Why Are Chinese Exports Not So Special?

*Shunli Yao**

Abstract

Applying a commonly used index for export sophistication in a cross-country study, Rodrik finds that the technological content of Chinese exports over the past decade has been so high that it cannot be explained simply by the economic fundamentals of a low-income country abundant with unskilled labor. Question has been raised for the empirical robustness of the index. I am also doubtful with Rodrik's analysis but develop my argument from a different perspective. This paper briefly reviews Rodrik's methodology and identifies other factors his empirical results potentially hinge on. Based on this, it elaborates on China's unique processing trade regime, the uneven distribution of its exports across Chinese regions and the limitation of HS codes in terms of identifying differentiated products, in an attempt to show that these factors also contribute to higher estimations of China's export sophistication level. Finally, it organizes trade data to reveal the trade patterns that are indeed consistent with the country's comparative advantage.

Key words: China, technological sophistication index, trade
JEL codes: C43, F10, F14,

I. Introduction

More than half a century ago, Harvard economist Wassily Leontief found that US exports were less capital intensive than US imports (Leontief, 1953). This famous finding, known as the "Leontief paradox," contradicts the prediction of the Heckscher-Ohlin theorem, and has since stimulated a series of inquiries into the empirical validity of the factor proportion theory. Dani Rodrik (2006), another Harvard economist, argues in a cross-country study

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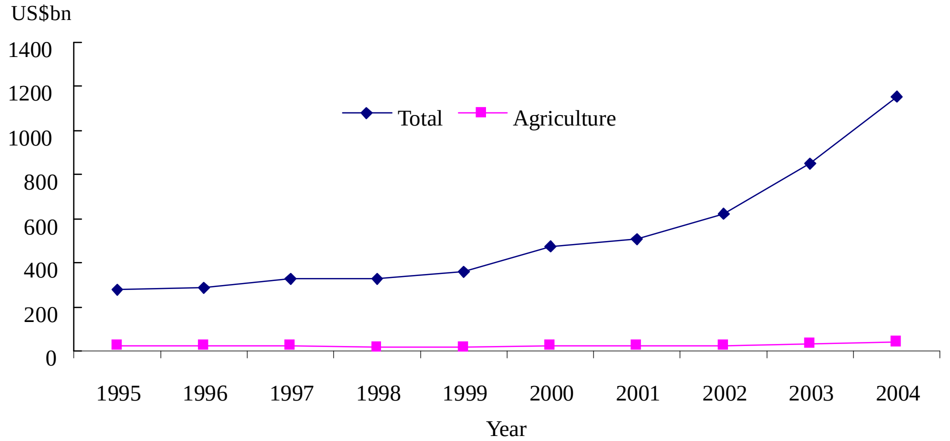
that the technological sophistication of Chinese exports in the past decade has been so high that it can not be explained simply by the economic fundamentals of a low-income country abundant with unskilled-labor (Rodrik, 2006). Rodrik further hypothesizes that this seeming anomaly, or "Rodrik paradox",[1] is a result of China's industrial policies that help nurture domestic capabilities in consumer electronics and other "advanced areas", which are making up an increasingly large portion of Chinese exports.

Indeed, China's trade growth over the past decade has been impressive not only in terms of volume but also in terms of structural change. As shown in Figure 1, from 1995 to 2004, Chinese foreign trade, defined as imports plus exports, increased from US$281bn to US$1 155bn, a growth of over 300 percent. Agricultural trade has been flat over time with its share in total trade decreasing to below 4 percent in recent years. The dramatic compositional change in trade is reflected most notably in the machinery, electrical machinery and parts (Mach/Electrical)[2] sector, which is traditionally regarded as a high-tech sector in developed countries. The sector's share in total Chinese exports rose from 20 percent over 1995–1997 to 40 percent over 2002–2004 (Figures 2 and 3). Specifically, from 1995 to 2004, exports of the said sector increased in value from US$27.7bn to US$247.8bn, up by 795.7 percent; and its share in total Chinese exports rose from 18 to 42 percent.

In fact, there have been quite a few suggestions by commentators of Chinese technological upgrading in view of the surge of electronics exports to the USA, as the

Figure 1. Total Foreign Trade (imports + exports) 1995–2004

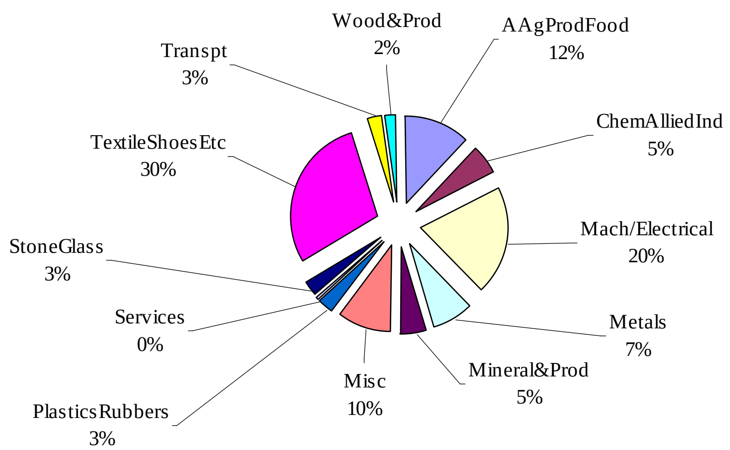


Source: Databank of China customs statistics.

[1] I thank Hossein Jalilian for suggesting this term.

[2] Keys to abbreviation of sector names used in this paper are listed in the appendix.

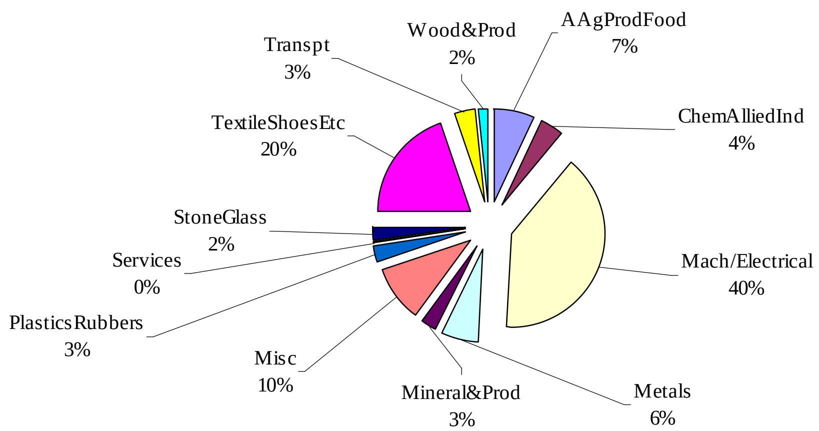
Figure 2. Chinese Exports to the World by Sector: 1995–1997 Average



Source: Databank of China customs statistics.

Note: Keys to abbreviation of sector names are listed in the appendix.

Figure 3. Chinese Exports to the World by Sector: 2002–2004 Average



Source: Databank of China customs statistics.

Note: Keys to abbreviation of sector names are listed in the appendix.

sector is often regarded as high-tech in the USA as well as in China. Particularly, the sector has been selected by several high-profile national programs in China for technology promotion. However, serious economists often dismiss these claims, arguing that those Chinese exports are just low-technology products from high-tech industries (e.g., Blustein, 1997). Even if Chinese exports of machinery and electronics have undergone genuine technological upgrading over time, because of the "product cycle hypothesis"and the accelerated pace of innovation in the developed countries, particularly in the US information and communications technology sector, it is still questionable whether its technological upgrading has come to the level that contradicts the principle of comparative advantage in a cross-country comparison. The "Rodrik paradox" is the first academic exposition of this commonly held belief or mis-belief, and therefore deserves careful scrutiny.

In a direct response to Rodrik's work, Kumakura (2007) illustrates using numerical examples that Rodrik's technological sophistication index of a country's export sector (*EXPY*) is quite sensitive to the size of the country and the product coverage of its exports. Also, by converting per capita GDP (Y) into its log form (lnY), measurements of a product's technological sophistication level and, in turn, a country's export sophistication level become lower, particularly for large and poor countries like China and India. Therefore, Kumakura concludes that the overly high index (*EXPY*) for China might simply represent an upward bias caused by the country's sheer size and its wide range of export products, and be a result of using Y instead of $\ln Y$ to construct the index *PRODY*.

Like Kumakura, I also harbor some doubts about Rodrik's analysis. However, I will not indulge in discussions regarding the specification of the indexes and their empirical robustness. Rather, in the next section, I will give a brief review of the Rodrik's methodology and identify other factors that his empirical results potentially hinge on. In Section III, I will elaborate on China's unique processing trade regime, the uneven distribution of exports across Chinese regions and the limitations of HS codes in terms of identifying differentiated products, in an attempt to show that these factors also contribute to higher estimations of China's export sophistication level. Section IV organizes the data to reveal the trade patterns that are indeed consistent with the country's comparative advantage. Section V concludes with a discussion on the implications for other studies on China based on the Rodrik indexes.

II. Interpreting Rodrik's Indexes

Rodrik's technology sophistication indexes for a product and for a country's exports are based on the idea that a rich country normally has comparative advantage in technologically sophisticated products. A product's technological content is positively associated with an exporting country's per capita income and its revealed comparative advantage in this product:

$$PRODY_k = \sum_j \frac{x_{jk}/X_j}{\sum_j (x_{jk}/X_j)} Y_j ,$$

where $X_j = \sum_l x_{jl}$ is country *j*'s total exports summed over commodity *l*, Y_j is country *j*'s per capita GDP, and x_{jk}/X_j is the share of country *j*'s export of good *k* in its total exports. In other words, $PRODY_k$ is measured as the weighted average of a country's per capita income with its revealed comparative advantage in this product (x_{jk}/X_j) as weights.

Based on the first index, Rodrik develops the second index to measure the level of technological sophistication of country *j*'s exports:

$$EXPY_j = \sum_l \frac{x_{jl}}{X_j} PRODY_l .$$

This is the weighted average of $PRODY$ over product *l* with the export shares of each product as the weights.

The two indexes are quite intuitive. The first defines a product's technological level and the second defines that of a country's exports. High-income countries' comparative advantage sectors must be technology intensive and, therefore, their main exports tend to be more technologically sophisticated. The same logic can also apply to low-income countries. Meanwhile, a country's exports are more (less) sophisticated if it exports more (less) technologically sophisticated products.

However, the ability of these indexes, especially the first one, to capture the true level of technological sophistication of a product or a country's export sector is conditional on the following assumptions:

1 Exports only use domestic inputs in their production. The logic behind Rodrik's first index is that only domestic factors are embodied in a country's exports, which makes it possible to infer from trade theory that rich countries with abundant capital and human capital will necessarily export skill-intensive products. The logic is consistent with trade in inputs, as long as imported inputs are used only in the non-tradable sector. However, if imported inputs are used in the production of exports in a significant way, a country's exports will contain not only domestic but also foreign factor contents. In that case, the indexes will not be able to serve their intended purpose.

2 Even income distribution across exporting and non-exporting regions. In the first index, country *j*'s per capita GDP (Y_j) is the proxy for capital and human capital abundance of its exporting region, and its weighted average across *j* provides a proxy of the technology content of a given product *k* ($PRODY_k$). In the second index, for a given country *j*, the weighted average of $PRODY_k$ across *k* provides the measurement of *j*'s export sophistication ($EXPY_j$). Conceptually, the exporting region's per capita GDP within country *j* should be

used to construct and to make comparison with these indexes. To be precise, an exporting region is an area where an export sector is located and factors and products can move freely. The regional per capita GDP could be substituted with the national one only if they do not differ very much. Otherwise, national $PRODY_k$ might not be a good indicator of an export product's technological sophistication. Similarly, $EXPY_j$ is comparable more with country *j*'s exporting region's per capita GDP than its national one.

3 Product classification scheme is detailed enough to exhaust all critical differentiations for any given type of product. For example, all products made in various parts of the world and classified as *k*, shall not differ significantly in quality, function and other key parameters. More detailed product classification can generate more precise correspondence between countries and their comparative advantage products (and vice versa), and, therefore, $EXPY_j$ is more accurately estimated. This is especially important when a low-income country happens to have a comparative advantage in goods that have the same trade commodity codes as those that mostly characterize the export patterns of high-income countries. This scenario is possible when there is a large number of variety for the type of goods, which are distinctly heterogeneous in nature, and the product classification scheme is not detailed enough to differentiate them. In this case, high-income countries' per capita GDP and their revealed comparative advantages will have a heavy influence on $PRODY_k$. When $PRODY_k$ is applied to a low-income country, its $EXPY_j$ is overestimated.

Assumptions 1 and 2 are country-specific characteristics, whereas assumption 3 is a general issue for all countries. Do the first two assumptions hold for China? Can China serves as a case study to shed any light on the validity of assumption 3? These questions are considered in the next section.

III. Institution, Regional Patterns and Limitations of HS Codes

1. Chinese Processing Trade Regime

The Chinese foreign trade regime is characterized by the co-existence of import substitution and export promotion (Naughton, 1996), Chinese customs regimes can be broadly grouped into two categories: ordinary and processing trade regimes. Ordinary trade is normal trade that does not benefit from special customs arrangements and tariff preferences. The ordinary trade regime serves the import substitution strategy of the country's industrialization. In the early years of reform in China, the country was eager to promote exports to earn foreign currency. To serve this export promotion strategy, a processing trade regime was set up under which imports were free of duty and value-added taxes, and products using imported inputs were required to be exported. This processing trade regime facilitates, if not necessarily encourages, processing trade.

This institutional arrangement for export promotion, which is equivalent to an "export processing zone," is nothing new in the world. However, the development of production fragmentation, a new aspect of modern world trade (Krugman, 1996), has set the global context for the rapid expansion of China's processing trade, with FDI in its processing sector as the main mode of foreign outsourcing to China.

FDI inflow into China over the past decade has been motivated by both external and internal factors. The Asian financial crisis in the late 1990s left the ASEAN economies in a shambles. In comparison, China was a much better alternative for FDI that would otherwise have gone to Southeast Asia. Data from the IMF shows that during the late 1990s and early 2000s, FDI inflow into China was increasing over time, whereas FDI inflows to key ASEAN countries (Thailand, the Philippines, Malaysia and Indonesia) were fluctuating and declining. Internally, the additional tax concessions given to export-oriented foreign funded enterprises (FFE) encourage FDI inflow into the processing trade sector and, therefore, encourage increased exporting. As a result, according to Naughton (1996), China has created a "gigantic export processing zone."

Traditionally, Southeast Asia has had a strong trade relationship with the USA, exporting mainly labor-intensive manufactured goods. Shift of FDI from ASEAN countries to China, resulting from the Asian financial crisis, also transferred their exporting capacity, as well as production linkages between China-based FFE and the ASEAN economies. Therefore, FDI inflows reinforced the production linkages in the region. This is evident from the development of China's trade patterns over the past decade as described below.

China ran a trade surplus over 1995–2004, which peaked at US$43.4bn in 1998 and stabilized around US$30bn in later years, but its trade deficits or surpluses with individual trading partners had been expanding significantly over the period. Among them, apart from Hong Kong,[3] China has the largest trade deficits with NAFTA[4] and the 15 EU-member countries combined. However, China is currently running a deficit with all major neighboring Asian countries and regions, including Taiwan, South Korea, Japan and the ASEAN economies.

China's soaring surpluses with NAFTA and the EU-15 countries are mirrored by soaring deficits with Asia and other regions. The patterns are consistent with the observation that re-organization of production and trade is accelerating and centering on China in the Pacific

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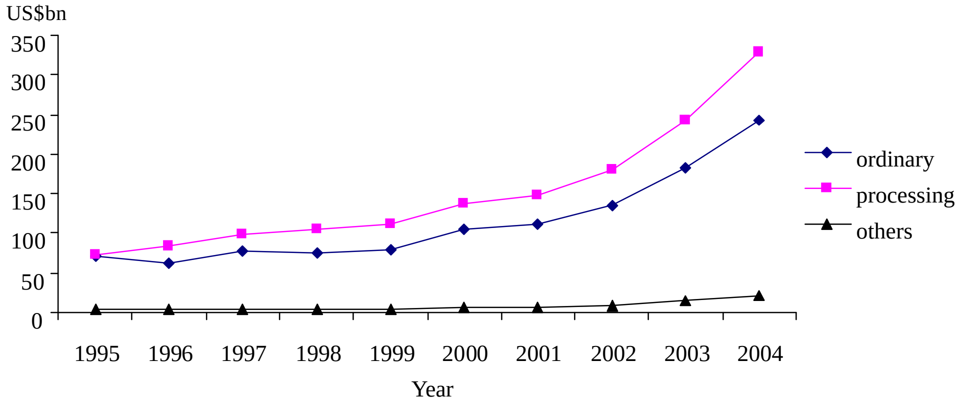
[3] Due to entrepot trade and smuggling, Hong Kong's trade data with mainland China can be quite misleading. For detailed discussion, see Yao (2008).

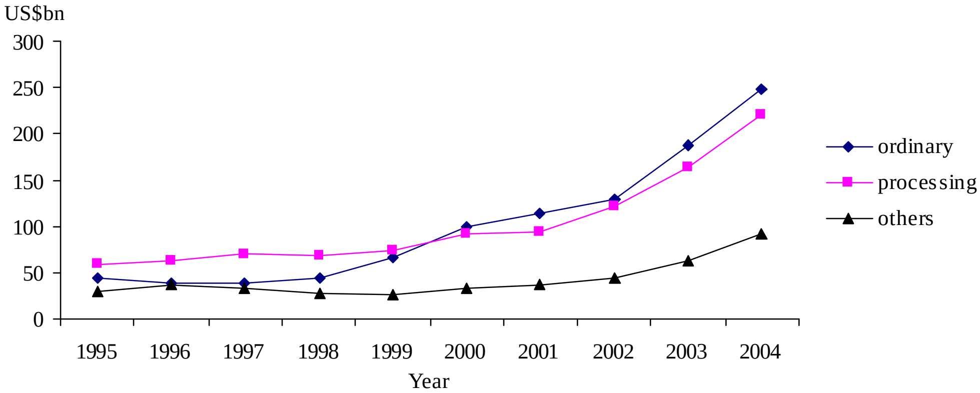
[4] The North American Free Trade Area, consisting of the USA, Canada and Mexico.

Figure 4. Chinese Exports by Customs Regime 1995–2004



Source: Databank of China customs statistics.

Figure 5. Chinese Imports by Customs Regime 1995–2004



Source: Databank of China customs statistics.

Rim region. The data highlight the driving force behind the trade imbalance between China and the USA: China is increasingly becoming part of the global production chain, importing parts and components from its Asian neighbors and exporting processed goods to the USA and EU15.

Ordinary and processing trade accounts for the bulk of Chinese foreign trade. On average, processing trade accounts for half of total trade (imports plus exports). As shown in Figures 4 and 5, both processing and ordinary trade (exports and imports) experienced steady growth between 1995 and 2004. But processing trade dominated Chinese exports, and ordinary trade dominated imports in later years. On the export side, processing exports led the ordinary exports by a big margin (US$84bn or 34.4 percent of the ordinary exports); on the import side, the gap was smaller (US$26bn or 11.7 percent of the processing imports in 2004).

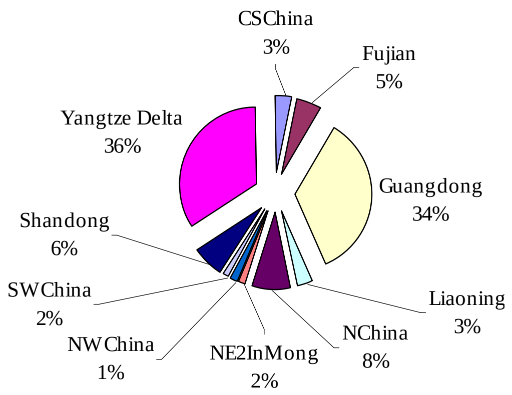
Given the nature and scale of the Chinese processing trade, assumption 1 does not hold true for China. It might well be the case that China imports high-tech components from Korea and Japan under the processing trade regime and then export them out of China as assembled products with China's labor-intensive assembly operations as the only value added.

2. Regional Distribution of Chinese Foreign Trade

China's foreign trade and investment reform started in the southern coastal provinces. The Pearl River Delta (Guangdong Province) was the leading region in Chinese exports in the early years of reform. In 1992, the focus of Chinese economic reform began to shift from the southeast provinces to the Yangtze Delta regions (Shanghai, Jiangsu and Zhejiang) and so did FDI inflows and the gravity center of Chinese exports.

An outcome of Chinese trade and investment development has been a high concentration of exports in the coastal regions. As shown in Figure 6, more than 80 percent of Chinese exports are concentrated along the coastal region. Guangdong and the Yangtze Delta alone, the two richest regions in China, account for 70 percent of exports on average over 2002–04. They have higher per capita GDP and abundant capital/skilled labor endowments. These characteristics also undermine Rodrik's conclusion.

Figure 6. Exports by Major Chinese Regions: 2002–2004 Average



Source: Databank of China customs statistics.

Notes: NChina (Northern China):Beijing, Tianjin, Hebei and Shanxi, SWChina (Southwestern China): Chongqing, Sichuan, Guizhou, Yunnan and Tibet, NWChina (Northwestern China): Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang, CSChina (Central/Southern China): Henan, Hubei, Hunan, Guangxi, Hainan, Anhui and Jiangxi, NE2InMong (Two Northeastern Provinces and Inner Mongolia): Heilongjiang, Jilin and Inner Mongolia. Keys to abbreviation of sector names are listed in the appendix.

Table 1. China's National Per Capita GDP versus Regional Per Capita Output

Year	China	Guangdong	Shanghai	Zhejiang	Jiangsu
2000	7 858	27 953	36 891	46 946	24 682
2001	8 622	31 020	39 910	50 984	26 690
2002	9 398	31 514	43 263	56 645	28 783
2003	10 542	29 774	47 250	65 629	32 568
2004	12 336	34 332	53 362	74 705	38 079
2005	14 103	38 763	57 902	80 278	44 625
2006	16 084	45 408	63 399	89 114	51 299

Sources: Official websites of China's national and local bureaus of statistics. For Jiangsu, total urban population is used as a substitute for its non-agricultural population. Shanghai's 2001–2003 total population numbers are drawn from media reports citing the Shanghai Population and Family Planning Commission as the source.

Note: Regional per capita output = (manufacture and services outputs)/(local and migrant residents-agricultural population).

Rodrik uses China's per capita GDP as a benchmark to evaluate the level of sophistication of the country's exports revealed from the second index. However, this national indicator fails to reflect the inland/coastal disparity, as well as the rural/urban divide. Given that almost all FDI fueled exports are produced in urban areas and agricultural population is disproportionately large for the sector's small share in total foreign trade, a regional indicator should be used to better depict the income level of the Chinese regions that are integrated into world trade. Table 1 presents a comparison of China's per capita GDP with the new indicator for China's leading export regions. For Guangdong, Shanghai, Zhejiang and Jiangsu, the indicators are constructed with the combined output in manufacturing and services sectors divided by total non-agricultural population.[5] It is shown that there is a huge gap between the national average and the regional per capita indicators for key export regions, with the latter roughly 3~6 times as high as the former. Those numbers suggest that if China's $EXPY_j$ is compared to export regions' indicators in Table 1, it would not appear to be overly high, as compared to the national per capita GDP.

3. HS Codes

Industry analysts are interested in identifying the high-tech products in international trade. Their traditional approach was to measure the industry-wide R&D to sales ratios and

[5] Here it is assumed that the primary sector in the selected regions mainly consists of agriculture.

industries with high R&D/sales ratios were regarded as high-tech industries and products in these industries were therefore labeled as high-tech products. According to Abbot (1991), in compiling the Advanced Technology Product (ATP) list, the US Bureau of Census adopted a different approach: expert subjective judgment on individual products. The two approaches give quite different measurements of the trade in technology products. The latter approach has been used as of today based on HS codes. This approach is susceptible to subjective errors as well as to incomplete identifications of trade products by HS codes. According to US Census experts, even at the most disaggregate level, some 10-digit HS codes can each cover many heterogeneous commodities.[6] Rodrik's indexes seem to be an alternative approach that does not require direct examination of the products. But as I will show in this section, it still can not escape the problem of incomplete HS codes. This can be seen in a recent USITC study (Ferrantino *et al.*, 2008) that gives a detailed analysis of the US-China ATP trade, most in the machinery and electronics sector. Table 2 below summarizes some of the findings.

As shown in Table 2, for the same commodities, around 82–90 percent of the ATPs, US exports to China have higher unit values than its imports from China. Furthermore, the paper shows that the average unit value of US ATP exports to China is in the range of 1 million US dollars, while the average unit value of its ATP imports from China lies mostly

Table 2. Ratios of ATP Unit Values between US Exports to and Imports from China

No. of HS10 lines	Less than 1	Between 1–10	Between 10–100	Over 100	Percentage over 1
134	16	49	42	27	88.1
151	25	65	42	19	83.4
146	20	50	49	27	86.3
151	18	62	49	22	88.1
159	23	51	63	22	85.5
165	30	58	56	21	81.8
167	28	61	57	21	83.2
167	26	65	55	21	84.4
174	30	68	57	19	82.8
189	28	75	62	24	85.2
193	19	88	68	18	90.2

Source: Drawn from Table 11 in Ferrantino *et al.*(2008) with the last column as the author's calculations.

[6] Communications with Zhi Wang of the United States International Trade Commission.

below US$1 000 (US$536 in 2006). This serves as an example of how different two product varieties under the same HS10 can be.

A similar comparison is also made in table 2 in Rodrik (2006), but it conveys a different message. It lists the unit values of 12 products made in China, Korea, Malaysia and Singapore. Those products are China's leading electronics exports. Among them, all unit values of Chinese products are higher than those of Korean, Malaysian and Singaporean counterpart products, except two which are higher only than the Korean but still significantly lower than other unit values. Instead of dismissing the two exceptions as outliers in the samples, Rodrik chooses to interpret them as a case for his argument, which I feel is problematic. His presentation and interpretation of the numbers are questionable for other four reasons. First, the products are not given associated HS codes and, therefore, it is difficult to pinpoint them for verification with the UN COMTRADE database. Second, the products are in 6-digit HS codes, broader than the HS10 ATP classification, and it is possible that the two exceptions refer to totally different varieties. Third, as discussed in Section III. 1, the two higher unit values may represent cases of imported expensive components as part of the processing trade operations. Finally, it is not clear whether Rodrik made an effort to adjust the quantity units in the UN COMTRADE database, which may be different across countries for the same HS codes. Ferrantino *et al*. (2008) pays particular attention to this problem and adjustments are made to achieve cross-country comparability of the unit values.

IV. Further Evidence

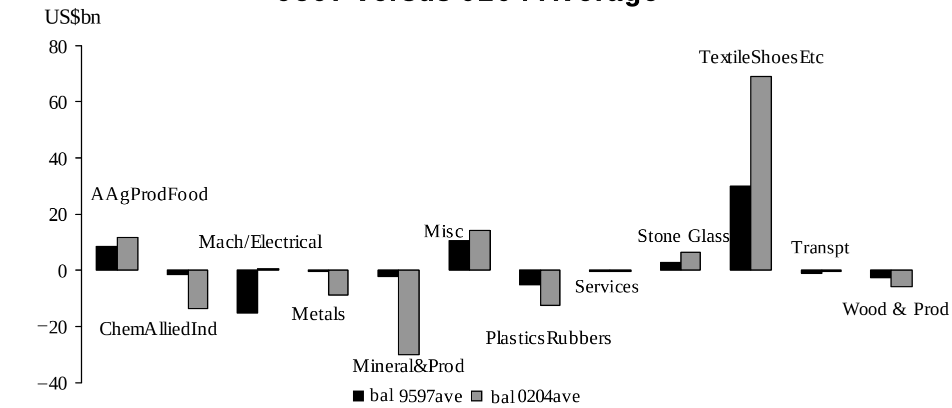
The proposition that the surge in Chinese machinery and electronics exports is not necessarily an indication of technological upgrading in that sector is consistent with observations of other China experts. Gilboy (2004) argues that the business risks inherent in China's unreformed political system have bred an "industrial strategic culture" where Chinese firms focus on developing privileged relations with government officials, spurn horizontal association and broad networking with each other, and forgo investment in long term technology development and diffusion. Lang (2006) examines the operations of several Chinese high-tech firms and reaches the conclusion that Chinese culture itself is simply not helpful in fostering the development of high-tech companies. This section will present further empirical evidences to reinforce this argument.

1. Evidence from Sectoral Trade Balances

As shown in Figure 7, with regard to China's trade with the world, the textile and clothing sector was the leading surplus sector during 2002–2004, followed at a distance by the miscellaneous (Misc) sector (mainly toys and furniture, etc). The Mach/Electrical sector turned from deficit during 1995–1997 to negligible surplus during 2002–2004. In contrast, for China-US trade (Figure 8), it was the Mach/Electrical sector that contributed the most surplus during 2002–2004, more than the sum of the surplus in textile and clothing and the Misc sectors.

What can we learn about the debate on China's trade relation with the USA from the difference in the Mach/Electrical sector in Figures 7 and 8? In light of the surge of Chinese Mach/Electrical exports, some observers argue that China is becoming a threat to the USA

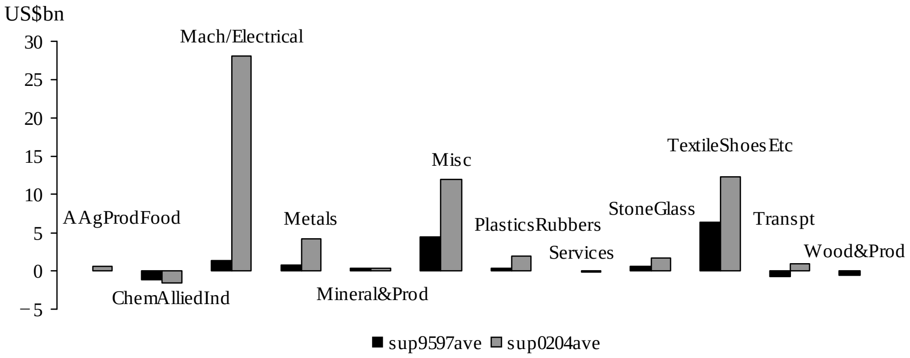
Figure 7. Trade Balances with the World: 9597 versus 0204 Average



Source: Databank of China customs statistics.

Note: Keys to abbreviation of sector names are listed in the appendix.

Figure 8. Trade Balances with the USA: 9597 versus 0204 Average



Source: Databank of China customs statistics.

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based on the understanding that the said sector is technology-intensive. Others believe that the exports mainly consist of labor-intensive low-tech products in traditional high-tech industries and, therefore, it does not constitute a threat. Simple comparison of the two figures tends to support the latter argument. If China's trade surplus with the USA in the said sector is a reflection of China's technological advancement, the surplus with the world should have been larger.

2. Evidence from Tariff Structure

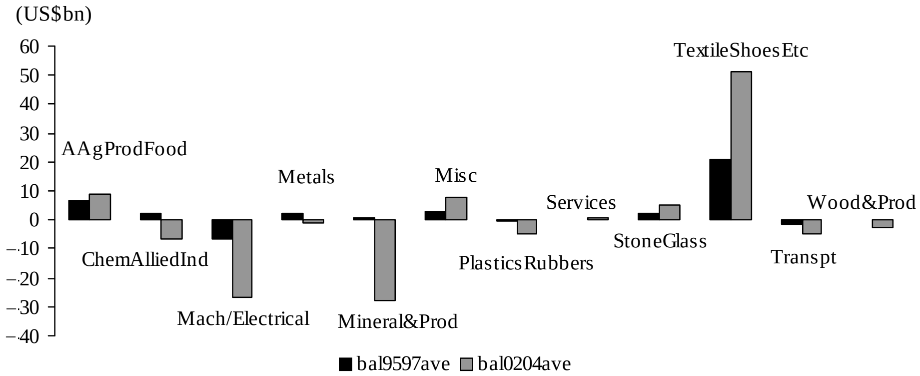
To take advantage of detailed information of the 8-digit HS trade data, I now use Chinese tariff rates at 10-digit HS codes to derive information on the technological content of a product in the Mach/Electrical sector. For this sector, the applied most favored nation (MFN) tariffs are normally low for inputs but high for final products, as part of China's industrial policy to promote the high-tech industry. ***Therefore, the level of the tariff rate can serve as a proxy for the level of technological content.*** Using the 2004 Chinese applied MFN tariffs and the 2004 data, simple averages of tariffs for ordinary and processing trade are calculated.

For the said sector, tariffs for Chinese imports from ASEAN (1.2–1.6 percent) are lower than those from South Korea (2.0–3.3 percent), which again is lower than those from Japan (2.4–5.5 percent). Imports from Korea and Japan also carry higher tariffs for ordinary trade. In terms of China perceived technological sophistication measured by tariff rates, its exports show lower technological contents for exports to NAFTA (mainly the USA) and the 15 EU countries than those to Latin America, Africa and Middle East. Among the two categories of trade with NAFTA and EU-15 countries, technological contents of processing exports are lower than those of ordinary exports, while for trade with other three developing regions, technological contents of ordinary exports are normally lower than those of processing exports. For the Mach/Electrical sector, the numbers and comparisons suggest that (i) Chinese imports from ASEAN are more labor-intensive than imports from Japan and Korea; (ii) Chinese exports to NAFTA and EU-15 countries are more labor-intensive than exports to the three developing regions; and (iii) Chinese processing exports to NAFTA and EU15 are more labor-intensive than its ordinary exports to the same regions, while the opposite is true for Chinese processing exports to the three developing regions.

3. Evidence from Customs Regime

Foreign companies' outsourcing of their labor-intensive operations to China in the Mach/ Electrical sector is part of the vertical specialization of global production that has been increasingly prevalent in the past decade (Hummels *et al.*, 2001). Indeed, Figures 9–12

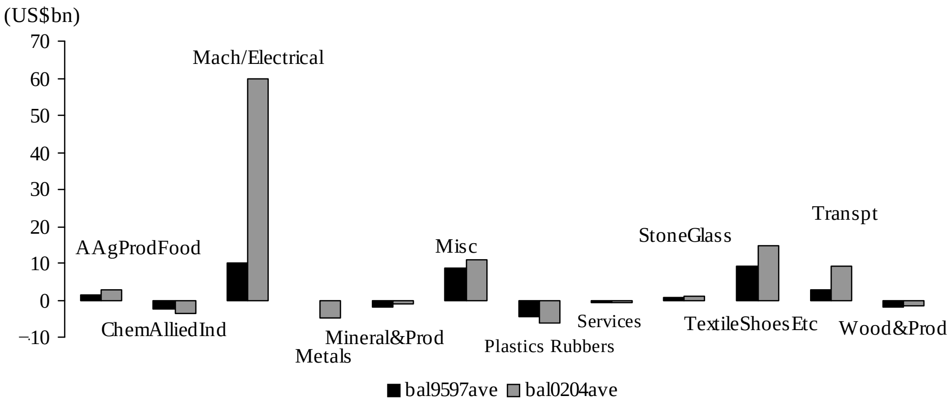
Figure 9. Trade Balances under Ordinary Trade Regime



Source: Databank of China customs statistics.

Note: Keys to abbreviation of sector names are listed in the appendix.

Figure 10. Trade Balance under Processing Trade Regime



Source: Databank of China customs statistics.

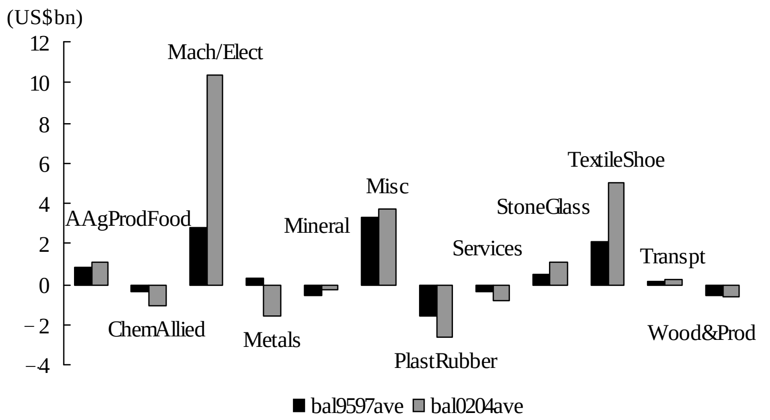
Note: Keys to abbreviation of sector names are listed in the appendix.

show that surplus in this sector only appears under the processing trade regime.

Figure 9 and 10 show that ordinary and processing trade regimes contribute to China's trade balance in different ways. During 2002–2004, for ordinary trade, the leading surplus contributor was textile and clothing sector (while the Mach/Electrical sector was running a deficit!); and for processing trade, it was the Mach/Electrical sector.

The huge surplus in Mach/Electrical sector in the processing trade is consistent with our belief that outsourcing was the main reason for its export expansion with low domestic value added, given the very nature of the processing trade regime. Over 1995–2004, machinery and electronics combined experienced the largest expansion in exports, particularly under the processing trade regime. This is not a surprise given that these products typically have

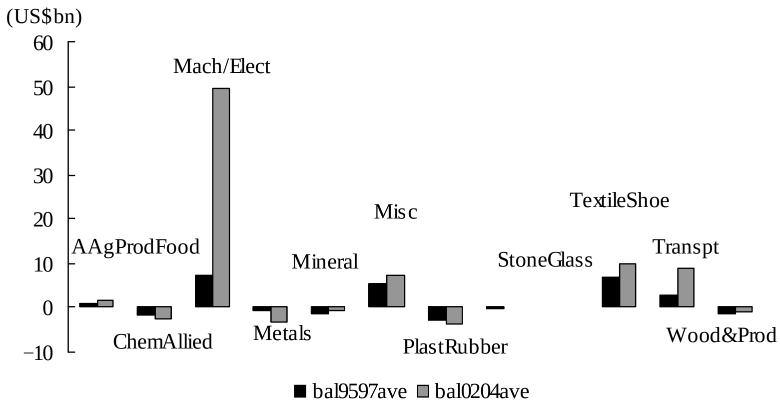
Figure 11. Trade Balances with the World under Processing and Assembly



Source: Databank of China customs statistics.

Note: Keys to abbreviation of sector names are listed in the appendix.

Figure 12. Trade Balances with the World under Processing with Imported Materials



Source: Databank of China customs statistics.

Note: Keys to abbreviation of sector names are listed in the appendix.

low transportation margin and are most suitable for production fragmentation.

Figures 11 and 12 further break the sectoral trade balances under the processing trade into two sub-arrangements: processing and assembly (P&A) and processing with imported materials (PWIM). Still the two figures resemble the sectoral patterns for processing trade (Figure 10), with the Mach/Electrical sector contributing the most to the Chinese trade surplus with the world for each of the two sub-regimes under the processing trade. In terms of magnitude, however, the 2002–2004 average surplus (and its increase from the 1995–1997 average) in the Mach/Electrical sector under PWIM is almost five (and six) times as much as that under P&A.

The key distinction between P&A and PWIM lies in the fact that P&A firms are fairly passive in taking orders and receiving materials from foreign trading companies, whereas the PWIM firms take full control of production, trading, as well as financing. Huang (2003) argues that lending discrimination by the Chinese banks against its non-state P&A firms has prompted the formation of PWIM joint ventures with foreign trading companies. By so doing, the processing operations are able to expand with the infusion of foreign capital, and the PWIM exports have become the driving force behind the growing Mach/Electrical surplus with the world under the processing trade regime. In light of this argument, the surge of Chinese Mach/Electrical exports can be anything but capital or technology-intensive.

V. Conclusion

Machinery and electrical machinery and parts were the single most important product category that helped to reshape Chinese foreign trade patterns, particularly in China–US trade. It is tempting to think that the export surge of that sector represents technological upgrading in Chinese exports. Along this line, Rodrik (2006) goes even further in arguing that Chinese export patterns have been distorted by the government's interventionist industry policy for technology promotion to such an extent that they defy the country's comparative advantage. This paper scrutinizes his reasoning by examining its three implicit assumptions, and finds that they are not supported by empirical evidence. All indications suggest that the rise of the sector in China's foreign trade be closely associated with its processing trade regime and foreign outsourcing to China, a reflection of the country's trade development along the lines of its comparative advantage.

Using Rodrik's methodology, a recent study makes an attempt to investigate the dynamics of domestic technological upgrading in Chinese regional exports (Yao and Zhang, 2008). By emphasizing domestic contents at the regional level, they have effectively addressed two of the three issues (assumptions 1 and 2) that have been raised in this paper, and it is a good move in the right direction. However, their efforts are still hampered by the invalid assumption 3 as well as by the lack of accurate information on domestic/imported inputs in the Chinese competitive IO tables.

Rodrik's methodology is flawed, at least in the context of China. Nevertheless, the "Rodrik paradox" is interesting enough to serve as a catalyst for research on the fundamental underpinnings of Chinese foreign trade development, just as the "Leontief paradox" has done for the field of international trade over the past 50 years.

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Appendix: Sector Grouping Scheme (HS Codes, 2008)

2-digit HS	Descriptions (Abbreviation)
01–24, 41–43	Animal and Agricultural Products and Foodstuffs (AAgProdFood)
25–27	Mineral Products (Mineral&Prod)
28–38	Chemicals & Allied Industries (ChemAlliedInd)
39–40	Plastics / Rubbers (PlasticsRubbers))
44–49	Wood & Wood Products (Wood&Prod)
50–67	Textiles, Footwear and Headgear (TextilesShoesEtc)
68–71	Stone / Glass (StoneGlass)
72–83	Metals
84–85	Machinery, Electrical Machinery and Parts (Mach/Electrical)
86–89	Transportation (Transpt)
90–97	Miscellaneous (Misc)
98–99	Services

(Edited by Xinyu Fan)