The Rise of Chinese Exports[$]

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May 2010

JEL codes: F14, P33

[$] This research was begun when the first author was on sabbatical leave as a Research Fellow at the Adam Smith Research Foundation at the University of Glasgow. He thanks them for their superb hospitality. We also thank Jim Cassing, Asatoshi Maeshiro, and Tom Rawski for helpful comments. The usual proviso applies.
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Abstract

The growth of Chinese exports both in volume and in market share over the past two decades is a singular event in the history of world trade. Using data from 1995-2005, we document this growth in a variety of ways. First, we show that the expanded trade is pervasive. Virtually every country in the world has seen China claim a larger share of its import market. Then, we use CMS analysis to try to determine which country or countries have lost market share as China's trade has grown. Contrary to much discussion in the popular press, we find strong evidence that other developing countries have not seen export shares fall as a result of China's gains. Rather, our results suggest that China's share growth has come largely at the expense of exporters based in Japan and the United States. We then turn to an attempt to identify the factor or factors responsible for export growth. Using a large set of data disaggregated at the 3 digit SITC level, we estimate a variety of import price and demand equations. The second major finding of this paper is that China's export growth is best explained by price advantages across essentially all differentiated products.

1. Introduction

Over the past two decades the Chinese economy has grown at a remarkable pace. According to the Penn World Tables, between 1995 and 2007 Chinese real GDP grew at an average annual rate of more than 10%. Per capita real GDP rose by 250% over this period.[1] One of the leading factors driving this economic growth has been the extraordinary performance of Chinese exports. According to the World Trade Organization (WTO), in 2008 China ranked second in exports to the world market with merchandise export sales of $1.4 trillion and a world market share of 8.9%. In 1998, China had less than 2% of the world market. Twenty years earlier, China's share was essentially zero. As China's share of world exports has grown, it has come under increasing pressure to allow its currency to appreciate; often the criticism of its exchange rate practices includes charges that other developing and emerging market economies have borne the brunt in terms of lost export markets.[2]

The purpose of this paper is to provide an analysis of Chinese export growth over the period when its share of world exports rose most rapidly, the years 1995-2005. We provide detail on the commodity composition of Chinese exports and how this composition has changed. We also discuss some aspects of the geographic pattern of Chinese trade. In addition, a fundamental contribution of this paper is that we provide considerable evidence that the principal exporting countries that have lost market share to China are Japan and the United States.

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[1] These numbers use China Version 2 data from the PWT6.3 data set. See "What is New in PWT 6.3?" link on the Penn World Tables site, http://pwt.econ.upenn.edu/php_site/pwt_index.php, for a discussion of the differences between this version of Chinese data and official Chinese data.

[2] See, for instance, Arvin Subramanian, "Who Pays for the Weak Renminbi?", 11 February 2010, *Vox Front Page*, http://www.voxeu.org/index.php?q=node/4604.

We then turn to a discussion of what factors have been most important in explaining Chinese export growth. We show that export price advantages are an important part of the story, and provide evidence that these advantages cover a broad range of differentiated products.

The rest of the paper proceeds as follows. In section 2 we present an overview of Chinese trade expansion. In section 3 we discuss Constant Market Share (CMS) analysis, an empirical technique that provides a method for studying changes in export market shares. In section 4, we apply CMS to study trade patterns among a sample of 24 countries over the period 1995-2005. In section 5, we expand our analysis by focusing on export behavior across industries and in individual export markets. In section 6 we report estimates of import price as well as import demand for more than 140 three digit SITC industrial sectors for 24 countries in order to determine which factors appear to be important in explaining export growth. Section 7 offers our conclusions.

2. An Overview of Chinese Export Performance

Figure 1 provides a time series plot of world export shares for five of the world's leading exporting countries, Germany, China, Japan, the United Kingdom, and the United States. As the figure shows, since the end of World War II, only Germany has seen as rapid and as large a rise in world export share as China. In the eleven year span from 1948 to 1958, Germany's share of world exports rose from 1.3% to 10.3%, roughly matching in both magnitude and duration China's performance. However there are several major differences between the two. First, Germany's growth almost certainly represented a return for that country to a market position similar to the one that it had held prior to the war era. Second, at the time of Germany's significant growth there were far fewer major exporters competing for market share. For instance, at the time of Germany's growth the combined world export share of the countries now known as the Asian NICs (Korea, Malaysia, Singapore, and Thailand) was virtually zero. In contrast, since at least the onset of the industrial revolution and prior to the 1990s, China had never held a significant share of world trade. And, China's export growth came only slightly after significant growth by the NICs and simultaneously with major growth by several other countries that along with China make up the BRICs (Brazil, Russia, and India), all of whom now also hold large shares of the world market.

[Insert Figure 1 about here]

Like all major exporting countries, China has a market presence in virtually every country in the world; this presence has grown in almost every market in recent years. Using data from the IMF's *Direction of Trade Statistics* we calculated aggregate exporter market shares in 80 countries and 1 territory (Hong Kong), from all parts of the world.[3] Several interesting patterns emerge from this exercise. First, the global extent of China's trade expanded significantly between 1995 and 2005. By 2005, China had at least 2% of the market in all but one of these countries.[4] Moreover, market share growth was pervasive; over the 1995-2005 period China's market share grew in all of these markets except one.[5] In many cases, especially in South America, Africa, and smaller European countries, shares were essentially zero prior to 1995. Table 1 provides some additional summary statistics.

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[3] These countries were chosen from those studied in Cassing and Husted (2004). See their Table 6A.1. Ten countries, all from low income countries from Asia and Africa, were excluded due to lack of data. Complete results provided on request.

[4] The one exception is Switzerland, where the Chinese market share was only 1.4% in 2005.

[5] The country where China's export share fell was Malawi. This fall was due in part to an abnormally high (for the time) level of China's exports to Malawi in 1995.

[Insert Table 1 about here]

According to the table, geography is clearly important for China's trade. Its highest shares are in Asia where among the sample countries it had an average share of 12.8%. Its highest market share among all the Asian countries in the sample stood at 45%.[6] Its next highest average regional market share was in North America; this included 13% of all U.S. merchandise imports in 2005. On average, China's smallest regional market penetration was in Europe, where its average national market share in 2005 was only 4.1%.

As China's export market share has grown in recent years, it has changed the mix of goods it supplies to these markets. In order to illustrate this change in the commodity composition of trade (and eventually to keep the data analysis manageable), we restrict our attention to data from a subset of twenty four countries.[7] Our sample includes countries from every continent; slightly more than half the countries chosen in our sample are classified by the World Bank as high income countries. In 2005, these countries accounted for 71% of total world imports. Trade among these countries accounted for roughly half of all world merchandise trade in each of the three years in our sample. With one minor exception, the data we use are imports and are taken from the United Nations Commodity Trade Statistics Database (UN Comtrade).[8]

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[6] This was China's share of Hong Kong's market. Among the other Asian countries in this sample China had more than 20 % of Japan's market in 2005 and more than 10% of the export markets of Bangladesh, Korea, Pakistan, Singapore, and Sri Lanka.

[7] In addition to China, the countries we use are Argentina, Australia, Brazil, Canada, France, Germany, India, Indonesia, Italy, Japan, Kenya, Malaysia, Mexico, the Netherlands, Poland, Republic of Korea, Saudi Arabia, Singapore, Spain, Sweden, Turkey, the United Kingdom, and the United States. With the exception of Poland, all of these countries were included in the 81 countries that make up the sample for Table 1. In 2005, these countries accounted for 71% of total world imports. Trade among these countries accounted for roughly half of all world merchandise trade in each of the three years in our sample.

[8] Data on Indonesia's exports to Singapore in 1995 and 2000 are used instead of Singapore imports from Indonesia.

[Insert Table 2 about here]

Table 2 provides detail on the composition of Chinese exports in 1995 and 2005 to our sample of markets as well as the countries identified as developing countries across broad categories of goods.[9] Also included in the table is China's portion of total world exports at the single digit level (SITC Rev.3) in 1995 and 2005. As the table shows, Chinese exports have been centered in manufactures for some time. In 1995, 88% of Chinese exports to our sample countries came from industries 5-9. By 2005, that share had risen to almost 95% of total exports. Traditionally, Chinese exports have been concentrated in Miscellaneous Manufactured Articles (Industry 8). This sector includes many labor intensive manufactured products such as clothing, footwear, and toys, items long identified as characteristic examples of Chinese exports. Thirty three percent of Chinese exports to our sample countries in 2005 came from this sector. However, this share had stood at 47% of total exports to these markets in 1995. Instead, in recent years, the share of Chinese exports of more sophisticated manufactures has risen substantially with exports in Machinery and Transport Equipment (Industry 7) more than doubling to almost 45% of its exports to the sample markets and 56% of its sales to the developing country markets in the sample in 2005.

China's world market shares changes over this period followed the transformation described above. Between 1995 and 2005, its share of Industry 7 exports to the world increased by a factor of six, while its Industry 8 market share doubled. We are not the first to point out the recent growth in the sophistication of Chinese exports. Rodrik (2006) calculates that by 2002 China had an export bundle "of a country with an income

[9] Developing countries are those not classified as being a High Income Country by the World Bank in its 2009 *World Development Report*.

per-capita level three times higher than China's".[10] In a related study, Schott (2008) focuses on Chinese exports to the United States. He finds that the composition of this export bundle "increasingly overlaps with that of the world's most developed economies".[11]

The data in Tables 1 and 2 document the growth of Chinese exports and the change in the sectoral composition of these goods over the period 1995-2005. Clearly, the rapid growth of China in the world market has had market share implications for other exporting nations. A number of papers have focused on various aspects of the recent growth of Chinese exports on global competition.

One focus of attention has been on whether the growth has occurred due to an expansion of the variety of goods exported (the extensive margin) or a growth in trade of existing varieties (intensive margin). Broda and Weinstein (2006) find that over the last quarter of the twentieth century roughly 30% of U.S. import growth was at the extensive margin, with China the largest contributor. However, using Chinese export data disaggregated at the HS-8 level, Amiti and Freund (2008) report that most of Chinese export growth to the world between 1997 and 2005 was in existing varieties. Most recently, Manova and Zhang (2009) using firm level data on Chinese trading firms find that a relatively few large firms are responsible for substantial share of exports; these firms export to many markets, and many are foreign owned.

A focus of our paper is on which other exporting countries are losing foreign markets due to the rise of China. Other papers have also attempted to address this question. Using a gravity model, Hanson and Robertson (forthcoming) study ten

[10] Rodrik (2006) pg. 4.
[11] Schott (2008) pg. 34.

developing countries they identify as potential losers to Chinese competition. However, they find Chinese export expansion over the 1995-2005 period has had only a modest negative impact on the exports of these other countries. In an earlier study, Ahearne et al (2003) use VAR analysis to see if Chinese exports reduce the exports of other Asian economies. They find instead a positive correlation between exports from these two sources. These findings along with the industry classifications of Chinese exports suggest that major competing countries with China in world export markets may be developed rather than developing countries. In the remainder of this paper, we try to identify which countries have lost share and to provide a measure of the size of the losses. We also focus on the growth of Chinese exports at broad industry levels and in individual export markets. We turn now to describe the modeling strategy we employ to answer these questions.

3. Market Shares Methodology

Constant Market Share (CMS) analysis has long been used to study export performance.[12] This modeling approach treats as a norm of behavior that a country's market share will remain constant over time. If instead it changes, that must be due to changes in competitiveness or changes in demand from the world as a whole or in individual markets. The analysis then proceeds to decompose export share changes in order to identify these factors. In the 1950s and 1960s, CMS was a popular tool of analysis. In a well known paper, however, Richardson (1971) criticized its use, arguing that the signs and magnitudes of the measured effects depend upon in part on the methods used in their calculation.

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[12] See Leamer and Stern (1970) Chapter 7 for a derivation of the original model and the references therein for examples of its use.

Taking these criticisms into account, Fagerberg and Sollie (1987) (hereafter FS) have proposed several refinements to traditional CMS analysis. These include improved theoretical consistency via the use of Laspeyres weights throughout and an explicit economic interpretation of all decomposed terms. They have also extended the traditional model to include two additional terms which measure the adaptability of the export sector of a country to changes in the commodity and national market composition of world exports.[13] We now turn to a brief derivation of their model.

First, consider the change in exporters' shares in each importer's market. We define the value of imports of commodity *i* from country *k* to *l* is defined as m_i^{kl}. The market share of country *k* (an exporter) in commodity *i* in market *l* (an importer) is

(1) $$a_i^{kl} = m_i^{kl} / \sum_k m_i^{kl} .$$

The commodity *i*'s share of country *l*'s total imports is defined as

(2) $$b_i^l = \sum_k m_i^{kl} / \sum_i \sum_k m_i^{kl} .$$

Since the market share of country *k* is written as

$$M^{kl} = \sum_i a_i^{kl} b_i^l ,$$

the change in country *k*'s share of market *l* between an initial year (time 0) and year *t* is

$$\Delta M^{kl} = M_t^{kl} - M_0^{kl} .$$

This equation can be rewritten as the sum of three terms:

(3) $$\Delta M^{kl} = \Delta M_a^{kl} + \Delta M_b^{kl} + \Delta M_{ab}^{kl} .$$

where

(4) $$\Delta M_a^{kl} = \sum_i (a_{it}^{kl} - a_{i0}^{kl}) b_{i0}^l$$

[13] Irwin (1995) uses the FS approach to study changes in the export market share of Great Britain in the early 20th century.

(5) $$\Delta M_b^{kl} = \sum_i a_{i0}^{kl}(b_{it}^l - b_{i0}^l)$$

(6) $$\Delta M_{ab}^{kl} = \sum_i (a_{it}^{kl} - a_{i0}^{kl})(b_{it}^l - b_{i0}^l)$$

Equation (4) is the effect of changes in the market share, weighting the change in exporter *k*'s share in commodity *i* by initial share of the commodity in market *l*. Equation (5) is the effect of changes in the commodity composition of importer *l*, weighted by the initial share of the commodity from country *k*. The final term, equation (6), is a residual term which can be written as

(7) $$\Delta M_{ab}^{kl} = r_{ab}^{kl}\left[\sum_i (a_{it}^{kl} - \bar{a}_t^{kl} - a_{i0}^{kl} + \bar{a}_0^{kl})^2\right]^{0.5}\left[\sum_i (b_{it}^l - b_{i0}^l)^2\right]^{0.5}$$

where r_{ab}^{kl} is the correlation coefficient between the changes in market shares and the changes in commodity shares.

FS then extend the decomposition exercise from one market to the world market. The country *l*'s share of world imports is defined as:

(8) $$c^l = \sum_k \sum_i m_i^{kl} / \sum_k \sum_l \sum_i m_i^{kl}$$

In this case, we can write the market share of county *k* in world market as

$$M^k = \sum_l M^{kl} c^l \ .$$

The change in M^k between time 0 and time *t* is

$$\begin{aligned}\Delta M^k &= \Delta M_m^k + \Delta M_c^k + \Delta M_{mc}^k \\ &= \Delta M_a^k + \Delta M_b^k + \Delta M_{ab}^k + \Delta M_c^k + \Delta M_{mc}^k\end{aligned}$$

where

(9) $$\Delta M_a^k = \sum_l \left[c_0^l \sum_i (a_{it}^{kl} - a_{i0}^{kl}) b_{i0}^l\right]$$

(10) $$\Delta M_b^k = \sum_l \left[c_0^l \sum_i a_{i0}^{kl}(b_{it}^l - b_{i0}^l)\right]$$

(11) $$\Delta M_{ab}^{k} = \sum_{l} \left[c_0^l \sum_{i} (a_{it}^{kl} - a_{i0}^{kl})(b_{it}^{l} - b_{i0}^{l}) \right]$$

(12) $$\Delta M_{c}^{k} = \sum_{l} M_0^{kl} (c_t^l - c_0^l)$$

(13) $$\Delta M_{mc}^{k} = \sum_{l} (M_t^{kl} - M_0^{kl})(c_t^l - c_0^l)$$

Our analysis focuses on equations (9)-(13); following FS, each can be interpreted as a separate factor that influences export performance.

Equation (9) is the ***market share effect***. This term captures the change in an exporter's share of each commodity in each country, holding constant the initial commodity composition and the country distribution of world trade. Thus, it captures the extent to which an exporter gains market share independent of changes in the commodity and destination pattern of world trade. Equation (10) is the ***commodity composition effect***. The commodity composition effect measures the influence of the changing share of commodities in world trade on an exporter's overall share. If, for instance, the structure of world imports changes towards more manufactured goods and away from agricultural products, the exporters manufactures (agricultural goods) would see an increase (a decrease) in their market shares.

Equation (12) is the ***market composition effect***. This effect measures the influence of changes in the country demand pattern of world imports. Thus, it identifies the countries that increase their world market share by selling their products heavily in expanding markets. Equation (11) is the ***commodity adaptation effect***. The commodity adaptation effect identifies whether the change in the structure of a country's exports is correlated with changes in the commodity composition of world imports. This number is zero if the country changes its export structure at the same rate as all countries exporting to the world market. Finally, equation (13) is the ***market adaptation effect***. This effect captures the correlation between a country's export destinations and world export destinations.

4. Empirical Results: Aggregate Analysis

For each country in our study, the change in market share of the world market is decomposed into the five effects discussed above. The results are given in Table 3.[14] The right-most column in table gives the total percentage change in the total sample export market share for each of the sample countries over the period 1995-2005. The other five columns represent different effects, corresponding to equations (9) to (13), and add up to the total change.

[Insert Table 3 about here]

The first thing to note about the table is that for most countries in the study, overall export shares hardly changed over the sample period (see the last column). This stability of trade shares is a stylized fact of trade patterns at the bilateral level first pointed out and analyzed by Cassing and Husted (2004 and 2009) in two related studies. The principal exceptions to this pattern of export share stability over the sample period are China (+10.4 percentage points (pp)), Japan (-4.66 pp) and the United States (-3.89 pp). These results clearly imply that the growth in Chinese export market share has come largely at the expense of exporters in Japan and the United States rather than exporters in other countries. Other principal world exporters did experience somewhat smaller market share losses; each of the other G7 countries in the table saw market shares drop about 1% over this period. We turn now to discuss what factors have contributed to these changes in trade shares.

[14] We concentrate on SITC 1-digit industries 5-8, including 166 3-digit sub-industries. A breakdown of these changes over the periods 1995-2000 and 2000-2005 or results with all 260 3-digit industries are available upon request.

First, according to the decomposition reported in the table, the market share effect appears to be responsible for most of the changes in export performance by the countries in our sample. During the period from 1995 to 2005, the market share effect was strongly positive for China (+10.4 pp) and strongly negative for Japan (-4.94 pp) and the United States (-4.10 pp). Moreover, the market share effect is almost fully responsible for the share changes. The commodity composition effect, the market composition effect, the commodity adaptation effect, and the market adaptation effect play no roles to explain the changes in world trade shares.

Consistent with the findings of Hanson and Robertson (2008), developing countries such as Brazil, India, Indonesia, Malaysia, Mexico, and Turkey did not lose their market shares in this period despite China's export growth. Indeed, all saw their shares rise, although by much smaller amounts than China's increase. Again, as was the case with China, Japan, and the United States, the market share effect appears to have been the primary factor responsible for the change in total market share.

Why, in particular, are market share losses to China concentrated in Japan and the United States? One answer may be outsourcing by exporters in these two countries to firms in China. As noted, without identifying the countries involved, Manova and Zhang (2009) report that "Chinese joint ventures and affiliates of foreign multinationals were responsible for fully 75%" of the increase in China's trade flows between 2003 and 2005.[15] We have no way to identify which countries host the parent companies of these firms, however there is considerable evidence that Japanese firms may be involved. Tomiura (2008) reports that in recent years China has been the destination for more than half of all outsourcing done by Japanese firms.

[15] Manova and Zhang (2009) pg. 2.

Evidence that outsourcing may be responsible for lost U.S. export share is much less strong. Branstetter and Foley (2007) assert that U.S. FDI in China is only an extremely small portion of total U.S. FDI activity. Moreover, they argue that more than 90% of the production of U.S. affiliates in China is sold in China rather than exported to the United States or other markets. Thus, for the United States Chinese outsourcing is at most only responsible for a share decline in the Chinese market. Instead, as we show below, a chief factor in explaining export market loss is a significant price advantage of Chinese exports across a large spectrum of products. And, given that we measure import prices in dollars, Chinese exchange rate policy may possibly play a role.

5. Empirical Results: Products and Markets

We now turn our attention to an extended analysis of changes in market shares across various regions and industries. To document further the nature of competition between Chinese exporters and exporters in other countries, we focus on bilateral competition in each of the 24 markets in our sample. Suppose that *k* denotes an exporting country such as China and *l* consists of 24 importers except *k*, we study the change in export share between time t and 0, $\Delta M^{kl} = M_t^{kl} - M_0^{kl}$, in individual importing markets. We then compare this change to that experienced by a variety of potentially competing exporting countries.

Figure 2-1 plots market share changes from 1995 to 2005 for China and the United States in 19 importer markets.[16] The change in market share in country *l* for China is on the horizontal axis and that for the United States is on the vertical axis. For example,

[16] Given that US (+14.9) and Chinese (+7.4) market shares both increased by large amounts in Kenya's market between 1995 and 2005, we exclude it as an obvious outlier. For presentation reasons, we also excluded NAFTA countries (Canada and Mexico), where in each US market shares losses were large (-9.6 & -21.6) while Chinese shares rose (7.7 & 9.1). Clearly, including these latter two countries does not change the general pattern of behavior.

over the period China increased its market share in Japanese market by 23.0 percentage points and the United States lost 12.5 percentage points. According to the figure the United States lost market share in all but two countries (Germany and the Netherlands), while China gained share in all 19 markets. During the period considered, the share changes of China and the United States are strongly and negatively correlated. Figure 2-2 plots the market share changes for China and Japan. Similar to the United States, Japan lost market share in most countries in our sample, particularly in those in the Asian and Pacific regions, and the correlation between market share changes of the two countries is again negative and significant.

[Insert Figures 2-1 and 2-2 about here]

Figures 2-3 and 2-4 provide the correlations for Malaysia and Mexico, each vis a vis with China, which Hanson and Robertson (2008) considered as the potential competitors for China. Surprisingly but consistent with them, there are no clear market losses for Malaysia and Mexico relative to China during the period. Consider, for instance, the case of Malaysia. Although the two countries might be specialized in the production of similar goods since they are in similar stages of development, their market share changes in third markets over the period are positively and significantly correlated.[17] Our findings also suggest that Mexico and China do not compete strongly in third country markets. As Figure 2-4 shows, there is essentially no correlation between market share changes in the two countries.[18] Indeed, Mexico's export shares in most

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[17] This result is also consistent with the findings reported in Aherne et al. (2003)

[18] Note that due to the creation of NAFTA during the period in question, Mexico's export market shares in both Canada and the United States rose significantly and appear to be significant outliers in the plot of market share changes. For that reason we omitted them in this figure. If they were included, then the correlation would be slightly positive, but still insignificant.

markets hardly changed over the decade, even as China's shares rose across the board. Not surprisingly, the correlation between the two sets of changes is essentially zero.

[Insert Figures 2-3 and 2-4 about here]

Finally in Figures 2-5 and 2-6 we consider competition between China and two other countries, Germany and India. Consider first Figure 2-5. As the plot shows, Germany saw market share gains in a handful of countries, averaging about 1 percentage point over the period in question. In most cases, however it lost roughly 1.5 percentage points of market share in the countries of our sample. Meanwhile Chinese market shares rose everywhere. As was the case with Japan and the United States there does appear to be some (small) degree of competition between the two countries in third markets. The correlation between changes by the two countries is negative, but much closer to zero than that for either Japan or the United States. Figure 2-6 provides detail on the relationship between China and India in third markets. As the figure shows, the relationship between Indian and Chinese market share changes over the 1995-2005 period is very similar to that between Mexico and China. Again there is little or no evidence of close competition between the exports of these countries in third country markets.

[Insert Figures 2-5 and 2-6 about here]

We turn now to focus on the major industrial sectors involved in the export market share changes detailed above. Again, using data from our twenty four country sample, Table 4 provides further detail on market share changes for China, Japan, and the United States by region and industry. In each of these regions for both SITC 1-digit industries 7 (machinery and transport equipment) and 8 (miscellaneous manufactures), Chinese export shares rose significantly, with gains exceeding 10 percentage points in most markets. And, as the table shows, regardless of region and product Chinese market share gains came at the expense of other developed countries. In many cases, the largest losses again were experienced by Japan and the United States.

[Insert Table 4 here]

6. Further Empirics: Exports by Industry

We have shown that China has increased its share of world exports, and, in particular, that the rise of China corresponds to market share losses by Japan and the United States. Although we have documented the picture of the share change from 1995 to 2005, we have not answered perhaps the most important question: is it possible to identify which factor (or factors) has been most important in contributing to Chinese export growth? Such things may include an increase in export varieties, an advantage in export prices, and an upgrade in the quality of Chinese exports.

Schott (2004) provides evidence that countries are vertically specialized in quality even within the same product. While developed countries export relatively high-quality high-value varieties, developing countries export low-quality low-price varieties. Moreover, rich countries tend to import relatively more from countries that produce high quality goods (e.g., Hallak (2006)). Thus, since a large proportion of Chinese goods is sold to various high-income countries, China's rise could be explained partially by an increase in the quality of goods that it exports.

Given that we have only a very limited time series on exports of any type of good by any single nation, we cannot estimate individual export equations for China or any other country. Rather, we estimate cross section regressions for each of the three digit commodity exports in both 1995 and 2005. This allows us to see the role that quality changes might play in export levels as well as the role other factors including price, distance, common language, FTA membership, and other controls commonly used in empirical trade models. The approach we take was developed by Hallak (2006).

Demand in each country l is obtained from a two-tier utility function of a representative consumer. Upper tier utility is weakly separable into sub-utility indices defined for each sector i = 1, …, I: $U^l = U[u_1^l, ..., u_i^l, ..., u_I^l]$. The sub-utility index u_i^l is a general function of the quantity consumed of good i augmented by its quality: $u_i^l = \left[\sum_{h \in i} (\theta_h^{\gamma_i^l} q_h)^{\alpha_i}\right]^{1/\alpha_i}$ where $0 < \alpha_i, \gamma_i^l < 1$. Here, q_h and θ_h are the quantity and quality of variety h in industry i, and the parameter γ_i^l is the intensity of quality preference for country l. The sub-utility functions are a quality-augmented version of Dixit and Stiglitz (1977). If consumer's intensity of quality preference is zero, the sub-utility functions are consistent with Dixit and Stiglitz : $u_i^l = \left[\sum_{h \in i} (q_h)^{\alpha_i}\right]^{1/\alpha_i}$.

The representative consumer in each country uses a two-stage budgeting process. The first stage involves the allocation of expenditure across sectors. Since country l's expenditures on goods ($E_1^l, ..., E_i^l, ..., E_I^l$) are determined at the first stage, the demand for each variety in a differentiated good sector can be derived from the following utility maximization problem:

$$\max_{q_h} \left[\sum_{h \in i} (\theta_h^{\gamma_i^l} q_h)^{\alpha_i}\right]^{1/\alpha_i} + \lambda\left(E_i^l - \sum_{h \in i} p_h q_h\right).$$

Setting $\sigma_i = 1/(1-\alpha_i)$, we have the following demand function:

(14) $$p_h q_h = \frac{(p_h / \theta_h^{\gamma_i^l})^{1-\sigma_i}}{\sum_{h \in i} (p_h / \theta_h^{\gamma_i^l})^{1-\sigma_i}} E_i^l$$

We then use (14) to define country *l*'s demand for imports of good *i* from country *k*. Here, we assume that country *k* produces N^k_i symmetric varieties in sector *i*.; they share the same quality and sell at the same price.[19] Thus, we can obtain the imports of product *i* for country *l* from country *k* (m_i^{kl}) as

(15) $$m_i^{kl} = N_i^k \frac{(p_i^{kl} / \theta_i^{k\gamma_i^l})^{1-\sigma_i}}{\sum_k \left[p_i^{kl} / (\theta_i^k)^{\gamma_i^l} \right]^{1-\sigma_i}} E_i^l .$$

where p^{kl}_i is the price of good *i* from country *k* to country *l*, and θ_i^k represents the quality of good *i* exported from country *k*.

By taking the logarithm of (15), we have the following model of bilateral trade:

(16) $$\ln(m_i^{kl}) = \ln(N_i^k) - (\sigma_i - 1)\ln(p_i^{kl}) + (\sigma_i - 1)\ln(P_i^l) + (\sigma_i - 1)\gamma_i^l \ln(\theta_i^k) + \ln(E_i^l)$$

where $\left(P_i^l\right)^{1-\sigma_i} = \sum_k \left[p_i^{kl} / (\theta_i^k)^{\gamma_i^l} \right]^{1-\sigma_i}$.

In a cross-section of bilateral trade flows at the commodity level, the first term, $\ln(N_i^k)$, is specific to exporter *k*. Thus, we capture this term by the sector-specific exporter dummy variables (α_i^k). The price of good *i* from country *k* in country *l* depends not only country *k*'s export price but also transport costs. Thus, we keep the superscripts of exporter *k* and importer *l* in p^{kl}_i. The expenditure share (E^l_i) and the quality weighted domestic price index (P^l_i) are specific to importer *l*, which is captured by the sector-specific importer dummy variables, α_i^l. Finally, the measure of intensity of demand for

[19] Recent trade literature that focuses on the behavior of heterogeneous firms and the accompanying empirical evidence indicate the size, productivity, and market share of a firm do differ and the firm's volume of exports depends on its productivity (e.g., Melitz, 2003). Helpman, Melitz and Rubinstein (2008) introduce firm-heterogeneity into the estimation of gravity equation.

high quality goods, $(1-\sigma_i)\gamma_i^l \ln(\theta_i^k)$, is the product of the log of country *k*'s export price, as a proxy for quality, and that of real GDP per capita in the importing country.

Since we are interested in the changes from year 1995 to 2005, we introduce the subscript *t* as years. Then, the empirical equation follows

$$\ln(m_{it}^{kl}) = \alpha_{it}^k + \alpha_{it}^l + \beta_{it}\ln(p_{it}^{kl}) + \gamma_{it}\ln(p_{it}^k)\ln(GDP_t^l) + \varepsilon_{it}^{kl}. \quad (17)$$

The number of export varieties ($\alpha^k{}_{it}$) and the quality-preference elasticity (γ_{it}) are expected to have positive signs and the price elasticity of imports (β_{it}) is expected to be negative. The signs of $\alpha^l{}_{it}$ are unknown since they depend not only on domestic prices (negative signs) but also on expenditures spent on each good *i* (positive signs).

The estimation procedure we follow is in two steps. To estimate equation (17), we first estimate import unit value ($p^{kl}{}_{it}$). Then, we estimate equation (17) and its variants by using the fitted values of $\hat{p}_{it}^{kl}$ and $\hat{p}_{it}^k$. To construct values for import prices we again rely on the UN Comtrade database, using 3 digit SITC sub-industries for those goods defined as differentiated products by Rauch (1999) and Hallak. We obtain a measure of import prices by dividing import value for each variety (*i*) traded from country *k* to *l* by quantity (weight).[20] Our empirical model for import prices is given as:

$$\begin{aligned} \ln(p_{it}^{kl}) &= \varphi_{it}^k + \varphi_i^l + \delta_i \ln(D^{kl}) \\ &\quad + \eta_{i1} NAF_t^{kl} + \eta_{i2} EU_t^{kl} + \eta_{i3} MER_t^{kl} + \eta_{i4} LAN_t^{kl} + \varepsilon_{it}^{kl} \end{aligned} \quad (18)$$

Since the import values are inclusive of cost, insurance, and freight (i.e., c.i.f values), the measured import price of a good shipped from country *k* to *l* in good *i* (p_i^{kl}) depends on several variables: the export price of country *k* (p_i^k), the distance from country *k* to *l* (D^{kl}) which captures transport costs, and other control variables such as dummy

[20] Unreported price data are interpolated using the growth rate of real GDP per capita if the data are available for any of the three years.

variables for common language (LAN^{kl}), and for regional trade agreements (FTA) including NAFTA (NAF^{kl}), EU (EU^{kl}), MERCOSUR (MER^{kl}).[21] Unobservable importer-specific variations are captured by importer fixed effects (φ_{it}^{l}). We set an exporter fixed effect term for the United States to zero. Thus, the remaining exporter fixed effects estimates represent effects relative to the United States. For estimating equation (17), we use the fitted value of equation (18): $\hat{p}_{it}^{kl}$ for p_{it}^{kl} and $\exp(\hat{\varphi}_{it}^{k})$ for p_{it}^{k}.

Before moving to a discussion of the estimation of equation (17), we report the estimation results of equation (18) for each of the 143 differentiated goods.[22] Given the large number of estimates we have for each product for each of the two years (1995 and 2005), we do not report all the results. Instead, in Table 5, we provide summary statistics for the estimated coefficients, the proportion of coefficients that have the expected sign, and the proportion of those that are significant at the 5% level. Consider the table. Import prices are positively related to the log of distance between countries *k* and *l*. 93.7 percent of industry-level estimates have positive signs, 69.9 percent of them are statistically significant. On average, a 1% increase in distance causes a 0.1% increase in import price. The maximum value of the distance coefficient (0.417) comes from glass industry.[23] FTA dummy variables are expected to be negative since countries involved in an FTA reduce or eliminate commercial trade barriers. As expected, most of the signs on FTA

[21] We create the dummy variables for NAFTA, EU and MERCOSUR using information taken from the World Trade Organization Regional Trade Agreements Information System (RTA-IS). The dummy variables for common border and common language as well as bilateral distance between capital cities are obtained from the World Bank Trade, Production and Protection (1976-2004).

[22] Of the 146 differentiated goods in our data set, we were able to construct price measures for 143. Not included in our sample were "Smoked Fish (SITC S3-35)," "Silver and Platinum (SITC S3-681)" and "Works of Art (SITC S3-896)." Since we have 24 countries in the data set, we have 276 bilateral country pairs. For each bilateral country pair, there are both country A's exports to and imports from country B. Thus, we have 552 observations at most for each differentiated good.

[23] The second highest is from fertilizer and the third is from limestone.

dummy variables are negative: 77.6 percent for NAFTA, 66.4 percent for EU, and 77.6 percent for MERCOSUR, although almost half of them are statistically insignificant at the 5% level.

[Insert Table 5 here]

In addition, we report exporter-specific coefficients for China and Japan ($\hat{\varphi}_{it}^{k}$) for years 1995 and 2005. Using 1995 data, 96.5 percent of Chinese products are cheaper in terms of export (shipping) prices relative to corresponding U.S. products, and 87.4 percent are statistically significant at the 5% level. This tendency is quite stable over the period: Chinese products are cheaper uniformly across industries. These price differences may be due to any of a variety of factors. First Chinese goods may have lower quality than comparable U.S. goods.[24] Or, the two sets of goods, although in the same 3 digit category, may be fundamentally different. Finally, even though they may be the same type and have the same quality, Chinese goods might be cheaper due to lower production costs (e.g. labor).

To contrast the price advantages of Chinese goods relative to other countries, we also report the coefficients on Japan relative to the United States. Less than half of Japanese goods are cheaper than American goods (40.6 percent for 1995 and 47.6 percent for 2005).

Figure 3 summarizes our findings on the behavior of the prices of Chinese and Japanese goods over the decade relative to those charged by U.S. exporters. The figure is constructed as follows. First, the exporter fixed effects estimates, $\hat{\varphi}_{it}^{k}$, for each of the differentiated goods, i=1, 2,…, N, for country k (k = China or Japan) in year t are

[24] Schott (2004) argues that this is an important factor in explaining Chinese export levels.

organized in ascending order. Second, we assign the cumulative frequency 1/*N* to the industry with the lowest shipping price, 2/*N* to the industry with the second lowest shipping price, and *N*/*N*=1 to the industry with the highest shipping price. Then, Chinese empirical cumulative distribution functions (CDF) across the 143 differentiated industries are plotted across two years. In both years of 1995 and 2005, 95 percent of Chinese products are cheaper than corresponding U.S. products. For Japanese goods, the majority of goods (around 60%) are expensive relative to U.S. goods, and this relationship remains stable over the period.[25]

[Insert Figure 3 here]

Next we turn to estimate equation (17). For comparison to Hallak as well as results from a standard gravity equation specification, we introduce three variations of equation (17). Equation (19) is the gravity equation similar to McCallum (1995). Here, there is no quality-interaction term. In addition, import price is decomposed into export price (p^k_{it}), distance, lnD, and other control variables. Since p^k_{it} is specific to each exporter, it is captured by exporter fixed effects.[26] Then, equation (19) follows:

$$\text{(19)} \qquad \begin{aligned} \ln(m_{it}^{kl}) &= \alpha_{it}^{k} + \alpha_{it}^{l} + \delta_{it}\ln(D^{kl}) \\ &\quad + \eta_{it1} NAF_t^{kl} + \eta_{it2} EU_t^{kl} + \eta_{it3} MER_t^{kl} + \eta_{it4} LAN_t^{kl} + \eta_{it5} Border_t^{kl} + \varepsilon_{it}^{kl} \end{aligned}$$

Equation (20) is the equation examined by Hallak (2006). From equation (19), the quality interaction term is introduced.

$$\text{(20)} \qquad \begin{aligned} \ln(m_{it}^{kl}) &= \alpha_{it}^{k} + \alpha_{it}^{l} + \delta_{it}\ln(D^{kl}) + \gamma_{it}\ln(\hat{p}_{it}^{k})\ln(GDP_t^{l}) \\ &\quad + \eta_{it1} NAF_t^{kl} + \eta_{it2} EU_t^{kl} + \eta_{it3} MER_t^{kl} + \eta_{it4} LAN_t^{kl} + \eta_{it5} Border_t^{kl} + \varepsilon_{it}^{kl} \end{aligned}$$

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[25] A large number of import prices (import values divided by weights) for Australia, Canada, Malaysia, Singapore, and the United States are not available for 1995. We interpolate the price data by using data from year 2000.

[26] Again, we exclude the United States from the exporter fixed effects, so that these estimates are all relative to the United States.

Finally, equation (21) is derived directly from equation (17) and an Alchian-Allen effect (e.g., Hummels and Skiba (2005) and Harrigan and Deng (2008)) is added. The hypothesis here is that high-quality goods tend to travel further. This effect is captured by the inclusion of an interaction term between the log of distance and exporter price.

$$\ln(m_{it}^{kl}) = \alpha_{it}^{k} + \alpha_{it}^{l} + \beta_{it}\ln(\hat{p}_{it}^{kl}) + \gamma_{it}\ln(\hat{p}_{it}^{k})\ln(GDP_{t}^{l}) + \lambda_{it}\ln(\hat{p}_{it}^{k})\ln(D^{kl}) + \eta_{it5}Border_{t}^{kl} + \varepsilon_{it}^{kl} \quad (21)$$

Since $\hat{p}_{it}^{kl}$ includes distance and other price-related control variables, we do not include these variables in equation (21).

Recent literature on the gravity equation has shown the problem of biased estimates when there are many zero trade observations. Although most of our data set consists of positive bilateral trade levels, there still are some zero observations. To deal with zeros, a possible non-normal distribution of disturbances, and heteroskedasticity, we employ the Poisson pseudo-maximum likelihood (PPML) estimation technique proposed by Santos Silva and Tenreyro (2006). The results of our estimation of equations (19), (20), and (21) are shown in Table 6.[27]

[Insert Table 6 about here]

Consider first our estimates of equation (19) reported in the top third of the table. The coefficients on the log of distance are negative and statistically significant at the 5% level for 83.9 percent of the cases for 1995 and 81.1 percent for 2005. Consistent with the results in Santos Silva and Tenreyro, the coefficients on the log of distance are much smaller than those obtaining using OLS. While the coefficients for the China exporter

[27] In each of the two sets of results we were forced to exclude a small number of industrial sectors due to multicollinearity problems. We fail to estimate SITC 3 digit sectors of 35, 613, and 677 for equation (19), those of 35, 612, 613, 667, 677, 681, 695, 712, 771, 784, 791, 871, 874, 885, 896, and 897 for equation (20), and those of 35, 613, 667, 681, 885, 896, and 897 for equation (21).

variable (relative to the United States) are positive and statistically significant for 15.4 percent of products in year 1995, positive and statistically significant estimates rise to 34.3% in 2005. This indicates that one third of industries in China export more than corresponding U.S. industries after controlling for distance, FTA, common language, border, and importer-specific fixed effects. While these numbers are quite intuitive, their interpretation remains difficult since the China variable captures not only the influence of exporting country, here China, but also export price (p^k_{it}).

Figures 4-1 and 4-2 report empirical cumulative distribution functions of α^k_{it} obtained from equation (19) for China and Japan. We can interpret them as intensive margins of exporter *k* relative to the United States. As we did in the construction of Figure 3, we order them from the smallest to the largest and develop the empirical CDF functions for years 1995 and 2005. Figure 4-1 reports the empirical CDFs of China for the two years. If China's export growth were due to a drastic change in comparative advantage, the compositions of exporting industries would vary over the period and these two functions would intersect each other. However, as the figure shows, there is no intersection. Rather, the empirical CDF using 2005 estimates first-order stochastic dominates that of 1995; after controlling for a number of factors that influence trade, Chinese industries' export levels have increased almost uniformly across *all* industries. This evidence is consistent with our earlier market share decomposition exercise where we show that the export market share changes are almost entirely due to market share effects rather than changing products or markets.

Figure 4-2 presents the case of Japan relative to the United States. Not surprisingly, there is no significant change in intensive margins. At most there appears to be a slight decrease in Japan's advantage relative to the United States. Moreover, because of the similarity of the CDF's for both years, it is straightforward to conclude that the shift found in Figure 4-2 also describes the change in Chinese exports vis a vis Japanese exports. Again, this provides additional evidence in favor of the conclusions from our earlier CMS analysis.

The middle third of Table 6 reports the results from estimating equation (20). Most of the coefficients had the expected signs, and many of these were significant. However, in contrast to Hallak, who found a significant impact of quality on imports, less than half of the estimated coefficients on our proxy measure for quality had positive signs. Furthermore, only about 18% of these estimates were positive and significant at the 5%.[28]

Finally, the results from estimating equation (21) are reported in the bottom third of the table. While quality terms and Alchian-Allen effects do not appear to provide strong explanatory power, import prices from country *k* to *l* are negatively and statistically significantly correlated with import values (74.1 percent for year 1995 and 77.7 percent for year 2005). Moreover, the inclusion of import prices does eliminate the positive coefficients on China exporter dummy in 2005 (i.e., 42.0 percent positive and significant in equation (19) and 3.6 percent positive and significant in equation (20)). In contrast to the results with equation (19), it seems clear from these results that an export price advantage is the most important factor in explaining the growth of Chinese export shares. Schott (2008) among others has also argued that China's export growth is driven by price

[28] The relatively poor performance of the quality term might be due to the data on prices developed from weight-base unit prices and the coverage of countries (skewed to rich countries) we chose for the estimation.

competitiveness. What our results appear to show is that its competitiveness is not limited to labor-intensive miscellaneous products but across *all* differentiated goods.

7. Conclusions

The growth of Chinese exports both in volume and in market share over the past two decades is a singular event in the history of world trade. Using data from 1995-2005, we document this growth in a variety of ways. First, we show that the expanded trade is pervasive. Virtually every country in the world has seen China claim a larger share of its import market. Then, we use CMS analysis to try to determine which country or countries have lost market share as China's trade has grown. Contrary to much discussion in the popular press, we find strong evidence that other developing countries have not seen export shares fall as a result of China's gains. Rather, our results suggest that China's share growth has come largely at the expense of exporters based in Japan and the United States. In this paper, we cannot identify the central reason why these two countries lost shares to China. Potentially, this might reflect American and Japanese firms' outsourcing to China, the growth of FDI from these countries in China, the value of the yuan relative to the yen and the dollar, and/or, improved comparative advantage in Chinese goods relative to goods produced by export industries in Japan and the United States.

In the last major section of this paper we focus on this issue. Using a large set of data disaggregated at the 3 digit SITC level, we estimate a variety of import price and demand equations. The second major finding of this paper is that China's export growth is best explained by price advantages across essentially all differentiated products.

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Tables and Figures

Table 1. China's National Export Market Share by Region

	Countries	2005 National Market Shares				Share Change 1995-2005			
		Average	Std. Dev.	Maximum	Minimum	Average	Std. Dev.	Maximum	Minimum
Africa	22	7.4	8.3	39.1	1.6	5.0	7.8	36.4	-1.0
Asia	16	12.8	9.8	45.0	3.2	6.5	3.2	10.6	0.4
Europe	17	4.1	1.8	8.8	1.2	2.6	1.6	7.4	0.3
Middle East	7	5.5	2.9	9.9	2.3	3.1	1.7	5.8	1.0
North America	3	8.4	6.2	13.0	2.7	5.4	3.4	8.7	2.0
South America	16	5.2	2.2	9.3	2.2	4.2	2.0	9.3	1.5
Total	81	7.2	7.0	45.0	1.2	4.5	4.6	36.4	-1.0

Table 2. Structure of Chinese Exports

SITC Rev 3	Commodities	Commodity Structure of Chinese Exports				China's shares in world exports	
		All 24 countries		Developing countries		(China's exports/World exports)	
		1995	2005	1995	2005	1995	2005
0	Food and live animals	5.5	2.5	6.0	1.8	4.6	7.7
1	Beverages and tobacco	0.2	0.1	0.9	0.1	1.0	0.9
2	Crude materials	3.0	1.1	6.2	1.5	3.3	4.1
3	Mineral fuels	3.2	1.7	5.3	4.4	3.3	2.7
4	Animal and vegetable oils	0.0	0.0	0.1	0.0	0.3	0.8
5	Chemicals and related products	4.2	3.4	14.6	7.7	2.3	4.4
6	Manufactured goods (materials)	15.0	13.0	25.6	14.5	5.5	14.3
7	Machinery and transport equipment	21.3	44.7	23.7	56.2	2.5	13.8
8	Miscellaneous manufactured articles	47.0	32.7	16.3	12.6	19.7	34.7
9	Other commodities	0.5	0.7	1.3	1.2	0.9	4.6

Table 3. Export Performance of 24 Countries on their Markets (1995-2005)

	Fagerberg and Sollie Decomposition (SITC 1-digit Industries 5-8: 166 Industries)					
	Market Share	Commodity Composition	Market Composition	Commodity Adaption	Market Adaption	Total Change in Share
Argentina	0.053	-0.022	-0.029	-0.030	0.006	-0.023
Australia	-0.010	0.014	-0.032	0.005	0.010	-0.013
Brazil	0.232	-0.023	-0.036	0.062	0.015	0.251
Canada	-0.955	-0.002	0.291	-0.032	-0.021	-0.719
China	10.370	0.308	-0.332	0.616	-0.605	10.356
France	-1.119	0.158	-0.129	-0.024	0.087	-1.026
Germany	-0.002	-0.406	0.089	-0.355	0.021	-0.652
India	0.383	0.021	-0.039	0.003	0.019	0.387
Indonesia	0.221	-0.054	-0.030	-0.023	-0.057	0.056
Italy	-0.902	-0.245	-0.060	-0.091	0.015	-1.283
Japan	-4.938	-0.378	0.767	-0.085	-0.024	-4.659
Kenya	0.003	0.000	0.000	0.000	0.000	0.004
Malaysia	0.415	-0.106	-0.211	-0.004	0.176	0.270
Mexico	0.686	0.340	0.095	-0.114	0.032	1.039
Netherlands	0.374	-0.171	-0.165	-0.142	-0.018	-0.123
Poland	0.442	-0.044	-0.055	0.024	-0.028	0.339
Korea	0.510	-0.303	0.289	0.416	0.472	1.385
Saudi Arabia	0.009	-0.010	0.011	0.020	0.019	0.048
Singapore	-0.556	0.033	-0.070	0.051	0.051	-0.491
Spain	0.123	0.029	-0.147	0.034	-0.009	0.030
Sweden	-0.217	0.089	-0.036	-0.134	0.011	-0.287
Turkey	0.416	-0.031	-0.037	0.039	-0.002	0.385
United Kingdom	-1.441	0.401	-0.188	-0.213	0.057	-1.385
USA	-4.097	0.402	0.053	-0.023	-0.225	-3.891

Table 4. Export Shares of China, Japan, and USA in Reginal Markets (1995-2005)

	NAFTA	Euro	Asia&Pacific	Others	Total
I. Machinery and transport equipment (SITC 3, Industry 7)					
China	13.2	8.4	13.2	7.4	11.3
Japan	-10.5	-3.9	-7.3	0.4	-6.9
USA	-3.2	-3.9	-9.4	-7.3	-5.1
Developed (exclude Japan and USA)	-4.5	-4.1	0.0	-6.0	-3.4
Developing (exclude China)	4.9	3.5	3.6	5.5	4.1
II. Miscellaneous manufactured articles (SITC 3, Industry 8)					
China	17.1	15.2	8.7	18.5	15.0
Japan	-4.9	-2.4	0.2	-2.8	-2.7
USA	-4.8	-3.1	-7.9	-11.8	-5.1
Developed (exclude Japan and USA)	-7.8	-10.2	0.7	-5.1	-7.4
Developing (exclude China)	0.4	0.6	-1.8	1.2	0.2
III. Other industries (SITC 3, Industries 0-6, and 9)					
China	4.6	2.3	2.9	5.0	3.3
Japan	-2.7	-0.4	-0.5	-0.3	-0.8
USA	-3.2	-0.3	-9.5	-5.7	-3.2
Developed (exclude Japan and USA)	-0.7	-3.4	5.0	-4.2	-1.6
Developing (exclude China)	1.9	1.7	2.1	5.2	2.3

Notes : Asia and Pacific includes Australia, China, India, Indonesia, Japan, Korea, Malaysia, and Singapore.
Euro includes France, Germany, Italy, the Netherlands, Poland, Spain, Sweden, Turkey, and the United Kingdom.
NAFTA consists of Canada, Mexico, and the United States.

Table 5. Import Price Estimations

	Expected signs	Sign match (%)	Sign match & 5% significance	Median	Max	Min	St. Dev
Coefficients							
log(distance)	+	93.7	69.9	0.106	0.417	-0.064	0.093
NAFTA	-	77.6	37.1	-0.193	1.168	-2.227	0.359
EU	-	66.4	36.4	-0.094	0.727	-0.854	0.246
MERCOSUR	-	77.6	24.5	-0.203	1.663	-1.639	0.458
Language	-	58.0	8.4	-0.026	1.265	-0.337	0.158
China (1995)	-	96.5	87.4	-0.857	0.407	-2.703	0.587
China (2005)	-	94.4	90.2	-0.907	1.433	-2.624	0.571
Japan (1995)	-	40.6	18.9	0.090	0.925	-2.352	0.470
Japan (2005)	-	47.6	21.0	0.019	1.156	-0.957	0.380
Observations				824	963	270	130
R squares				0.346	0.547	0.145	0.076

Note : 143 of 146 sectors are estimated from OLS with robust standard errors.

Table 6. Estimation Results with 146 Differentiated Sectors (with Poisson Pseudo-Maximum Likelihood Estimator)

		I. Year 1995						II. Year 2005					
	Expected signs	Sign match (%)	Sign match & 5% significance	Median	Max	Min	St. Dev	Sign match (%)	Sign match & 5% significance	Median	Max	Min	St. Dev
Estimation I: Standard Gravity Equation, Equation (19), for 143 sectors													
log(distance)	-	93.7	83.9	-0.533	0.410	-1.479	0.311	94.4	81.1	-0.568	0.547	-1.111	0.300
NAFTA	+	86.7	72.7	1.202	4.956	-1.902	1.077	92.3	79.0	1.370	3.823	-2.970	1.041
EU	+	89.5	74.1	1.134	5.360	-1.743	1.015	90.9	76.2	1.166	5.711	-1.349	0.973
MERCOSUR	+	93.7	83.9	2.608	6.285	-2.556	1.559	94.4	86.0	3.344	8.772	-2.239	1.670
Language	+	83.2	46.9	0.368	2.156	-0.927	0.488	79.7	45.5	0.307	3.539	-1.309	0.552
Border	+	47.6	9.1	-0.050	2.483	-2.852	0.877	37.1	9.1	-0.263	3.982	-4.024	1.081
China Dummy (negative signs)	-	81.1	70.6	-2.037	2.904	-7.837	2.180	53.8	42.0	-0.273	5.515	-6.087	2.116
China Dummy (positive signs)	+	18.9	15.4					46.2	34.3				
Japan Dummy (negative signs)	-	66.4	46.9	-0.537	3.272	-8.801	1.834	69.2	53.1	-0.914	6.515	-7.192	1.706
Japan Dummy (positive signs)	+	33.6	17.5					30.8	16.1				
Estimation II: Equation (20) for 130 sectors													
Quality	+	42.3	17.7	-0.126	4.254	-3.673	1.153	30.0	10.0	-0.283	2.532	-3.542	0.764
log(distance)	-	94.6	84.6	-0.578	0.367	-1.482	0.314	93.8	83.1	-0.582	0.524	-1.111	0.305
NAFTA	+	88.5	68.5	1.214	5.435	-1.651	1.136	94.6	82.3	1.438	4.034	-0.755	0.894
EU	+	90.0	72.3	1.122	5.461	-0.859	1.035	93.8	79.2	1.186	5.795	-0.552	0.921
MERCOSUR	+	96.2	88.5	2.732	6.462	-3.382	1.537	96.9	87.7	3.214	8.894	-2.208	1.601
Language	+	87.7	53.1	0.470	2.898	-0.811	0.492	82.3	50.0	0.354	3.589	-1.246	0.562
Border	+	44.6	10.0	-0.105	2.531	-4.780	0.955	42.3	11.5	-0.172	4.036	-4.056	1.106
China Dummy (negative signs)	-	77.7	45.4	-2.779	21.089	-21.081	5.803	73.8	37.7	-2.227	12.393	-22.460	4.641
China Dummy (positive signs)	+	22.3	3.8					26.2	6.9				
Japan Dummy (negative signs)	-	41.5	17.7	-0.307	11.236	-12.916	3.641	39.2	14.6	-0.433	6.908	-6.932	2.451
Japan Dummy (positive signs)	+	58.5	27.7					60.8	34.6				
Estimation III: Separation of Price and Export Capacity, Equation (21), for 139 sectors													
Quality	+	39.6	15.8	-0.102	3.958	-4.502	1.147	28.8	12.9	-0.246	3.442	-4.040	0.780
Price	-	85.6	74.1	-3.434	9.571	-26.586	4.301	84.2	77.7	-3.555	14.126	-20.955	4.209
Alchian-Allen Effects	+	30.2	10.1	-0.143	1.170	-1.784	0.388	30.9	9.4	-0.139	1.099	-2.380	0.394
Border	+	64.7	23.7	0.315	3.227	-4.389	0.901	64.0	28.1	0.273	9.137	-4.668	1.415
China Dummy (negative signs)	-	87.8	61.2	-5.346	22.087	-30.563	7.583	85.6	63.3	-5.490	23.681	-28.731	7.135
China Dummy (positive signs)	+	12.2	1.4					14.4	3.6				
Japan Dummy (negative signs)	-	41.0	22.3	0.643	18.018	-12.066	4.389	51.8	30.2	-0.205	8.121	-15.699	3.112
Japan Dummy (positive signs)	+	59.0	36.0					48.2	25.2				

Figure 1. World Market Export Shares 1948-2005

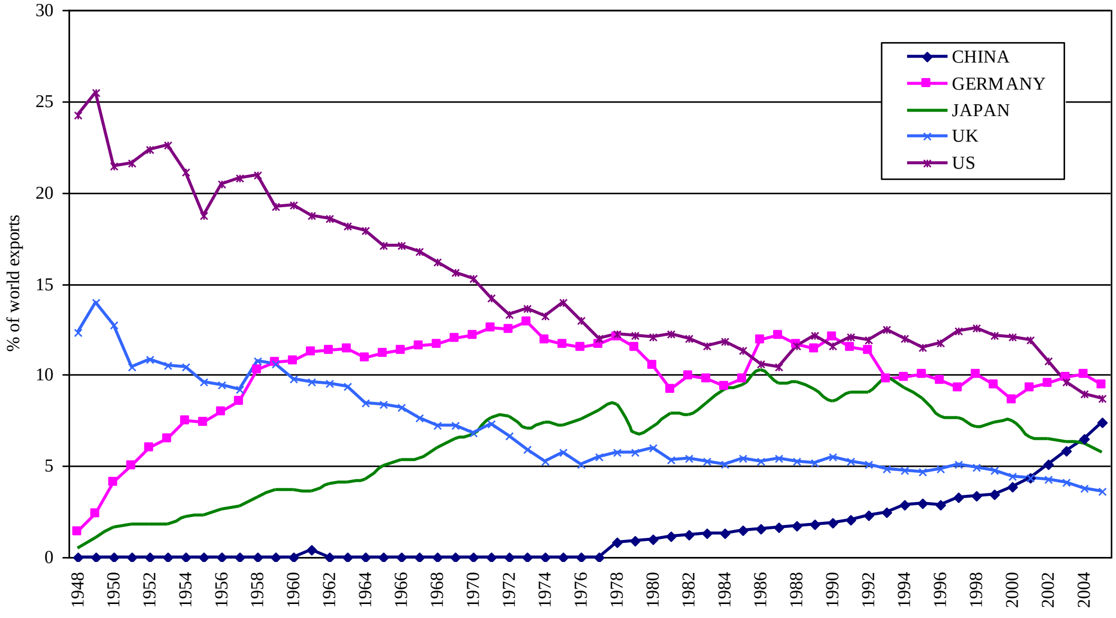

Figure 2-1. Share Changes between China and USA in 3rd Markets
(Excluded Canada, Kenya, and Mexico)

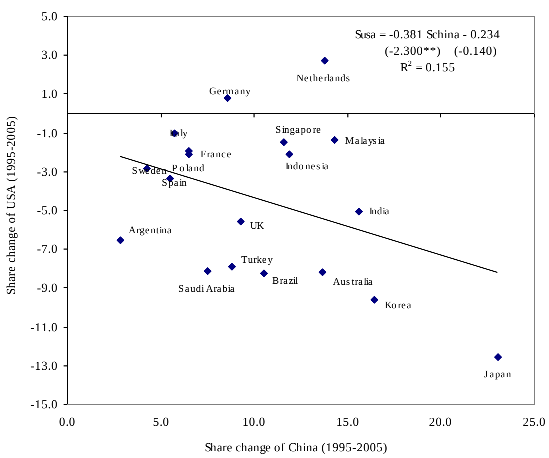

Figure 2-2. Share Changes between China and Japan in 3rd Markets

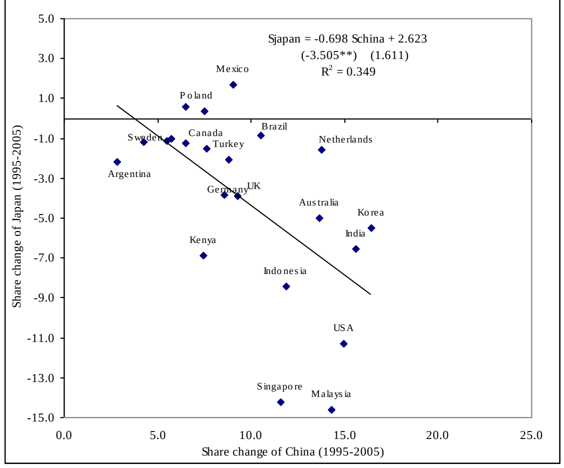

Figure 2-3. Share Changes between China and Malaysia in 3rd Markets

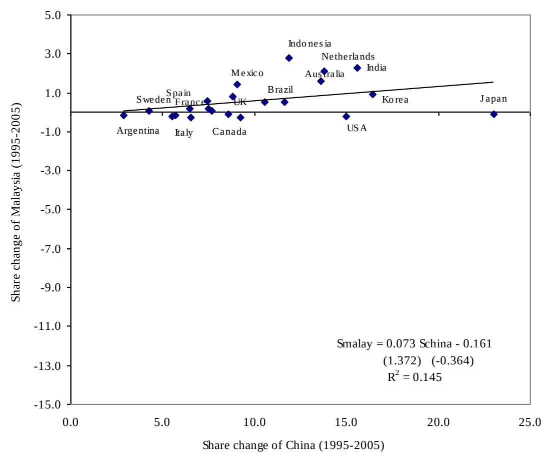

Figure 2-4. Share Changes between China and Mexico in 3rd Markets
(Excluded Canada and USA)

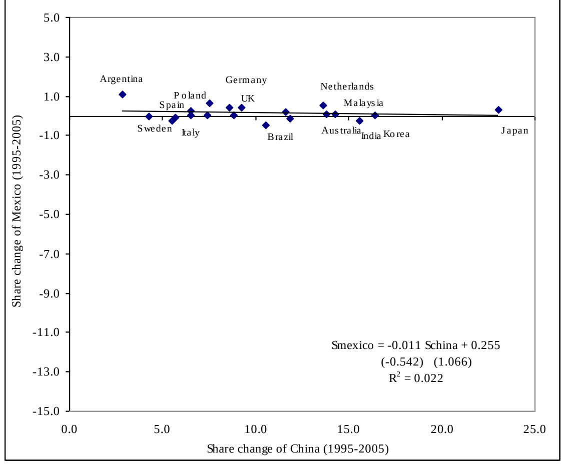

Figure 2-5. Share Changes between China and Germany in 3rd Markets

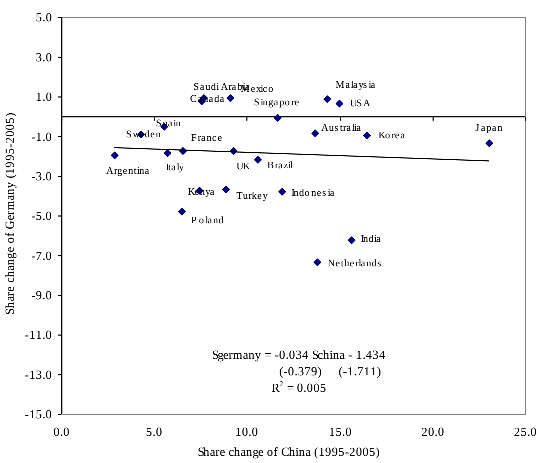

Figure 2-6. Share Changes between China and India in 3rd Markets

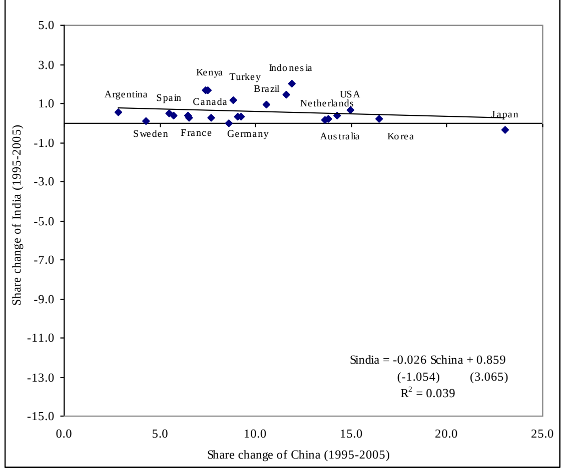

Figure 3. Relative Export Prices of Chinese and Japanese Goods (U.S.=0)

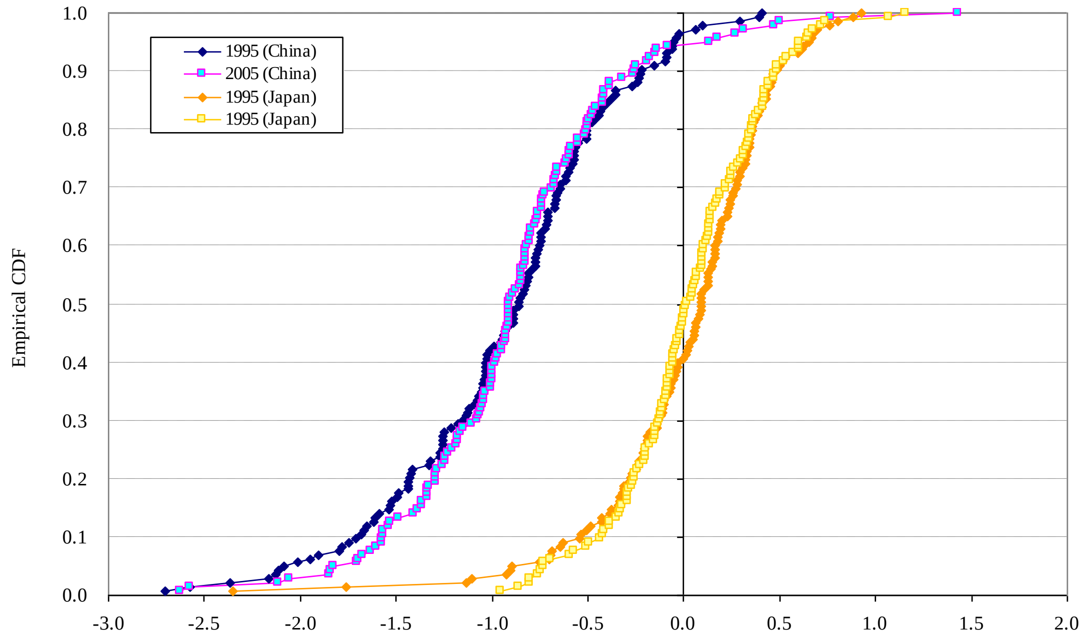

Figure 4-1. Relative Export Advantage of China (U.S.=0)

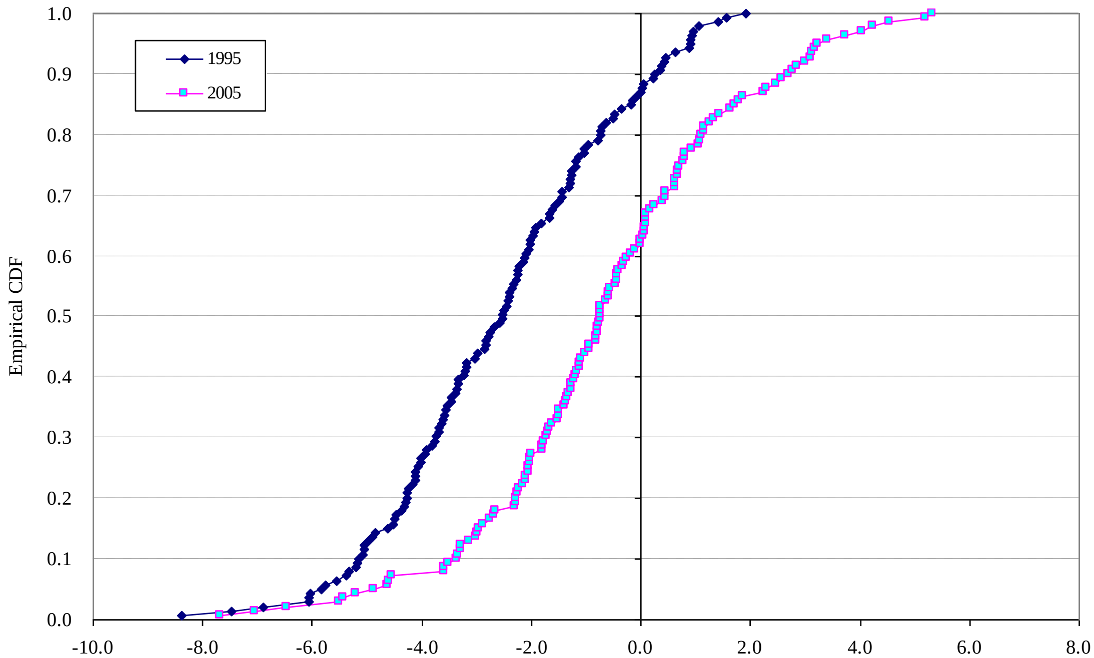

Figure 4-2. Relative Export Advantage of Japan (U.S.=0)