars)
6. Video equipment
Japan
China
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1000
10000
100000





Source: Calculated by the author based on U.S. Department of Commerce, *U.S. Imports History.*

6 Possibility of Leapfrogging by the Chinese Economy

Our analysis has clearly shown that even though China has made rapid progress towards industrialization in many fields—including IT, its industrial development has been broadly in line with the flying-geese pattern. Still, many speculate that China may skip the usual long process of industrialization and enter the ranks of developed nations in a short span of time by exploiting IT and other new technologies. While a majority of Japanese experts have adopted this leapfrog scenario to predict the future course of Chinese economy, most economists in China are much less optimistic.

In retrospect, China has already failed in two leapfrogging attempts. The first came during the Great Leap Forward in the 1950s under the leadership of Chairman Mao Zedong. The goals at the time were to overtake the United Kingdom in 10 years and leave the United States behind in 20 years. These goals, however, were far from being realized. These efforts turned out to be a disaster that wasted a lot of time and took millions of lives.

The second attempt was the Great Leap Outward undertaken by the administration of Hua Guofeng in the 1970s before the resurgence of Deng Xiaoping. The idea was to import the latest technologies from abroad and carry out full-swing industrialization at an accelerated pace. In the end, however, the Chinese could not effectively use the equipment they imported and end up wasting a great deal of foreign currency.

There has never been an economic law saying that a company should pursue high-tech for its own sake. Profitable industries in China do not necessarily belong to the high-tech variety. Instead, most of them are low-tech. To make money in China, whether you are operating a local business or a foreign affiliate, you naturally require good management. An even more important question, however, is whether you will be able to exploit China's current strengths and comparative advantages.

A great many Japanese have the wrong impression that China's strength lies in its high-tech industries. But the truth is that the sectors requiring labor-intensive methods of production are still the strongest. While Japan maintains a comparative advantage in high-tech industries, it is in the labor-intensive industries where China can compete in international markets. Thanks to the existence of a huge pool of surplus labor in rural areas, China will be able to hold on to its competitiveness without significantly raising wages while maintaining high economic growth.

But this is not to dismiss the possibility of leapfrogging advances in certain areas. China is such a big country that if it concentrates its resources in a specific area it may produce impressive results. For example, China is seen as being ahead of Japan in rocket development. Furthermore, many foreign affiliates bring cutting-edge technologies and facilities to China to take advantage of the country's policy of giving market access in exchange for technology.

Yet, investment efficiency must also be addressed by taking opportunity cost into account in terms of the kinds of economic effects that can be expected when the same amount of capital is invested in alternative areas. Unfortunately, perhaps because trained engineers outnumber trained economists among the Chinese leadership, efficiency is neglected and projects that pursue high technology for it own sake are seen everywhere.

In the new economy, the most important assets are not the most-advanced technologies and facilities themselves, but rather human resources that have acquired the knowledge to develop and utilize them. For China to catch-up with developed nations, there is no alternative other than to improve the overall quality of the country's human resources. In addition to raising the level of education of its 1.3 billion people, China must also enhance its capacity for technological development and its ability to absorb technologies from abroad. Since the educational level of the country as a whole cannot be improved significantly in a short time, the economy can only develop by moving forward one step at a time. If we look at China's past experiences and the constraints it is now facing, it is clear that leapfrogging is a highly unrealistic expectation.

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(1) The resulting product sophistication index for each type of product is not fixed and shifts according to changing circumstances. For example, in the initial period, a product may be exported only from advanced countries and this would be reflected in a high sophistication index. Later, with the transfer of production to developing countries, however, the sophistication index would decline accordingly. In the actual calculation, moreover, per capita GDP is measured in log-form data.

(2) To be exact, in order to represent a discrete distribution in a continuous way, the share of each separate product should not be matched directly with the sophistication index. Rather, it is necessary to obtain aggregate shares by dividing products into several intervals according to the product sophistication index.

(3) The degree of competition between any two countries (such as China and Japan, for example) can actually be calculated independent of the product sophistication index. For each product category, compare the corresponding figures for China and Japan to obtain the minimum value of the two. The total amount of overlap between the two countries' exports can be calculated by summing these minimum values for all product categories. For China, the degree of competition with Japan can be obtained by dividing this overlap amount with total Chinese exports; and for Japan, the degree of competition with China can be obtained by dividing the same amount with total Japanese exports. Even so, in order to understand whether the competition between the two countries is in the high-value-added or low-value-added product categories, it is useful to base our analysis on the product sophistication index.

References:

Akamatsu, Kaname, "A Historical Pattern of Economic Growth in Developing Countries," *The Developing Economies* (preliminary issue; 1962).

JETRO, *White Paper on International Trade* (2001), Japan External Trade Organization.