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Are U.S. Exports Different from China's Exports? Evidence from Japan's Imports

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Abstract

Are U.S. exports different from China's exports? If so, how? This paper attempts to answer this question, focusing on the quality, variety, and overlap of their products. Using product-level manufacturing import data from Japan, I find that the exports of China and the United States are similar in terms of variety. More than 85 percent of U.S. export products to Japan are commonly exported from China. However, U.S. exports are different from China's exports in terms of quality. A comparison with the European Union (EU) shows that U.S. exports are similar to EU exports in terms of both quality and variety when compared to China's exports. These results suggest that quality matters. Both the EU and the United States are better endowed with the factors needed to produce quality or are relatively more productive in producing quality products than China.

Key words: Product Quality; Product Variety; China; United States; Japan
JEL classification code: F11, F14, F2, C21

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1 Introduction

With the rapid expansion of China's exports, it is interesting to consider how China's exports compete with other countries' exports.[1] In 2006, China has become the world's third biggest exporter, accounting for 8.0 percent of world merchandise exports next to Germany (9.2 percent) and the United States (8.6 percent).[2] Several studies have addressed whether or not China's exports displace other Asian countries' exports (e.g., Greenaway, Mahabir, and Milner, 2006; Eichengreen, Rhee, and Tong, 2007; Hanson and Robertson, 2007). However, no studies have examined explicitly the similarities or differences of export products between two of the largest trading countries, namely China and the United States.[3] In other words, we do not know whether or not trade theory can explain the differences or similarities of export products between China and the United States.

The Ricardian model suggests that countries with higher productivity will export products that differ from countries with lower productivity. On the other hand, the standard Heckscher-Ohlin (HO) model suggests that relatively labor-abundant countries will export labor-intensive products while relatively capital-abundant countries will export capital-intensive products. Given that the United States is more capital abundant and/or more productive than China, both traditional trade models imply that the United States can be expected to export products that are different from China's products. In other words, one would expect that U.S. exports are different from China's exports in the sense that the number of products exported in common, or "overlapping" products, would be rather small.

A recent study by Schott (2008), however, suggests that such a prediction might not be applicable to China's exports. He examined the differences in exports between China and the OECD countries (except the United States) based on an export similarity index (ESI). The ESI was developed by Finger and Kreinin (1979) to examine how countries' export bundles are similar to each other, focusing on overlapping products.[4] Using U.S. product-level import data, he found China's export-bundle similarity with the OECD (except the United States) was greater than one would expect given China's size and income level.

This "puzzle" could possibly be explained by the "new" trade theories that emphasize the role of horizontal product differentiation (e.g., Krugman, 1979) or vertical product differentiation (e.g., Flam and Helpman, 1987). But whether or not existing theories can explain the differences of exports between China and the United States is still an open question. A study on the similarities or differences between China's and U.S. exports may thus provide a deeper understanding of current patterns of international trade as well as the empirical validity of trade theories.

[1] For a treatment of recent issues on China's trade, see Rodrik (2006) and Feenstra and Wei (2007).

[2] Figures are obtained from World Bank (2008).

[3] Note that Germany is different from China and the United States in the sense that its major export destination is other European Union (EU) member countries. In 2006, Germany's exports to EU 25 member countries were 62.3 percent of its total exports.

[4] More specifically, the ESI is defined as $ESI_{jk} = \sum_{i \in I} \min(s_{ij}, s_{ik})$, where i denotes the products; j and k denote trading partners; I denotes the set of overlapping products between countries j and k; s_{ij} denotes the value share of country j's exports in product i.

In addition, the study of the export patterns of China and the United States could have some important policy implications. That is, the increase in overlapping products may be a source of conflict between China and the United States and possibly worsen the bilateral relationship. Although the analysis of this paper does not compare U.S. imports from China with U.S. domestic products directly, the comparison of export products between China and the United States can provide useful information as the first approximation to clarify how China's products compete with U.S. products.

This paper uses manufacturing import data from Japan. There are three advantages in focusing on Japan's imports. First, Japan is one of the largest trading partners for both China and the United States.[5] China's and U.S. exports to Japan, therefore, should reflect some of the important features of their production. Second, Japan is a country with which both China and the United States have not yet established free trade agreements. There is thus little concern about the effects of trade policy. Finally, import data are available at the 9-digit level. This enables me to compare China's and U.S. exports at highly disaggregated level. To make the comparison clear, I also examine the exports from the EU to Japan.

The contribution of this paper is twofold. First, to the best of my knowledge, this paper is the first study that compares directly the overlap, quality, and variety of China's and U.S. export products. Several papers have addressed empirically the issues of the quality and variety of exports and imports.[6] In spite of the rapid increases in China's exports, little attention has been given to the differences in the quality and variety of China's and U.S. export products. This is partly due to prevailing notion that there is little overlap between China's and U.S. products. There may also be problems of data availability. Because the quality and variety of products can be defined within the same product category, the difference of quality or variety is not an issue so long as China and the United States export different categories of product. In addition, a clean match between trade data and data on domestic products is difficult to obtain. Indeed, previous studies on the quality and variety of exports have mainly utilized U.S. import data.[7] However, China's and U.S. products can be compared directly if one uses the import data of another country in which detailed product-level data are available. Accordingly, this paper uses Japan's import data that permit direct comparison of China's and U.S. products.

Second, in examining the difference of exports between China and the United States, this paper takes into account both overlapping products and products that are not exported in common by two countries, that is, "non-overlapping" products. Note that the ESI employed by Schott (2008) does not take into account non-overlapping products. Non-overlapping is hardly observed at the aggregated industry level but is often observed at the disaggregated product level and, therefore, cannot be ignored. This paper therefore utilizes a cross-country analogue to Feenstra

[5] According to JETRO (2007), for the United States, Japan is the third largest export destination (5.8 percent of total exports) next to Canada (22.3 percent) and Mexico (12.9 percent). Similarly, for China, Japan is the third largest export destination (9.5 percent of total exports) next to the United States (21.0 percent) and Hong Kong (16.0 percent).

[6] For example, Feenstra, Yang, and Hamilton (1999) and Schott (2004, 2008) have examined the quality and variety of U.S. imports.

[7] An exception is Hummels and Klenow (2005), who utilized 1995 United Nations export data that cover exports from 126 countries to each of 59 importers at 5,000 six-digit categories.

(1994) so that the analysis can take into account non-overlapping as well as overlapping products.

The paper is structured as follows. Section 2 provides a brief overview of the relevant theories of international trade. Section 3 considers whether or not U.S. export products overlap with China's exports. Section 4 investigates whether or not the quality and variety of U.S. exports are different from those of China's exports. Section 4 also examines the exports from the EU to Japan to make the comparison clear. Concluding remarks are in Section 5.

2 Theory

As previously noted, traditional trade models predict that U.S. exports are different from China's exports in the sense that the number of overlapping products should be rather small. If China and the United States export different products, differences in the quality and variety of China's and U.S. exports will not be an issue.

The "new" trade theory predicts that countries export differentiated products from the same industry, thereby allowing for overlapping export products. There are two types of models. One focuses on horizontally differentiated products in which quality is the same but variety is different across product varieties. An example of the model is the love-of-variety model, such as Krugman (1979) model that is based on the Dixit and Stiglitz (1977) preferences.

Hummels and Klenow (2005) have pointed out that horizontal differentiation models predict that variety is positively correlated with the size of the economy. Although China's economy size is less than one-fifth of the United States in terms of GDP, it is five times greater than the United States in terms of its labor force.[8] Because the size of the economy can be measured by GDP and/or the labor force, whether or not the United States has a larger variety of export products than China is not necessarily clear based on the love-of-variety model.

Note also that the love-of-variety model predicts that, under the Armington (1969) assumption in which variety is defined according to the country of origin, U.S. exports will be priced lower than China's exports if the United States has higher productivity than China. In the love-of-variety model, price differences between two different varieties come from productivity differences rather than quality differences. The love-of-variety model assumes that a variety's price is a constant markup over productivity-adjusted marginal cost. The relative price between varieties m and n is written as follows:

$$\frac{p_m}{p_n} = \frac{w/\varphi_m}{w/\varphi_n}, \tag{1}$$

where p_m and p_n are the prices of varieties m and n, respectively; w is the wage; and φ is productivity. Because the Armington assumption implies that each country of origin corresponds to each variety, the model implies that the higher the countries' productivity, the lower the export price will be.[9]

[8] According to World Bank (2008), the real GDPs (2000 prices) of China and the United States are 11,411 billions and 2,092 billions of US dollars in 2006, respectively. On the other hand, the labor force of China and the United States are 782.5 and 156.9 millions, respectively.

[9] For more detail, see Schott (2004).

The other model focuses on vertically differentiated products in which quality is different but variety is the same across products. An example is the quality-ladder model in Grossman and Helpman (1991). The quality-ladder model basically predicts that more productive countries export higher quality and higher price products than less productive countries. This in turn implies that the United States will export higher quality products than China.

Previous studies thus suggest that the overlap of export products between China and the United States is small if the prediction of traditional trade models is correct. The horizontal product differentiation models predict that the overlap of export products between two countries will be large and the quality of export products will be generally the same. Whether or not the United States has more varieties than China is, however, ambiguous. The vertical product differentiation models predict that the overlap of export products between two countries will be large and that the quality will be higher for U.S. exports than China's exports.

In the following empirical analysis, I first ask whether or not U.S. export product overlap with China's exports and then examine whether the quality and variety of U.S. exports are different from China's exports. In doing so, I also discuss the empirical validity of these theoretical implications in order to examine whether existing trade models can explain the differences of exports between China and the United States.

3 Do U.S. export products overlap with China's export products?

3.1 Data

This paper uses Japan's import data from the Ministry of Finance (MOF) (2007), *Trade Statistics of Japan*.[10] The data are available monthly on the 9-digit Harmonized System (HS).[11] The HS was introduced in 1988 and revised in 1992, 1996, 2002, and 2006.[12] To trace each product category consistently through time, I use annual data for 2002-2006.

Table 1 presents an example of 4-digit, 6-digit, and 9-digit HS categories. A 4-digit category 61.09 is "T-shirts, singlets and other vests, knitted or crocheted," which is separated into two categories at the 6-digit level, according to whether or not T-shirts are made from cotton. These 6-digit categories are further decomposed into 12 categories at the 9-digit level, according to the type of cottons or the type of fibers. The 9-digit category is used by the Japanese government to set tariff rates. This paper takes each 9-digit category as a "product" and each 4-digit category as an "industry" for which product variety and product quality are to be measured.[13]

[10] The 9-digit trade data are available at the MOF website: http://www.customs.go.jp/toukei/info/index_e.htm

[11] The HS is an international product classification based on the International Convention on the Harmonized Commodity Description and Coding System. The HS is standardized universally at 6-digit categories but may be different at 7-digit or more detailed level categories.

[12] For more detail, see http://www.mof.go.jp/singikai/kanzegaita/tosin/kana171215gai/06.pdf

[13] Some studies employ the Armington assumption. For example, Broda and Weinstein (2006) and Schott (2004, 2008) define the product as each product category and variety according to the different countries of origin. However, the Feenstra et al. (1999) approach employed in Section 4 is unable to apply the Armington-type product

Data include both quantities and values. Unit-price is obtained from value divided by quantity.[14] For products with a small quantity within each product category, the price data are not necessarily available because of rounding. I exclude products in which quantity data are not available from the analysis because the unit price cannot be calculated. The share of excluded products is less than 0.005 percent.

=== Table 1 ===

3.2 Results

Table 2 summarizes the value, the number of industries, and the number of products of Japan's imports. Three findings are particularly important in this table. First, the value of imports increases from 2002 to 2006. Second, Japan imports a large number of products. In 2006, the number of industries and products covered by Japan's total imports is 1,235 and 8,066, respectively. Japan imported 6,921 manufacturing products from 1,024 industries in the world, implying that manufacturing products cover 82.9 percent of industries and 85.8 percent of products. This means that each industry covers 6.8 products on average.[15] Third, the rapid increases in the imports of oil are worth mentioning. This rapid increase is, however, largely attributable to the increase in oil prices.

=== Table 2 ===

Table 3 presents the ranking of import share by country or region. In both total imports and manufacturing imports, one of the notable findings in this table is the expansion of imports from China. China was the largest source country for Japan in both 2002 and 2006 in both total imports and manufacturing imports. China accounted for 18.3 percent of total imports in 2002 and 20.5 percent in 2006. Its remarkable expansion is clearly confirmed for manufacturing imports. The share of total manufacturing imports from China grew from 24.6 percent in 2002 to 31.4 percent in 2006.

=== Table 3 ===

The import shares from the EU and the United States declined between 2002 and 2006. However, China, the EU, and the United States remain the three largest sources with 42.2 percent of

differentiation.

[14] Note that the unit-price may be affected by the product composition within each industry (Leamer and Stern, 2006, p. 15) and/or lower production costs (Hallak and Schott, 2008). Section 4 addresses these issues in more detail. Another concern may be that unit-price reflects not only quality but also transportation cost because imports are reported as C.I.F. (cost, insurance, and freight) values (F.O.B. (free on board) imports are not available). Section 4.2 addresses this issue.

[15] One may think that an "industry" can be defined at the 6-digit category level. However, the 6-digit category is still so disaggregated that the number of products within each 6-digit categories is not large enough to apply the model that is described in Section 2. The number of 6-digit categories in manufacturing is about 4,400, implying that the average number of 9-digit categories within each 6-digit category is 1.6 ($\simeq 7,000/4,400$).

total imports and 62.8 percent of manufacturing imports in 2006. Other major source countries are the East and Southeast Asian countries. For total imports, oil exporting countries like Saudi Arabia are ranked highly. To exclude the effects of oil imports, I focus on manufacturing imports hereafter.

Table 4 shows the ranking of the number of 4-digit categories, or "industries", in the imports of Japan by country or region. The ranking of industries is slightly different from the ranking of the value of imports. Despite that China's exports to Japan are more than twice as much as EU exports, the number of industries is higher for the EU than China. In 2002, the EU covers the greatest number of industries (984 industries), followed by the United States (958 industries) and China (942 industries). China's remarkable growth is also confirmed in the coverage of the industry. In 2006, China's exports cover 979 industries, which exceeded the coverage of the U.S. exports. Table 4 also shows the ranking of the number of 9-digit categories, or "products." Similar findings are obtained at the 9-digit product level.

=== Table 4 ===

Do U.S. export products overlap with China's export products? Table 5 presents the ranking of the number of overlapping manufacturing industries and products with the United States by country or region. Table 5 indicates that, in 2006, 85.5 percent of U.S. export products to Japan are commonly exported from China. This is smaller than the overlap with EU exports (91.5 percent) but larger than any other Japan's trading partners. This result suggests that U.S. exports are similar to China's exports in terms of the coverage of the products.

=== Table 5 ===

Such similarity of export products is also confirmed between China and the EU. Table 6 presents the ranking of the number of overlapping manufacturing industries and products with the EU by country or region. In 2002, EU exports overlapped with U.S. exports by 79.5 percent, followed by China (76.3 percent). In 2006, the overlap between China's and EU exports was 83.5 percent, which exceeded the overlap between EU and the United States. In other words, the coverage of EU exports to Japan is more similar to China's exports than U.S. exports.

=== Table 6 ===

A concern is that the overlap simply means the overlap of the product categories. Relative amount between China and the United States within each 9-digit category may be different from each other. For example, one unit of a product at the 9-digit level comes from the United States while a thousand units come from China (or vice versa). If the relative amount is different between China and the United States, high overlap does not necessarily mean the high competition between China's and U.S. products.

Figure 1 presents the distribution of the quantity of U.S. exports relative to China's exports (log value): $\log(x_{i,US}/x_{i,CN})$, where $x_{i,US}$ and $x_{i,CN}$ are the imports of product i from the United States and China, respectively. If the relative amount is different between China and the United States, the distribution is expected to take the fat tails. However, Figure 1 indicates that the distribution does not take fat tails: the quantities of China's and U.S. exports are also similar to each other even within 9-digit categories. Figure 2 presents the distribution of the quantity of EU exports to China's exports, implying that the amount of China's exports is similar to that of EU exports. These results suggest that U.S. exports are similar to China's exports in terms of the coverage of 9-digit HS categories.

=== Figures 1 and 2 ===

4 Are the quality and variety of exports different between China and the United States?

4.1 Methodology

To compare the quality and variety of imports between China and the United States, I follow the Feenstra et al. (1999) that utilizes a cross-country analogue to Feenstra (1994), which enables us to examine product quality and variety at the same time in a comprehensive way. Feenstra (1994) is based on an exact price index developed by Diewert (1976) and formalized by Sato (1976) and Vartia (1976) for the CES functional form for the existing product varieties.[16] Feenstra (1994) has extended Sato-Vartia price index to incorporate the effects of new and disappearing product varieties.

There are two advantages in using Feenstra (1994) methodology. First, it incorporates not only the effects of overlapping products between two countries but also those of non-overlapping products.[17] This is a cross-country analogue to the existing and new/disappearing product varieties. Second, his methodology does not depend upon the unobservable product-specific quality.

Suppose that there are $j(=1,\ldots,J)$ countries and $i(=1,\ldots,N)$ products for a given industry. Country j supplies the products $I_j \subseteq \{1,\ldots,N\}$. Let x_{ij} be the import quantity of product i from country j and $\mathbf{x}_j$ be the corresponding import vector. Similarly, denote p_{ij} as the price of product i from country j and $\mathbf{p}_j$ as the corresponding price vector. Let I be the set of overlapping products between countries j and k (i.e., $I = (I_j \cap I_k)$). Suppose that the set of overlapping products is not empty. Following Feenstra et al. (1999), the quality and variety indexes are defined as follows.[18]

The product quality of country j relative to country k in a given industry $Q_{j/k}$ is defined as country- and industry-specific quality index:

$$Q_{j/k} = \frac{(E_j/X_j)/(E_k/X_k)}{P(\mathbf{p}_j, \mathbf{p}_k, \mathbf{x}_j, \mathbf{x}_k, I)}, \tag{2}$$

[16] An exact price index is defined as "the price index that exactly equals the ratio of the unit-costs" (Feenstra, 2004, p. 414), which makes it possible to remove the effects of unobservable product-specific quality from the price index (Feenstra, 1994).

[17] Note that quality and variety can be defined for industries that exist in common in both China and the United States, or "overlapping" industries. If China and the United States specialize in different industries, the relative service ratio cannot be defined. This may not be a serious problem, however, because 96.5 percent of U.S. export industries overlap with China's export industries (Table 5).

[18] The Appendix provides a derivation of these indexes.

where $X_j = \sum_{i \in I_j} x_{ij}$; $X_k = \sum_{i \in I_k} x_{ik}$; and $P(\mathbf{p}_j, \mathbf{p}_k, \mathbf{x}_j, \mathbf{x}_k, I)$ is the price index and defined as:

$$P(\mathbf{p}_j, \mathbf{p}_k, \mathbf{x}_j, \mathbf{x}_k, I) = \prod_{i \in I} \left(\frac{p_{ij}}{p_{ik}} \right)^{\omega_i(I)}, \tag{3}$$

where $\omega_i(I)$ is the logarithmic mean of the expenditure shares of the two countries, normalized to sum to unity.[19]

As Leamer and Stern (2006, p. 15) pointed out, unit-expenditure does not necessarily represent quality because it may be affected by the difference of product composition between countries j and k in an industry. Unit-expenditure is thus divided by the price index in order to control for the difference of product compositions. This implies that $Q_{j/k}$ captures the difference of unit-expenditure adjusted by the differences of product compositions, which therefore can be interpreted as a quality difference of exports between countries j and k in a given industry.[20] If the unit-expenditure and unit-price are the same between countries j and k, $\ln Q_{j/k} = 0$ (i.e., $Q_{j/k} = 1$). If country j exports more higher-priced products than country k within a given industry, $\ln Q_{j/k} > 0$ (i.e., $Q_{j/k} > 1$).[21]

On the other hand, the product variety of country j relative to country k in a given industry $V_{j/k}$ is defined as:

$$V_{j/k} = \frac{\lambda_j}{\lambda_k} \tag{4}$$

where $\lambda_j = \sum_{i \in I_j} p_{ij} x_{ij} / \sum_{i \in I} p_{ij} x_{ij}$, which equals the ratio of the expenditure on the entire set of goods I_j relative to common goods I in country j in a given industry. Note that λ_j^{-1} is the relative expenditure shares on common goods. Therefore, if the relative expenditure shares on common goods are the same between countries j and k, $\ln V_{j/k} = 0$ (i.e., $V_{j/k} = 1$). If the import share of non-overlapping products from country j becomes large relative to country k, $\ln V_{j/k} > 0$ (i.e., $V_{j/k} > 1$). This means that the larger the import share of non-overlapping products from country j relative to country k, the larger $V_{j/k}$ will be, which therefore can be interpreted as a variety difference of exports between countries j and k in a given industry.

To compare the product quality and variety between China and the United States, I first calculate the product quality index $Q_{j/k}$ and the variety index $V_{j/k}$ for China (country k) and the United States (country j), take the natural log of each index, and compute the mean over the manufacturing products. If the quality (or the variety) of U.S. exports is greater (less) than that of China's exports, the log of index takes positive (negative) values. To make the comparison

[19] One may think that product quality can be defined as unit-price at the 9-digit product level. However, this makes it difficult to define the product variety of country.

[20] A recent study by Hallak and Schott (2008) proposed a more advanced method to decompose countries' observed export prices into quality and quality-adjusted-component. This paper, however, follows Feenstra et al. (1999) in order to take into account both overlapping and non-overlapping products as well as to examine product quality and variety at the same time in a comprehensive way.

[21] Note that, unlike Hummels and Klenow (2005), country j's export products are not necessarily a subset of country k's export products (i.e., $I_k \neq (I_j \cup I_k)$). This, in turn, implies that Hummels and Klenow (2005) decomposition is not directly applicable to this framework.

clear, I also examine the exports from the EU to Japan. Product quality and variety indexes are calculated for each industry in each year.[22]

4.2 Results

Table 7 presents the average of the qulity and variety indexes. The major findings are threefold. First, the quality of U.S. exports is, on average, higher than China's exports. The quality index is positive both in 2002 (0.65) and 2006 (0.68). This implies that the average quality is higher for U.S. products than for China's products. The increase in the quality index suggests that the quality difference between China and the United States is becoming larger. This supports the finding of Schott (2008) that China's relative price is falling over time in some industries.

=== Table 7 ===

Second, in contrast to the quality index, the variety index changes from positive to negative. The variety index decreases from 0.06 in 2002 to -0.04 in 2006. This implies that the variety of China's exports exceeded U.S. exports in the early 2000s. Table 7 also shows that China's export varieties are catching up with EU export varieties from 0.11 in 2002 to 0.03 in 2006. These results suggest that, in terms of product variety, China's exports are now equally competing with EU and U.S. exports.

Third, U.S. exports are quite similar to EU exports in terms of both quality and variety. The quality index changes from 0.06 in 2002 to 0.02, implying that the quality of EU exports is catching up with U.S. exports. The variety index, on the other hand, does not show large change: -0.05 in 2002 and -0.04 in 2006. Theses results imply that the varieties of EU and U.S. exports to Japan are similar to each other.

How we do know which of above results are statistically significant? To compare the product quality and variety indexes between China and the United States statistically, I have run the following regression:

$$\ln(\text{Product Quality (Variety) Index})_{Mt} = \alpha + \beta \text{Year Dummies} + \varepsilon_{Mt}, \tag{5}$$

where the dependent variable is the log of product quality or variety index in equation (15) in industry M; α is a constant; and ε_{Mt} is an error term. If the quality (or variety) of U.S. exports is, on average, higher than that of China's exports, the coefficient α is positive and significant. On the other hand, the coefficient α takes significantly negative values if the quality (or variety) of China's exports is higher than that of U.S. exports. To make the number of reporting coefficients reasonable, the regression is conducted at the "sector" level in which industries are further aggregated into 17 categories.[23] Year dummies are included to control for the effects of unobservable year-specific shocks such as exchange rate shocks. These groups are further classified into intermediate products and final products, following Feenstra et al. (1999).

[22] If the unit is different within each 4-digit category, I calculate the relative service ratio by product and by unit.
[23] "Sector" is distinguished from "industry" and refers to 17 categories in Table 8.

Table 8 presents the regression results of the coefficients α in equation (5) with robust standard errors in brackets.[24] A comparison with EU is also conducted. The first three columns show the results for the United States relative to China ($Q_{US/CN}$ and $V_{US/CN}$). The middle three columns show the results for the United States relative to EU ($Q_{US/EU}$ and $V_{US/EU}$). The last three columns show the results for EU relative to China ($Q_{EU/CN}$ and $V_{EU/CN}$).

=== Table 8 ===

Two results stand out for the United States relative to China. First, U.S. exports are different from China's exports in terms of quality. The results show significantly positive coefficients in 13 out of 17 sectors. The large quality difference is confirmed in machinery sectors such as Transportation equipment and Precision machinery. Among the machinery sectors, it is notable that electrical equipment shows a relatively small quality difference. Second, in terms of variety, however, U.S. exports are somewhat similar to China's exports. The significantly positive coefficients are obtained only for Chemical products and Rubber & plastic products. A negative and significant coefficient is confirmed in Textile mill products. For other sectors, the coefficients are insignificant, implying that the product variety of U.S. exports is not significantly different from that of China's exports in many sectors.

Different results emerge from the comparison between the United States and EU. First, U.S. exports are relatively similar to EU exports in terms of quality. Significant coefficients are obtained only in two sectors: Metals and Food products. Second, U.S. exports are also similar to EU exports in terms of product variety. Negative and significant coefficients are obtained in Textile mill products, Apparel & textile products, and Industrial machinery. For other sectors, the coefficients are insignificant. These results suggest that, in general, EU and U.S. exports are similar to each other in both quality and variety.

The comparison of EU exports with China's exports is similar to the comparison of U.S. exports with Chinese exports. For product quality, significantly positive coefficients are confirmed in 14 out of 17 sectors. This in turn implies that the product quality of EU exports is generally higher than that of China's exports. Like the United States, quality difference is large in machinery sectors such as Transportation equipment and Precision machinery, although the difference is relatively small for electrical equipment. For product variety, six out of 17 sectors show positive and significant coefficients. One notable difference between the EU and the United States might be that the EU holds a slightly strong advantage in product variety compared with the United States. Among six sectors with significantly positive coefficients, five sectors are classified as final products.

[24] As mentioned above, unit-price may reflect not only quality but also transportation cost because imports are reported as C.I.F. values. However, transportation costs are not available at the product level. As a compromise, this paper focuses only on the relatively large differences in indexes (i.e., significance level at 1 and 5 percents). Note also that if the difference of transportation costs is negligibly small within each sector (i.e., transportation costs are the same and thus constant across products within each sector), year dummies can remove the effects of transportation costs.

5 Concluding remarks

This paper examines whether and how U.S. exports differ from China's exports, using product-level manufacturing import data from Japan. I find that more than 85 percent of U.S. export products to Japan are commonly exported from China. This result thus suggests that the standard Ricardian or HO trade models cannot explain the difference between China's and U.S. exports. I also find that the exports of China and the United States are similar in terms of variety but different in terms of quality. A comparison with the EU is also presented, which shows that U.S. exports are similar to EU exports in terms of both quality and variety when compared to China's exports.

These results suggest that quality matters in explaining the difference of exports between China and the United States. The EU and the United States are better endowed with the factors needed to produce quality,[25] or they are relatively more productive in producing quality products than China. The vertical product differentiation model such as the quality-ladder model can explain the difference of exports between China and the United States (or the EU). On the other hand, the horizontal product differentiation model such as the love-of-variety model can explain the similarity of exports between the EU and the United States.

Caveats worth mentioning are threefold. First, the empirical validity of trade models depends upon the assumption that intra-product "homogeneity" holds across countries. If intra-product heterogeneity exists across countries, or if the actual factor use is different across countries even within the same narrowly defined product categories, traditional trade models could explain the differences of exports between China and the United States.[26] Although this paper implicitly assumes intra-product homogeneity across countries because of data availability, a study of the validity of the assumption is an important avenue for future research.

Second, as noted, the quality index in this paper may include some of the effects of transportation costs, China's cost advantage, and so on. Transportation costs will be higher from the United States than from China if they depend upon the distance. On the other hand, the production costs will be lower in China than the United States because of, for example, undervalued exchange rate. These effects raise the ratio of unit-expenditure for U.S. exports to China's exports, which lowers the quality index. Therefore, the quality difference in this paper should be interpreted as the upper bounds. In other words, the quality difference between China's and U.S. export products could be smaller than the results of this paper.

Third, concern may be whether or not the products exported from China and the United States to Japan are representative of the overall characteristics of China's and U.S. exports. Although Japan is one of the major trading partners for both China and the United States, it is still an open

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[25] For the theoretical literature on the relationship between product quality and factor endowment, see Murphy and Shleifer (1997).

[26] For example, Schott (2003) and Kiyota (2007) found the evidence of intra-industry heterogeneity: the actual industry capital intensity is different across countries or regions. This is because "standard" industry classification such as the International Standard Industry Classification groups output loosely, according to the similarity of end use (e.g., textiles, transportation machinery) rather than actual factor use (e.g., capital-intensive goods, labor-intensive goods). Schott (2003) and Kiyota (2007) have shown that HO specialization (i.e., sectoral output is a function of factor endowments) works well once industry output is adjusted in a more theoretically appropriate way.

question whether or not the results can be generalized to the trade of other countries.

In terms of policy, there might be a concern that the exports of China's low price products may displace U.S. products. But U.S. exports do not necessarily compete with China's exports in the same quality space. Indeed, significant quality differences exist between China's and U.S products even within a narrowly defined product space. This result suggests that China's products do not necessarily displace U.S. products if the quality difference is large enough to distinguish U.S. products from China's products.[27]

For EU and U.S. firms, the quality difference can therefore be a key aspect in competing with China's products. My results indicate that the variety of China's exports is almost the same as that of EU and U.S. exports in many sectors. This implies that EU and U.S. exports do not have a strong advantage in variety compared to China's exports. On the other hand, because the qualities of EU and U.S. exports are significantly higher than China's exports, the quality differences are a strong advantage for EU and U.S. exports compared with China's exports. In other words, quality upgrading is necessary to compete with China's exports.

It may also be important to note that the electrical equipment sector shows smaller quality differences than other machinery sectors. This may be attributable to the fact that multinational firms in the electrical equipment sector are more actively involved in offshore production than firms in other sectors.[28] In other words, "made in China" does not necessarily mean "Chinese brand." For example, suppose that Japanese multinational firms in the electrical equipment sector export high-quality parts from Japan to China, assemble the parts in China, and export the final products back to Japan as a "Japanese brand." This implies that some of the quality of China's products reflects the quality of intermediate inputs from Japan.[29] To analyze the relationship among the qualities, brands, and production sites of products may be another interesting question for research.[30]

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[27] Eichengreen et al. (2007) found that China's growth had a positive effect on the exports of high income countries such as Japan.

[28] The importance of foreign firms in China's exports are often pointed out by the literature. See, for example, Lardy (2002), Gilboy (2004) and Branstetter and Lardy (2006).

[29] In this connection, the "excess" quality upgrading that was pointed out by Rodrik (2006) and Schott (2008) may be attributable to the high-quality intermediate inputs by multinational firms in China. Lardy (2002, p. 38, Table 2-2) found that processed exports accounted for 58 percent of China's total exports in 2000.

[30] As a case study, Linden, Kraemer, and Dedrick (2007) focused on the production process of Apple iPod that is sold in the United States. They examined all the parts that went into the iPod and asked who makes it. They found that although a finished iPod was exported from China, U.S. companies and workers captured $163 of the iPod's $299 retail value in the United States. Varian (2007) featured this paper and stated that "their study offers a fascinating illustration of the complexity of the global economy, and how difficult it is to understand that complexity by using only conventional trade statistics."

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Appendix

This appendix explains the derivation of the quality and variety indexes, which follow the model of Feenstra et al. (1999). Suppose that there are $j(=1,...,J)$ countries and $i(=1,\ldots,N)$ products for a given industry. Country j supplies the products $I_j \subseteq \{1,...,N\}$. Let x_{ij} be the import of product i from country j and $\mathbf{x}_j$ be the corresponding import vector. Similarly, denote p_{ij} as the price of product i from country j and $\mathbf{p}_j$ as the corresponding price vector.

The measurement of product quality is an issue. Schott (2008, p. 38) states that export unit values are a sufficient statistics for quality "when products possess only vertical attributes, that is, attributes for which all consumers agree to pay more." However, a part of the quality may be neither observable nor captured by the prices. To take into account unobservable as well as observable quality, I introduce the unobservable product-specific quality parameter a_i for product i. Let $\mathbf{a}$ be the corresponding unobservable quality vector. Denote the total services from imports from country j for an industry as $f(\mathbf{x}_j, I_j, \mathbf{a})$. Define the services per unit of import from country j as:

$$A_j \equiv f(\mathbf{x}_j, I_j, \mathbf{a})/X_j, \tag{6}$$

where $X_j = \sum_{i \in I_j} x_{ij}$. Equation (6) is rewritten as follows.

$$A_j = \frac{E_j/X_j}{c(\mathbf{p}_j, I_j, \mathbf{a})}, \tag{7}$$

where $E_j(= c(\mathbf{p}_j, I_j, \mathbf{a}) f(\mathbf{x}_j, I_j, \mathbf{a}))$ denotes total expenditure on imports from country j and $c(\mathbf{p}_j, I_j, \mathbf{a})$ represents unit-cost function dual to $f(\mathbf{x}_j, I_j, \mathbf{a})$.

Note that the unit-cost function includes an unobservable part of the product-specific quality $\mathbf{a}$. This implies that the relative service ratio also depends upon the unobservable part of the product-specific quality and, therefore, the service per unit of import cannot be measured. This problem can be resolved by taking the ratio between countries j and k in an industry:

$$\frac{A_j}{A_k} = \frac{(E_j/X_j)/(E_k/X_k)}{c(\mathbf{p}_j, I_j, \mathbf{a})/c(\mathbf{p}_k, I_k, \mathbf{a})}. \tag{8}$$

Assume that $f(\mathbf{x}_j, I_j, \mathbf{a})$ takes the following CES functional form.

$$f(\mathbf{x}_j, I_j, \mathbf{a}) = \left(\sum_{i \in I_j} a_i x_{ij}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \quad \sigma > 1, a_i > 0, \tag{9}$$

where σ denotes the elasticity of substitution. The unit cost function dual to (9) is

$$c(\mathbf{p}_j, I_j, \mathbf{a}) = \left(\sum_{i \in I_j} a_i^{\sigma} p_{ij}^{1-\sigma} \right)^{\frac{1}{1-\sigma}}. \tag{10}$$

Let I be the set of overlapping products (i.e., $I = (I_j \cap I_k)$). Suppose that the set of overlapping products is not empty. Denote the ratio of the expenditure on the overall imports from country j relative to common goods I in a given industry as λ_j, where

$$\lambda_j = \frac{\sum_{i \in I_j} p_{ij} x_{ij}}{\sum_{i \in I} p_{ij} x_{ij}}. \tag{11}$$

Denote the logarithmic means of the expenditure shares of countries j and k as:

$$\omega_i(I) = \frac{s_{ij}(I) - s_{ik}(I)}{\ln s_{ij}(I) - \ln s_{ik}(I)} \Big/ \sum_{h \in I} \frac{s_{hj}(I) - s_{hk}(I)}{\ln s_{hj}(I) - \ln s_{hk}(I)}, \tag{12}$$

where $s_{ij}(I) = p_{ij}x_{ij} / \sum_{m \in I} p_{mj}x_{mj}$ and $s_{ik}(I) = p_{ik}x_{ik} / \sum_{m \in I} p_{mk}x_{mk}$.

Based on this setup, Feenstra (1994) showed theoretically that the ratio of unit-cost could be measured as follows.

$$\frac{c(\mathbf{p}_j, I_j, \mathbf{a})}{c(\mathbf{p}_k, I_k, \mathbf{a})} = P(\mathbf{p}_j, \mathbf{p}_k, \mathbf{x}_j, \mathbf{x}_k, I) \left(\frac{\lambda_k}{\lambda_j}\right)^{\frac{1}{\sigma-1}}, \tag{13}$$

where

$$P(\mathbf{p}_j, \mathbf{p}_k, \mathbf{x}_j, \mathbf{x}_k, I) = \prod_{i \in I} \left(\frac{p_{ij}}{p_{ik}}\right)^{\omega_i(I)}. \tag{14}$$

Equation (13) can be decomposed into two components. One is the "conventional" price index $P(\mathbf{p}_j, \mathbf{p}_k, \mathbf{x}_j, \mathbf{x}_k, I)$. It is the exact index of the overlapping products for countries j and k that now does not depend on the unobservable product-specific quality $\mathbf{a}$. The other is the effects of non-overlapping products $(\lambda_k/\lambda_j)^{1/(\sigma-1)}$. This term implies that the smaller the country j's share of expenditure from selling products outside the set of overlapping products, the larger λ_j will be, which results in the lower unit-cost ratio.

From equation (13), equation (8) is then written as follows.

$$\begin{aligned} \frac{A_j}{A_k} &= \frac{(E_j/X_j)/(E_k/X_k)}{P(\mathbf{p}_j, \mathbf{p}_k, \mathbf{x}_j, \mathbf{x}_k, I)} \left(\frac{\lambda_j}{\lambda_k}\right)^{\frac{1}{\sigma-1}} \\ &= Q_{j/k} \times (V_{j/k})^{1/(\sigma-1)} \\ &= (\text{Product Quality Index}) \times (\text{Product Variety Index})^{1/(\sigma-1)} \end{aligned} \tag{15}$$

The relative service ratio consists of two terms. The first term $Q_{j/k}$ is the ratio of the unit-expenditure to the price index. This term will be large if country j exports more higher-quality products than country k within a given industry. The second term is the ratio of the inverse of the expenditure shares. The second term $V_{j/k}$ will be large if the import share of non-overlapping products from country j becomes large relative to country k. Following Feenstra et al. (1999), I interpret the first term as a measure of country- and industry-specific product quality while the second term as a measure of product variety that captures the effects of non-overlapping product varieties. Unobservable product-specific quality $\mathbf{a}$ is no longer required in calculating the quality index.

Table 1. Example of the HS 9-digit Level Category

4-digit	6-digit	9-digit	Description
61.09			T-shirts, singlets and other vests, knitted or crocheted.
	.10		Of cotton
			1 Of yarns of different colours or printed
		.011	(1) Containing embroidery or lace, or figured
		.012	(2) Other
		.020	2 Other
	.90		Of other textile materials
			1 Of yarns of different colours or printed
			(1) Containing embroidery or lace, or figured
		.011	- Of wool or fine animal hair
		.012	- Of synthetic fibres
		.013	- Of artificial fibres
		.014	- Other
			(2) Other
		.016	- Of synthetic fibres
		.017	- Of artificial fibres
		.019	- Other
			2 Other
		.021	- Of man-made fibres
		.029	- Other

Source: http://www.customs.go.jp/english/tariff/2007_4/data/61.htm

Table 2. Values, Number of Industries, and Number of Products in Japanese Imports

(Billions of yen and percent)

	Value of imports					
	All		Manufacturing		Oil	
	Value	Share	Value	Share	Value	Share
2002	42,226	100.0	28,249	66.9	5,362	12.7
2003	44,361	100.0	29,333	66.1	6,288	14.2
2004	49,215	100.0	32,341	65.7	7,207	14.6
2005	56,948	100.0	35,460	62.3	10,245	18.0
2006	67,342	100.0	40,783	60.6	13,340	19.8
	Number of industries (defined by HS 4-digit category)					
	All		Manufacturing		Oil	
	Industries	Share	Industries	Share	Industries	Share
2002	1,236	100.0	1,023	82.8	2	0.2
2003	1,234	100.0	1,022	82.8	2	0.2
2004	1,236	100.0	1,023	82.8	2	0.2
2005	1,235	100.0	1,022	82.8	2	0.2
2006	1,235	100.0	1,024	82.9	2	0.2
	Number of products (defined by HS 9-digit category)					
	All		Manufacturing		Oil	
	Products	Share	Products	Share	Products	Share
2002	8,197	100.0	7,050	86.0	39	0.5
2003	8,212	100.0	7,079	86.2	38	0.5
2004	8,212	100.0	7,059	86.0	40	0.5
2005	8,201	100.0	7,052	86.0	43	0.5
2006	8,066	100.0	6,921	85.8	42	0.5

Note: The value of imports excludes products in which quantity data are not available because of rounding. The share of excluded products is less than 0.005 percent. A variety is defined as each HS 9-digit category.

Source: MOF (various years).

Table 3. Ranking of the Share of Imports by Country or Region

(Percent)

	Total imports = 100.0					Manufacturing imports = 100.0			
	2002		2006			2002		2006	
Rank	Country (region)	Share	Country (region)	Share	Rank	Country (region)	Share	Country (region)	Share
1	**China**	**18.3**	**China**	**20.5**	1	**China**	**24.6**	**China**	**31.4**
2	**United States**	**17.1**	**United States**	**11.7**	2	**United States**	**20.4**	**United States**	**16.0**
3	European Union	13.0	European Union	10.0	3	European Union	17.8	European Union	15.5
4	Korea	4.6	Saudi Arabia	6.4	4	Korea	5.3	Korea	6.4
5	Indonesia	4.2	United Arab Emirates	5.5	5	Taiwan	5.2	Taiwan	4.9
6	Australia	4.2	Australia	4.8	6	Thailand	3.9	Thailand	4.2
7	Taiwan	4.0	Korea	4.7	7	Malaysia	3.3	Malaysia	2.7
8	Saudi Arabia	3.4	Indonesia	4.2	8	Indonesia	2.5	Indonesia	2.5
9	United Arab Emirates	3.4	Taiwan	3.5	9	Philippines	2.4	Philippines	1.8
10	Malaysia	3.3	Thailand	2.9	10	Singapore	1.8	South Africa	1.7
	Sum of China, EU, and US	48.4	Sum of China, EU, and US	42.2		Sum of China, EU, and US	62.8	Sum of China, EU, and US	62.8
	Sum of top 10 countries	75.6	Sum of top 10 countries	74.3		Sum of top 10 countries	87.3	Sum of top 10 countries	86.9

Notes: 1) European Union includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom.
2) Share indicates the percentage share of each country (or region) to total imports.

Source: MOF (various years).

Table 4. Ranking of the Number of Manufacturing Industries and Products by Country or Region

Number of industries (4-digit HS categories)					Number of products (9-digit HS categories)				
Rank	Country (region)	2002	Country (region)	2006	Rank	Country (region)	2002	Country (region)	2006
1	European Union	984	European Union	982	1	European Union	5,998	European Union	5,811
2	**United States**	**958**	**China**	**979**	2	**United States**	**5,213**	**China**	**5,545**
3	**China**	**942**	**United States**	**959**	3	**China**	**5,151**	**United States**	**4,981**
4	Korea	865	Korea	875	4	Korea	4,039	Korea	4,013
5	Taiwan	826	Taiwan	843	5	Taiwan	3,465	Taiwan	3,390
6	Thailand	719	Thailand	730	6	Thailand	2,696	Thailand	2,838
7	Canada	674	Switzerland	656	7	Switzerland	2,324	Switzerland	2,232
8	Switzerland	648	Indonesia	641	8	Indonesia	2,192	Indonesia	2,202
9	Indonesia	614	Canada	625	9	Canada	2,131	Canada	1,967
10	Australia	609	India	606	10	Malaysia	1,868	India	1,884

Notes: 1) The number of industries indicates the number of 4-digit HS categories imported by Japan.
2) The number of products indicates the number of 9-digit HS categories imported by Japan.

Table 5. Ranking of the Number of Overlapping Manufacturing Industries and Products with the United States by Country or Region

Number of overlapping industries (number of U.S. export industries = 100.0)							Number of overlapping products (number of U.S. export products = 100.0)						
Rank	Country (region)	2002	Share	Country (region)	2006	Share	Rank	Country (region)	2002	Share	Country (region)	2006	Share
	United States	958	100.0	United States	959	100.0		United States	5,213	100.0	United States	4,981	100.0
1	European Union	940	98.1	European Union	938	97.8	1	European Union	4,766	91.4	European Union	4,558	91.5
2	**China**	**898**	**93.7**	**China**	**925**	**96.5**	2	**China**	**4,107**	**78.8**	**China**	**4,261**	**85.5**
3	Korea	840	87.7	Korea	853	88.9	3	Korea	3,528	67.7	Korea	3,458	69.4
4	Taiwan	805	84.0	Taiwan	821	85.6	4	Taiwan	3,118	59.8	Taiwan	3,047	61.2
5	Thailand	699	73.0	Thailand	711	74.1	5	Thailand	2,413	46.3	Thailand	2,515	50.5
6	Canada	670	69.9	Switzerland	651	67.9	6	Switzerland	2,130	40.9	Switzerland	2,059	41.3
7	Switzerland	640	66.8	Indonesia	624	65.1	7	Canada	2,058	39.5	Indonesia	1,915	38.4
8	Australia	601	62.7	Canada	622	64.9	8	Indonesia	1,905	36.5	Canada	1,895	38.0
9	Indonesia	598	62.4	India	587	61.2	9	Malaysia	1,708	32.8	Malaysia	1,681	33.7
10	Malaysia	566	59.1	Australia	583	60.8	10	Hong Kong	1,706	32.7	India	1,623	32.6

Note: 1) The number of overlapping industries is the number of 4-digit HS categories exported commonly from the United States and other countries.
2) The number of overlapping products is the number of 9-digit HS categories exported commonly from the United States and other countries.

Table 6. Ranking of the Number of Overlapping Manufacturing Industries and Products with the European Union by Country or Region

	Number of overlapping industries (number of EU export industries = 100.0)							Number of overlapping products (number of EU export products = 100.0)						
Rank	Country (region)	2002	Share	Country (region)	2006	Share	Rank	Country (region)	2002	Share	Country (region)	2006	Share
	European Union	984	100.0	European Union	982	100.0		European Union	5,998	100.0	European Union	5,811	100.0
1	United States	940	95.5	**China**	**951**	**96.8**	1	United States	4,766	79.5	**China**	**4,850**	**83.5**
2	**China**	**918**	**93.3**	United States	938	95.5	2	**China**	**4,575**	**76.3**	United States	4,558	78.4
3	Korea	854	86.8	Korea	860	87.6	3	Korea	3,781	63.0	Korea	3,709	63.8
4	Taiwan	815	82.8	Taiwan	831	84.6	4	Taiwan	3,256	54.3	Taiwan	3,174	54.6
5	Thailand	710	72.2	Thailand	723	73.6	5	Thailand	2,504	41.7	Thailand	2,649	45.6
6	Canada	670	68.1	Switzerland	656	66.8	6	Switzerland	2,276	37.9	Switzerland	2,205	37.9
7	Switzerland	645	65.5	Indonesia	633	64.5	7	Canada	2,052	34.2	Indonesia	2,026	34.9
8	Australia	606	61.6	Canada	619	63.0	8	Indonesia	2,015	33.6	Canada	1,902	32.7
9	Indonesia	604	61.4	India	602	61.3	9	Hong Kong	1,775	29.6	India	1,791	30.8
10	Malaysia	570	57.9	Australia	587	59.8	10	Malaysia	1,754	29.2	Malaysia	1,723	29.7

Note: 1) The number of overlapping industries is the number of 4-digit HS categories exported commonly from the EU and other countries.
2) The number of overlapping products is the number of 9-digit HS categories exported commonly from the EU and other countries.

Table 7. Quality and Variety Indexes in Manufacturing

	United States relative to China			United States relative to European Union			European Union relative to China		
	Quality index	Variety index	Number of industries	Quality index	Variety index	Number of industries	Quality index	Variety index	Number of industries
2002	0.65	0.06	1,035	0.06	-0.05	1,094	0.57	0.11	1,070
2006	0.68	-0.04	1,072	0.02	-0.04	1,092	0.68	0.03	1,105

Note: Figures show the natural log of indexes. Indexes are averaged over all manufacturing industries.

Table 8. Regression Results

Sector (HS 2-digit code)	United States relative to China			United States relative to European Union			European Union relative to China		
	Product quality	Product variety	*N*	Product quality	Product variety	*N*	Product quality	Product variety	*N*
Intermediate products									
Textile mill products (50-53)	0.175	-0.649**	91	0.263	-0.816*	91	0.269*	-0.087	170
	[0.169]	[0.213]		[0.213]	[0.346]		[0.124]	[0.073]	
Lumber & wood products (44-46)	0.370**	-0.001	135	0.174	-0.019	130	0.259*	-0.048	145
	[0.108]	[0.089]		[0.089]	[0.046]		[0.107]	[0.075]	
Pulp & paper products (47-48)	0.283*	0.092	131	0.073	0.123	149	0.029	0.168	128
	[0.142]	[0.194]		[0.098]	[0.115]		[0.155]	[0.217]	
Chemical products (28-38)	0.192	0.159*	824	0.032	0.080	851	0.097	0.111**	826
	[0.129]	[0.069]		[0.083]	[0.050]		[0.117]	[0.042]	
Stone, clay & glass products (68-70)	0.487**	0.014	245	0.101	0.011	247	0.484**	0.012	249
	[0.173]	[0.011]		[0.162]	[0.011]		[0.131]	[0.009]	
Metals (72-83)	0.573**	0.034	718	0.279**	-0.083	733	0.402**	0.041	724
	[0.115]	[0.046]		[0.091]	[0.051]		[0.082]	[0.056]	
Final products									
Food products (16-24)	0.038	-0.001	239	-0.231*	-0.021	265	0.128	0.305	242
	[0.108]	[0.187]		[0.089]	[0.096]		[0.105]	[0.175]	
Apparel & textile products (54-67)	0.462**	-0.097	653	-0.043	-0.190**	667	0.431**	-0.034	692
	[0.106]	[0.054]		[0.070]	[0.053]		[0.071]	[0.048]	
Furniture (94)	0.953**	0.004	45	0.065	0.000	45	0.869**	0.012	45
	[0.292]	[0.004]		[0.193]	[0.000]		[0.318]	[0.012]	
Printing & publishing (49)	0.367	0.011	54	0.151	0.000	60	0.388*	0.001	54
	[0.465]	[0.011]		[0.368]	[0.000]		[0.159]	[0.001]	
Rubber & plastic products (39-40)	0.399**	0.118**	215	0.090	-0.003	214	0.366**	0.163**	215
	[0.103]	[0.040]		[0.062]	[0.006]		[0.098]	[0.049]	
Leather products (41-43)	0.870*	-0.372	91	-0.235	-0.273	97	0.776**	0.631*	117
	[0.352]	[0.300]		[0.378]	[0.232]		[0.197]	[0.271]	
Industrial machinery (84)	1.308**	0.070	630	-0.027	-0.100**	676	1.232**	0.143**	646
	[0.156]	[0.053]		[0.114]	[0.034]		[0.122]	[0.054]	
Electrical equipment (85)	0.865**	0.021	355	0.174	-0.028	357	0.656**	0.032	355
	[0.148]	[0.012]		[0.107]	[0.020]		[0.124]	[0.025]	
Transportation equipment (86-89)	1.513**	0.568	134	0.118	-0.037	153	1.540**	0.567*	136
	[0.380]	[0.325]		[0.130]	[0.027]		[0.391]	[0.283]	
Precision instruments (90-92)	1.376**	0.143	411	0.067	-0.014	410	1.309**	0.196*	417
	[0.202]	[0.075]		[0.092]	[0.016]		[0.195]	[0.079]	
Misc. manufacturing (71, 93, 95-96)	0.613**	0.215	290	0.051	0.123	311	0.545**	0.088	292
	[0.175]	[0.129]		[0.208]	[0.108]		[0.206]	[0.070]	

Notes: 1) Table reports the coefficient of α in equation (5) for the Japanese imports for 2002-2006.
2) Robust standard errors are in brackents. * and ** indicate significant at 5% and 1% level, respectively. HS 2-digit codes are in parentheses.

Figure 1. Quantity of U.S. Exports Relative to China's Exports in 2006, HS 9-digit Level

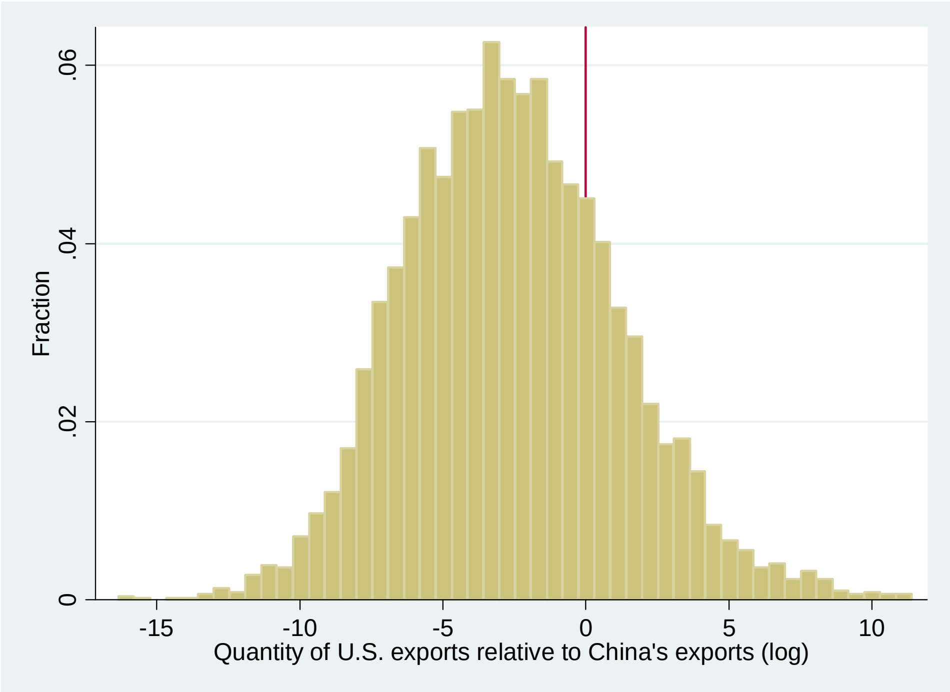

Figure 2. Quantity of EU Exports Relative to China's Exports in 2006, HS 9-digit Level