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How Important Is the New Goods Margin in International Trade?*

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ABSTRACT

We propose a methodology for studying changes in bilateral trade due to countries exporting goods that they did not export previously or exported only in small quantities. Applying this methodology to country pairs that undergo trade liberalization and to pairs in which one of the countries undergoes significant structural transformation, we find large increases on this extensive — or new goods — margin. Looking at country pairs with no major trade policy change or structural change, however, we find little or no increases on the extensive margin. Studying time series on trade by commodity, we find that data from before 1988 and 1989, when most major trading countries moved to the Harmonized System, are not compatible with data from afterward.

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1. Introduction

Recent research in international trade has focused on changes in trade patterns driven by countries starting to export goods that they had not exported before or ceasing to export goods that they had exported before. We refer to these sorts of changes in trade as changes on the *extensive margin*, or the *new goods margin*. Changes in trade on the *intensive margin* are changes in exports of goods that were previously exported. Recently, models have been developed which rely on the extensive margin to deliver results. Models with heterogeneous firms facing fixed export costs, as in Melitz (2003), or market penetration costs, as in Arkolakis (2008), have proven useful in understanding firm-level export patterns, and models of Ricardian comparative advantage, as in Yi (2003), use the extensive margin to explain the growth in aggregate trade volumes. The theoretical models predict that changes in the underlying fundamentals of an economy — changes in tariffs, for example — have an effect on the extensive margin. We take this idea to the data: Do we see changes in the extensive margin during periods of structural change? How important are these newly traded goods?

In this paper, we study the detailed trade statistics — specifically, bilateral commodity trade data disaggregated at the four-digit level of the Standard International Trade Classification (SITC) (revision 2) — of countries during significant trade liberalizations or other structural changes that have brought about trade growth to determine the importance of the extensive margin. We construct a new measure of the extensive margin that takes into account the relative importance of a good in a country's trade, rather than imposing country-invariant dollar-value cutoffs for determining whether a good is traded or not. Studying trade data disaggregated by type of good is complementary with, but conceptually distinct from, studying data disaggregated by firm as done, for example, by Eaton, Kortum, and Kramarz (2008).

Our study includes such large-scale trade liberalizations as the North American Free Trade Agreement (NAFTA), the Canada-U.S. Free Trade Agreement (FTA), and China's accession to the World Trade Organization, as well as the structural transformation episodes in Chile, Korea, and China. We find significant evidence of growth in the extensive margin following a decrease in trade barriers. The set of least traded goods which accounted for only 10 percent of trade before the trade liberalization

may grow to account for 30 percent of trade or more following the liberalization. Furthermore, we construct a time series measure and find that the growth in the extensive margin coincides with the trade liberalization, supporting our hypothesis that the extensive margin growth is driven by the trade liberalization and is not the consequence of other factors, such as the product cycle.

The extensive margin is also important in explaining the growth in trade that accompanies episodes of rapid economic growth and development. Studying Chile and Korea during the 1970s and 1980s, we find substantial extensive margin growth. In the case of Korea's trade to the United States, the "least traded" goods, which made up only 10 percent of exports in 1975, made up more than 60 percent of exports in 1980, reflecting Korea's change from an exporter of commodities and light manufactures to an exporter of a wide variety of manufactured goods. Currently, we see a similar pattern in China as the country has begun exporting and importing new kinds of goods as it moves away from a centrally planned economy.

In contrast, when we examine the trade between the United States and trade partners with which there has been no major trade policy or structural changes, we find little evidence of growth on the extensive margin. This suggests that extensive margin growth is brought about by structural changes and moves very little in response to events like business cycles.

The method we develop for measuring the extensive margin represents a break from the few previous studies of the extensive margin. These other studies use country-invariant dollar-value cutoffs to determine whether a good is traded or not in a particular period. Hummels and Klenow (2005) and Broda and Weinstein (2006) classify a good as not traded if the value of trade is 0 U.S. dollars, while Evenett and Venables (2002) classify a good as not traded if its yearly value of trade is 50,000 1985 U.S. dollars or less, regardless of the country in question. Since countries have very different aggregate trade quantities, this cutoff can imply a drastically different relative importance of a good that is regarded as not traded, and biases small countries toward trading very few goods. Compare Chile and the United States in 1985: Chile had commodity exports of 3.9 billion U.S. dollars, while the United States had 213.3 billion U.S. dollars in exports, more than 50 times larger. A 50,000 dollar cutoff implies that a good trading for 0.00128

percent or less of Chile's total trade is not considered traded, while a good trading for anything more than 0.00002 percent of total trade in the United States is counted as traded. In our measure of tradedness, we allow the actual dollar value of the cutoff to differ across countries, relying instead on the relative importance of these goods in a country's trade.

Evenett and Venables (2002) consider the extensive margin while studying the geographic distribution of exports in developing countries. They find that a significant fraction of a developing country's trade growth can be attributed to exports of "long-standing exportables" to new destinations. Thus, their concept of the extensive margin is a cross-country aggregation of our bilateral concept.

Hummels and Klenow (2005) use detailed trade data to decompose a nation's trade into an extensive component and an intensive component for a large cross section of countries. They find that the extensive margin is important in explaining why big countries trade more than small countries, in that big countries trade more kinds of goods than smaller countries. It is worth noting that most of the "big" countries in their sample have already liberalized much of their trade. Hillberry and McDaniel (2002) use the Hummels-Klenow decomposition to study the growth in trade between the United States and its NAFTA partners. They find growth in both the intensive and extensive margins. We extend the decomposition in Hummels and Klenow (2005) to create a time series analog that is comparable to our measure of the extensive margin.

Broda and Weinstein (2006) study the growing number of varieties in U.S. imports from 1972 to 2001. Their focus is not on specific episodes, but on the welfare effects of newly traded goods. They find, using a method based on Feenstra (1994), that ignoring the increase in varieties leads to an overstatement of inflation by 1.2 percentage points per year, equivalent to an extra 2.6 percent increase in GDP over the period.

In developing time series measures of changes in the extensive margin, we discover and document a major limitation in the data that we use. In 1988 and 1989, most countries in the world changed their systems for classifying commodity trade to the Harmonized System. The data that we use, four-digit SITC data from the Organisation for Economic Co-operation and Development (OECD), is meant to be consistent before and after these changes, but we find the concordances between the SITC and the different

classifications used before and after the switch to the Harmonized System to be far from perfect. In particular, the SITC data indicate that there are large changes in the composition of bilateral trade in exactly the year of the change to the Harmonized System. Our analysis indicates that many goods were classified in the Harmonized System in ways that led to their being assigned to SITC codes that were different from those to which they were assigned in the older systems used in each country. Unfortunately, this problem extends to other disaggregated trade data, such as the World Trade Flows data provided by Feenstra (2000). It seems that currently there is no data source of disaggregated commodity trade flows that span the years 1988 and 1989.

Following the methodology laid out here, Mukerji (2009) studies the liberalization of trade in India in the 1990s. Growth in the extensive margin is found in both Indian exports and imports. Sandrey and van Seventer (2004) also use the methodology developed here to study the liberalization of trade brought about by the Closer Economic Relationship agreement between Australia and New Zealand starting in 1988. They find evidence that the extensive margin was growing for New Zealand exports to Australia during this period, while the export share of these goods from New Zealand to the rest of the world was relatively stable. Their results in this respect are similar to ours in that extensive margin growth coincides with trade liberalization.

2. Methodology

For a given pair of countries, we study data on annual trade flow values by good. We define a *good* as an SITC (revision 2) four-digit code. In general, we study an 11-year window centered on the date of the event being considered. A complete list of countries, years, and classifications is contained in the data appendix that can be found at www.econ.umn.edu/~tkehoe.

To characterize the extensive margin, we need a definition of a nontraded good. We certainly want to include goods with zero trade in the set of nontraded goods. There is no absolute concept of zero in trade statistics, however, since low value shipments tend to go unreported. For example, export shipments from the United States are, in general, required to be reported only if the value of the shipment is greater than 2,500 U.S. dollars, and import shipments must be reported only if the shipment value is greater than

2,000 U.S. dollars. A good could have trade with a number of shipments smaller than this limit and be reported as having zero trade. The minimum reporting level tends to vary across countries as well. In Canada, for example, exports must be reported if the shipment value is greater than 2,000 Canadian dollars. In our definition of a nontraded good, we choose to consider goods with zero trade as well as goods with very small amounts of trade. We refer to the goods in this set as the *least traded goods*. It is worth noting that the goods with very small but nonzero amounts of trade play a crucial role in the theory of market penetration costs developed by Arkolakis (2008)

To construct the set of least traded goods for a particular trade flow, we order the SITC codes by their average value of trade over the first three years of the sample. By averaging over a few years, we eliminate the ordering's dependence on our choice of base year. We cumulate the ordered codes to form 10 sets, each representing one-tenth of total exports. The first set is constructed, starting with the smallest codes, by adding codes to the set until the sum of their values reaches one-tenth of total export value. The next set is formed by summing the smallest remaining codes until the value of the set reaches one-tenth of total export value. The first set consists of the least traded goods: the codes with the smallest export values, including all the SITC codes with zero trade value. To create sets that account for exactly 10 percent of total trade, some SITC codes had to be split.

Conceptually, we would prefer to rank the codes by their share of trade in output of that code. Operationally, this requires data on gross output by four-digit SITC code for many countries, which is not available. For the United States, we have constructed such data, and we use it to compare the results when we sort exports from the United States by trade with those when we sort by trade share. We find only small differences.

Given this system of partitioning the SITC codes, we study two features of the data. First, we compute the change in each set's trade share over the sample period. The resulting statistics summarize the change in the distribution of the goods being traded. Second, we compute the evolution of the least traded set of codes to summarize the timing of the growth in these goods.

Figure 1 shows the values of the 10 sets of codes in 1989 for Canadian exports to Mexico; the total value of each set of codes is equal to 0.10 of total Mexican exports to

Canada by construction. The numbers above each bar in the figure are the number of SITC codes needed to account for 10 percent of the trade flow. The distribution of trade is skewed; it requires 723.8 least traded goods — 370 of which have zero recorded export value in 1989 — to account for 10 percent of total exports from Canada to Mexico, while the most traded good (automobile parts, code 7849) makes up more than 10 percent of exports itself.

The bars in figure 1 are the fractions of trade in 1999, after 10 years, which include 1994, when the NAFTA came into force. To interpret these statistics, consider two extreme cases. If the growth in trade were driven only by a proportional increase in the value of all the goods already traded — that is, if the growth in trade were entirely on the intensive margin — each set of codes would retain its one-tenth share in trade and the bars in figure 2 would all be 0.10. On the opposite extreme, if the growth in trade were driven only by trade in goods not previously traded — that is, if the growth was only on the extensive margin — the set of least traded goods would gain trade share, while the trade shares of the other sets would decline.

As we can see in figure 1, although the movements in the trade shares of the highest nine sets of goods are not uniform, the trade data do have a very large positive spike in share of trade accounted for by the least traded goods. The 723.8 least traded goods that account for 10 percent of Canadian exports to Mexico in 1989 account for 30.7 percent in 1999. Furthermore, the increases in exports are spread across many goods. Of the 370 least traded goods that have zero recorded export value in 1989, for example, 69 have positive recorded export value in 1999, and exports of these goods account for 9.4 percent of exports from Canada to Mexico in that year.

Our second computation uses the same partition of SITC codes, but focuses only on the set of least traded goods — the goods with the least trade that account for 10 percent of trade. For each year in the sample, we compute the share of the total trade flow accounted for by the codes in the least traded set. As in the first measure, if there is growth on the extensive margin, we should see an increase in the share of trade accounted for by this set of goods. More importantly, this computation shows us the timing of any changes in the trade of new goods. An increase in the share of exports that coincides

with the implementation of trade reforms provides evidence of the link between lower trade barriers and growth in the extensive margin.

3. Growth in the extensive margin

We use data from the International Trade by Commodity Statistics data set from the OECD. The data are reported at an annual frequency. We use revision 2 of the SITC, which contains 789 codes. We consider three types of episodes involving bilateral country pairs in our analysis: first, *trade liberalization episodes*; second, periods of rapid growth driven by structural transformation to one of the countries, which we refer to as *structural transformation episodes*; and, third, episodes in which neither country has significant structural transformation nor significant changes in trade policies. We refer to these last sorts of episodes as *business cycle episodes*, since these stable bilateral relationships allow us to observe how the extensive margin changes in response to the usual turbulence of business cycle fluctuations.

3.1. Trade liberalization episodes

In our analysis of North American trade liberalization, we consider the Canada-U.S. FTA and the NAFTA together as one episode of liberalization. Data issues prevent this experiment from being as clean as we would like, however. In particular, the adoption of the Harmonized System (HS) creates a break in the data that we cannot ignore. The Canada-U.S. FTA was implemented in 1989, one year after Canada switched to the HS classification and the same year that the United States switched. Since we cannot compare data from before the adoption of the HS classification to data from after, we have a short pre-liberalization sample. The Mexico-U.S. trade relationship suffers from a similar problem. Mexico had begun lowering its trade barriers with the United States in the late 1980s — a time period of significant adjustment — which we cannot incorporate in our analysis. In light of these issues, we use Canadian-collected data to study the Canada-U.S. relationship, as this strategy allows for an extra year at the beginning of the sample. For the Mexico-U.S. relationship there is little we can do, so we begin the sample in 1989 using U.S.-collected data. The Canada-Mexico liberalization is a complete experiment. The trade barriers between Canada and Mexico were

significantly impacted by the NAFTA's implementation in the mid- and late 1990s, and this period is fully captured in our data sample.

As can be seen in figures 1 and 2, there is a significant amount of extensive margin growth between Canada and Mexico during the NAFTA period. The 723.8 least traded Canadian goods to Mexico went from 10 percent of total exports to Mexico in 1989 to 31 percent of exports in 1999. The 736.6 least traded Mexican goods to Canada increased their share from 10 percent to 23.2 percent of total exports to Canada over the same period. (In figure 2, the good in the 0.8–0.9 set that drives the large increase in trade share is passenger motor cars [code 7810].) Figure 3 shows the timing of these changes: the increases coincide with the implementation of the NAFTA in 1994. Table 1 summarizes the results for the North American free trade episode. Reported in the table is the end of period share of the least traded goods in total exports for the country pair. The Canada-Mexico relationship had significant changes in the extensive margin, while Canada and Mexico realized smaller extensive margin gains in exports to the United States. It is likely that these gains would be larger if we had been able to account properly for the late 1980s. The United States appears to have made only small adjustments on the extensive margin in its exports to Canada and Mexico over this period.

It is worth noting that, when we analyze 1980–1988 data on Mexico-U.S. trade, we find that the least traded Mexican goods to the United States went from 10 percent of Mexican exports in 1980 to 37.2 percent in 1988 and the least traded U.S. goods to Mexico went from 10 percent of U.S. exports in 1980 to 14.4 percent in 1988.

The extensive margin growth we have found in the North American trade liberalization experience is not unique. Following the methodology outlined here, Mukerji (2009) finds that, during unilateral trade liberalization in India, the least traded goods grew from 10 percent to 33.8 percent of total imports over the period 1988–1999 and from 10 percent to 26.5 percent of total exports. In another study, also using our methodology, Sandrey and van Seventer (2004) find that, during liberalization of Australia–New Zealand trade, New Zealand's least traded exports to Australia grew from 10 percent of exports in 1988 to 29.5 percent in 2003, while the least traded exports from Australia to New Zealand grew from 10 percent to 21.9 percent over the same period.

3.2. Structural change episodes

Besides changes in trade policy, changes in the efficiency with which goods can be produced are likely to lead to changes in the composition of goods that a country exports and imports. These changes are constantly occurring; firms enter and exit production, new products are created and old ones are retired, and better ways of producing existing goods are continuously being developed. In most countries, these changes seem to cancel themselves out and do not have an aggregate impact on the composition of trade, a topic that we address below. In cases of significant structural change, however, this is not the case. These episodes are accompanied by a significant restructuring of the composition of a country's trade.

Recently, China has been undergoing a dramatic transition from a centrally planned economy to a free market economy. An important part of this transition has been opening the country to foreign trade and investment, culminating in China's accession to the World Trade Organization in 2001. The period 1995–2005 was one of rapid growth in Chinese exports and imports. Exports of goods grew from 19.7 percent of GDP in 1995 to 34.1 percent of GDP in 2005, even though GDP itself was growing very rapidly. Over this same period, imports of goods grew from 17.4 percent of GDP to 29.5 percent of GDP. Figures 4 and 5 show the effect this restructuring has had on the extensive margin in both U.S. exports to China and China's exports to the United States. The least traded goods in China's exports to the United States increase from 10 percent of exports in 1995 to 24.7 percent in 2005. In U.S. exports to China, the exports of least traded goods grow to 20.0 percent of exports over the same period. Figure 6 provides interesting detail regarding the timing of the extensive margin growth. It appears that the structural reforms of the early 1990s had a larger effect on the extensive margin for U.S. exports to China, whereas China's membership in the WTO, which took effect in 2001, seems to have had an effect on the extensive margin for both countries' exports.

Even more striking patterns emerge for other growth episodes, such as Korea's rapid growth and development in the 1970s and 1980s. As shown in table 2, the least traded Korean exports to the United States grew to 60.4 percent of exports in 1985, from only 10 percent in 1975. This extraordinary change in the extensive margin reflects Korea's shift from exporting very specific light manufactured goods in the 1970s to

exporting a far more diversified set of goods in the 1980s; 22.1 percent of Korean exports to the United States in 1975 consisted of footwear (code 8510), and, although footwear was still the top export in 1985, it accounted for only 11.3 percent of exports. Notice that, as Korea restructured, the composition of its imports from the United States changed. In particular, the least traded imports from the United States went from 10 percent of imports in 1975 to 51.3 percent in 1985.

Chile's transition to a free market economy also brought about significant changes along the extensive margin. Chile's least traded exports to the United States grew from 10 percent of exports in 1975 to 24.4 percent in 1985. The United States had an even larger change in the composition of its exports to Chile; the least traded goods grew to be 54.4 percent of total exports to Chile over the same period.

The dramatic growth in the extensive margin during these episodes suggests that these are periods of important structural change, much of which involved trade liberalization. These episodes, however, are not clean policy experiments, as were the trade liberalization episodes considered above. The reforms in China, Korea, and Chile touched many aspects of the economy: labor, capital, and international markets were all reformed to some extent in these transition economies. It will be difficult to disentangle the effects of the different policies on the composition of exports and imports for these countries, but incorporating the changing extensive margin in models of trade and development, as in Romer (1994), will make them more consistent with the empirical evidence and perhaps provide further insights into the development process.

It is worth pointing out that, in some of the cases that we have studied, the growth in trade on the extensive margin increases significantly as we widen the time period studied. Figure 7 shows the evolution of the extensive margin in trade between Canada and Mexico and trade between China and the United States over the period 1989–2006. Notice that the fraction of Canadian exports to Mexico accounted for by the least traded goods increases as we lengthen the time period, going from 30.7 percent in 1999 to 43.0 percent in 2006. The fraction of Mexican exports to Canada accounted for by the least traded goods shows a far more modest increase, however, going from 23.2 percent in 1999 to only 27.0 percent in 2006. Notice that the growth on the extensive margin for both exports from China to the United States and exports for the United States to China

increases as we lengthen the time period. Now both increase from 10 percent of trade to roughly 30 percent of trade. The increase in the extensive margin for U.S. exports to China occurs mostly in the 1990s, while the increase for Chinese exports to the United States occurs after 2000.

3.3. Business cycle episodes

The episodes we have studied so far have been times of structural change. The changes in policy that occurred during these episodes represent departures from the environment in which the agents of the countries operated. We can also study country pairs that have not had significant structural changes in order to study the effects of the normal fluctuations in their economies on the extensive margin. A plausible hypothesis is that country pairs continually change the mix of goods that they trade in such a way that the extensive margin always increases after a decade or so. We now argue that this is not the case. We also argue that normal business cycle fluctuations do not cause fluctuations in the extensive margin.

To see how the extensive margin changes over the business cycle, we compute the same measures of extensive margin growth for the United States and three of its trading partners: Japan, Germany, and the United Kingdom. Of the top seven trading partners of the United States in 2000, these three have had no major trade reform with the United States, nor were they part of a structural transformation episode over the sample period. We have already examined the extensive margin for the other four major trading partners of the United States: Canada, Mexico, China, and Korea.

As can be seen in table 3, none of these relationships is characterized by large growth in the extensive margin. The extensive margin on U.S. exports to the United Kingdom did not grow at all over the period, and on Japan's exports to the United States it shows very little growth, with the least traded goods making up only 10.3 percent of trade at the end of the sample period. The largest increase in the extensive margin among the countries with stable trade policy was U.K. exports to the United States and U.S. exports to Japan, each of whose least traded goods grew to about 13 percent of total trade at the end of the period. Figures 8 and 9 further demonstrate how little the trade patterns have changed between these countries. These figures show the composition of trade

between the United States and the United Kingdom, which are representative of all the country pairs studied in this subsection. As can be seen, there is almost no change in the mix of goods traded between these two countries over the sample period. Further, figure 10 shows that there were no large variations in the share of exports accounted for by the least traded goods over this period.

The lack of change in the extensive margin over the business cycle suggests that exporting decisions are not trivial matters. Why, for example, would a U.S. firm not stop exporting goods when prices of traded goods in the United Kingdom were low compared to those in the United States in 1993–1994, and begin exporting when prices of traded goods in the United Kingdom were low compared to those in the United States in 1998–1999? One explanation for this behavior would be that firms face large sunk costs in order to set up an export operation, as in Melitz (2003). In an environment such as this, a firm may not find it worthwhile to make (or abandon) large sunk investments in response to temporary changes. Large permanent changes, such as the structural changes considered in the previous two sections, may, however, induce firms to enter or exit the export market. Ruhl (2008) constructs a model of fixed costs under uncertainty in a quantitative general equilibrium framework, and finds that much of the difference in the response of exports to business cycles versus trade liberalization can be accounted for by these factors.

4. What drives our results?

To understand the economic forces behind growth in trade on the extensive margin, we need to use models like those of Melitz (2003), Yi (2003), and Arkolakis (2008) and to develop new models. Nonetheless, we can try to answer a couple of simple questions about the driving forces behind our results just by looking at the data: First, are the increases in trade on the extensive margin driven by decreases in tariffs that are larger for the least traded goods than they are for other goods? Second, are the increases in trade on the extensive margin driven by decreases in the prices of least traded goods relative to the prices of other goods?

4.1. Tariff changes

In answering the question of whether the growth of exports on the extensive margin is driven by decreases in tariffs on the least traded goods, we are faced with data limitations. Using tariff data from the United States International Trade Commission database, we are limited to looking at data on imports to the United States after 1989. The time restriction rules out looking at Korean exports to the United States over the period 1975–1985. We therefore have studied exports from Canada, Mexico, and China to the United States after 1989. We report the results for exports from China to the United States over 1995–2005 because it is this episode that showed the largest increase in trade on the extensive margin.

To construct tariff rates on U.S. imports from China, we divide calculated duties by customs value for each SITC code. For SITC codes in which there is no customs value, we cannot compute a tariff rate. For each code, we average the available tariff rates over the periods 1995–1997 and 2003–2005. From the first period to the second, the tariff rates on least traded goods went down by an average of 1.1, percent while the tariff rates on other goods went down by an average of 1.2 percent. Figure 11 depicts the distribution of these tariff changes. Notice that the tariff changes for least traded goods are more dispersed, but there is no evidence that the tariffs on the least traded goods decreased systematically more than those on other goods.

4.2. Relative price changes

In answering the question of whether the growth of exports on the extensive margin is driven by decreases in the prices of least traded goods relative to the prices of other goods, we are faced with a different sort of data limitation: the unit value data that we use to calculate relative prices is very noisy. This is a well-understood problem; see, for example, the report by the U.S. General Accounting Office (2005). Nonetheless, analyzing these data suggests that much of the increase in the exports of the least traded goods for China to the United States was driven by decreases in the relative prices of these goods. It is tempting to speculate that these price decreases were the results of productivity gains in the industries producing these goods. For the least traded exports from Canada to Mexico and from Mexico to Canada, the data are too noisy for us to say

much. For exports from the United States to China, the relative prices of the least traded goods increased even as these goods increased in share.

We calculate the relative price of a code in year t relative to base year t_0 as

$$P_k^t = \frac{p_k^t}{p_k^{t_0}} = \frac{v_k^t / q_k^t}{v_k^{t_0} / q_k^{t_0}}. \qquad (1)$$

Here, v_k^t is the value of exports of code k in year t and q_k^t is the quantity. Prices are calculated for every code for which prices and quantities were positive in both years, and the units that quantities were measured in did not change. In figures 14 and 15, we report the median price of the least traded exports relative to the median price of the other exported goods. We use medians rather than means or geometric means because of the noisiness of the data.

Figure 12 shows the movements in the median price of the least traded goods relative to the median price of other goods for exports from Canada to Mexico and exports from Mexico to Canada over the period 1989–1999. We see little discernible pattern in these data, which seem to be dominated by noise. Figure 13 shows the movements in the median price of the least traded goods relative to the median price of other goods for exports from China to the United States and exports from the United States to China over 1995–2004. We have had to drop 2005 from our sample period because most of the unit value data are missing that year. Here the data seem less noisy. What is worth noting is the fall in the price of least traded Chinese exports relative to other Chinese exports over the sample period. This observation seems consistent with anecdotal evidence that the surge in Chinese imports occurs in goods with low prices.

5. Robustness checks

As we noted earlier, it may be more attractive conceptually to sort goods by the ratio of exports to total output in the base period. In this section, we report on the analysis in which we do such sorting for U.S. exports. We find that the results do not change in any significant way. We also ask how our characterization of the extensive margin differs from those of Evenett and Venables (2002), Hummels and Klenow (2005),

and Broda and Weinstein (2006). We find that our characterization differs significantly from those of these other researchers.

5.1. Sorting codes by the trade-output ratio

In determining the tradedness of a good, we ranked goods according to the value of their trade in a base year. An alternative method would be to rank goods by their trade-to-output ratio in a base year. A good produced in very large quantities, but consumed in large part domestically, may be very traded in the absolute, but may have little trade relative to the amount produced. In this section, we study how our results change under this alternative ranking. We find that our results about the growth in the least traded goods do not change significantly under the trade-output ordering.

To compute the trade-output ratios, we require gross output data by four-digit SITC code. These data are not generally available, as output data are collected according to classification schemes that tend to classify goods according to how they are produced — such as the International Standard Industrial Classification (ISIC) — while the SITC tends to classify goods according to the type of material from which the good is made. To construct the data, we begin with gross output by four-digit ISIC and use a concordance from the ISIC to the SITC. The four-digit ISIC classification contains only 92 codes, compared to the 789 codes in the SITC, so we frequently have to assign one ISIC code to many SITC codes. To do so, we split the ISIC code evenly across the SITC codes. The data appendix provides a detailed description of the data as well as the concordance.

Consider the flow of U.S. exports to China, in which the least traded goods doubled its share from 0.10 to 0.20 from 1995 to 2005. We sort the goods by their average export–gross output ratios for the years 1995–1997. Once we have sorted the goods, we build the set of least traded goods as we have before: no other part of the procedure changes. In figure 14, we plot the results of the alternative ordering. As a comparison, we also plot the results from the baseline method. There are some differences in the intermediate categories, but the growth in the least traded goods is almost identical across the two methods: the least traded goods grow to 0.20 when the

goods are ordered by trade levels and 0.21 when the goods are ordered by trade-output ratios. The alternative ordering changes our measure of the extensive margin very little.

The two methods produce similar results because the two rankings are similar. In figure 15, we plot the ranking of each good under the two methods. A data point is a good: along the *x*-axis is the good's rank according to its trade-output ratio, and along the *y*-axis is the good's rank according to its value of trade. The two dashed lines show the cutoffs for the set of least traded goods in each of the two cases. The data points that lie in the southwest quadrant are classified as least traded under both methods. The goods that lie in the southeast quadrant are least traded according to trade volume, but not by the trade-output ratio. The goods in the northwest quadrant are considered least traded by the trade-output ratio, but not by the trade volume measure. Very few goods lie in the northwest and southeast quadrants, and it is this fact that explains why our results are so similar.

We have conducted this exercise for U.S. exports to Mexico over the time period 1989–1999 and for U.S. exports to Canada trade over the same time period as well, with similar findings. Notice that table 1 indicates that these trade relationships are less interesting than U.S. exports to China over the period 1995–2005 because there is no large increase on the extensive margin.

5.2. Decomposing trade growth

As an alternative way of measuring the extensive margin, we consider the decomposition in Hummels and Klenow (2005). In this section, we show how their method compares to ours and bring out the important differences that arise from the definition of a nontraded good.

Hummels and Klenow (2005) decompose country *i*'s share of total imports to country j into two parts: the intensive (IM) and extensive (EM) margins,

$$IM^{i}_{j,t} = \frac{\sum_{k \in K^{i}_{j,t}} x^{i}_{jk,t}}{\sum_{k \in K^{i}_{j,t}} x^{W}_{jk,t}} \tag{2}$$

$$EM^{i}_{j,t} = \frac{\sum_{k \in K^{i}_{j,t}} x^{W}_{jk,t}}{\sum_{k \in K} x^{W}_{jk,t}}, \tag{3}$$

where the value of imports of good k from country i to country j at time t is denoted $x^i_{jk,t}$, and $x^W_{jk,t}$ is the value of total imports to country j of good k. The set K contains all of the SITC codes, while the set $K^i_{j,t}$ contains only the SITC codes in which country j imports from country i, as determined by some cutoff value. The intensive margin measures the importance of imports from country i relative to total imports of the goods which country *j* imports from country i. The extensive margin measures the importance of the set of goods which j imports from i, relative to country *j*'s total imports. Notice that if country i exports every good to j, the extensive margin equals 1. If country i was the sole exporter to j in each of these goods, the intensive margin would equal 1. Multiplying the intensive margin by the extensive margin returns country *i*'s share of total imports to j, $s^i_{j,t} = EM^i_{j,t} IM^i_{j,t}$. To measure the growth in import share between periods t and $t+n$, we take the logarithm in each period and subtract the two to obtain

$$\log\left(s^i_{j,t+n} / s^i_{j,t}\right) = \log\left(EM^i_{j,t+n} / EM^i_{j,t}\right) + \log\left(IM^i_{j,t+n} / IM^i_{j,t}\right), \qquad (4)$$

which decomposes the change in the share of imports from country i into that accounted for by the extensive and intensive margins.

To compute (4) we need to define a nontraded good. In this study, we have chosen a definition that utilizes a relative cutoff: we use the least traded goods that make up 10 percent of the trade flow under study in some base year. Other papers have used a fixed cutoff value. We compare the results of the decomposition under different definitions of nontradedness below.

We compute (4) for the NAFTA pairs and report them in table 4. The first column of the table shows the growth rates of our measure of the extensive margin for reference. (To compute the decomposition, we need data on a country's total imports by four-digit SITC. We do not have this data for Mexico until 1991 and for the United States until 1989. Thus, the sample period used in these comparisons is slightly different from the ones used in table 1.) Columns 2 and 3 report the decomposition when a good is nontraded according to a fixed cutoff value. Column 2 uses a cutoff value of 0 dollars, as in Hummels and Klenow (2005), and column 3 uses a cutoff value of 50,000 dollars as in Evenett and Venables (2002). The fourth column reports the decomposition when we

use the cutoff values implied by our definition of the least traded goods. In this case, we take as the cutoff value the average (over the first three years of the sample) amount of trade in the first good which would not be included in the set of least traded goods. In contrast to the other cutoffs, this value varies across country pairs.

The two decompositions in table 4 that employ country-invariant cutoffs are similar; they both find very little extensive margin growth for the NAFTA pairs, except between Canada and Mexico. This finding reflects that many country pairs trade more than 50,000 U.S. dollars in almost every good: there are no nontraded goods! In table 5 we report the levels of the extensive and intensive margins. The extensive margin is greater than 0.99 for Canada-U.S. trade and exports from the United States to Mexico. The 50,000 U.S. dollar cutoff allows for some nontraded goods from Mexico to the United States and between Canada and Mexico, and this is where we find a small amount of extensive margin growth in these measures.

We are interested in capturing the change in the composition of goods that are traded between two countries. Fixed dollar cutoffs imply that most goods are traded in large trading relationships, which rules out growth in the extensive margin, even if the types of goods being traded are dramatically changing. One solution would be to increase the cutoff value. If this value is country-invariant, then this leads to problems in small trade relationships. For example, our relative cutoff implies that any good exported from Canada to the United States at less than 76,122,400 U.S. dollars is nontraded. The total flow of exports from Canada to the United States is very large, however, so a good exported in the amount of 76,122,400 U.S. dollars accounts for only 0.093 percent of the total trade flow. This good would be considered heavily traded by the country-invariant cutoffs in table 4. If we were to force these goods to be classified as nontraded under a fixed dollar measure, we would need to increase the cutoff value. If this cutoff is constant across country pairs, we create problems measuring nontraded goods in other relationships. For example, total exports from Canada to Mexico are small compared to those to the United States: 524 million U.S. dollars to Mexico compared to 81.9 billion U.S. dollars to the United States in 1989. The cutoff value of 76,122,400 U.S. dollars would imply that a good valued at 14.5 percent of total Canadian exports to Mexico would be considered a nontraded good!

This example highlights the underlying tension in country-invariant definitions of tradedness: a fixed cutoff may understate the extensive margin in large trade relationships and overstate the extensive margin in small trade relationships. Looking at table 4, we see that the decomposition with a cutoff of 50,000 U.S. dollars implies that the Canada-Mexico extensive margin grows about 148 times faster than the Canada-U.S. extensive margin. In comparison, our relative measure finds the Canada-Mexico extensive margin growing only about 2.4 times the rate of the Canada-U.S. extensive margin.

6. Data quality and the switch to the Harmonized System

In addition to the usual concerns that arise when working with trade data, our focus on newly traded goods means that we must be careful that changes in the way goods are classified do not appear as newly traded goods. Unfortunately, the adoption of the Harmonized System — which took place in many countries in 1988 and in the United States in 1989 — was accompanied by a significant change in the codes that are reported as traded. This problem creates a discontinuity in the data which forces us to restrict our sample periods to preclude the year in which a country transitioned to the Harmonized System. In this section, we discuss the extent of this problem.

Prior to 1988, data were collected by individual nations according to their own classifications and converted into the SITC by the OECD for reporting purposes. In 1988, many nations adopted the Harmonized System as the classification used to collect data and assess tariffs. This change is a step forward in the collection of trade data, as it standardizes the classification of goods across countries, making the data more consistent and comparable. This change, however, has created an inconsistency in the data at the year of adoption that has a large impact on measuring the changes in the extensive margin.

The problem with the change in nomenclature lies in the mapping of the old system of classification to the new system. The United States, for example, had been using the Tariff Schedule for the United States, Annotated (TSUSA) to classify import data prior to 1989 and mapping the TSUSA codes to the SITC. With the adoption of the HS in 1989, the trade flows were reported under the new classification and mapped to the SITC. If, for some good, the map between its TSUSA code and the SITC, and the map

between its HS code and the SITC, differ, the SITC data may show one code surging in value while another one shrinks. If the change affects an SITC code in the set of least traded goods, our measures would find a change in the extensive margin.

The International Trade by Commodity Statistics (ITCS) data set allows us to study the same trade flow measured by two different countries. This feature of the data, combined with the fact that different countries adopted the HS in different years, allows us to identify the changes caused by the switch in nomenclature. Consider the flow of goods from Canada to the United States, measured both by Canada (as exports) and by the United States (as imports). An important difference between these two countries is that Canada adopted the HS in 1988, while the United States adopted the HS in 1989. If the switch in classification system systematically created discontinuities in the data, then we would expect to see the discontinuities in 1988 in Canadian-collected data and 1989 in the U.S.-collected data.

The problem can be clearly seen when inspecting individual codes. Figure 16 plots the value of Canadian transmission parts (SITC 7493) exported to the United States, reported by both the United States and Canada. Notice the timing of the large jumps in the two series. The Canadian-measured series jumps between 1987 and 1988, while the U.S.-measured series jumps between 1988 and 1989. The timing of the change in trade values coincides exactly with the two countries' adoption of the HS.

How prevalent is this problem? As a simple measure of this discontinuity, consider the amount of code turnover in the data. Define a SITC code *death*, in period t, as a code that has a value greater than 10,000 U.S. dollars in year $t-1$ and less than 10,000 U.S. dollars in year t. Analogously, a code *birth*, in period t, occurs when a code has value less than 10,000 U.S. dollars in year $t-1$ and value greater than 10,000 U.S. dollars in year t. Code turnover is the sum of code births and deaths. The number of total codes is constant throughout the sample at 789.

Turnover in the ITCS data set displays the pattern consistent with a poor concordance between the nomenclatures. Table 6 presents data on code birth and death for trade between Canada and the United States. The first panel presents statistics about Canadian exports to the United States. For data collected by Canada, the code turnover is highest in 1988, but for the U.S.-collected data, turnover is highest in 1989. In the

Canadian-collected data, 343 of 789 codes were turned over in 1988. The high turnover is driven by the 332 new codes put into service in 1988, which is almost 42 times larger than the average number of births in the other years of the sample. The U.S.-collected data on this same trade flow have 57 new codes being traded in 1989, more than four times the average births in other years. The second panel in table 6 reports statistics for exports from the United States to Canada, and it displays the same pattern: code turnover is highest in the U.S.-collected data in 1989 and highest in the Canadian-collected data in 1988. It is worth noting that for both trade flows the importing country seems to be less affected by the change in classification. This is consistent with the idea that import data are more carefully collected than export data. In our analysis above, we have used data collected as imports whenever possible.

It is worth noting that the problem that we are discussing seems to be systematic. Looking at exports from Italy to Switzerland and exports from Switzerland to Italy, we see what look like large increases on the extensive margin in 1988 for both, the year that both countries switched to the HS. The benefit of focusing on the United States and Canada is that these two countries switched to the HS in different years, which makes explanations for the increases in the extensive margin, other than problems with the concordances between the pre-HS system and the SITC and the HS and the SITC, less plausible.

Are there ways to fix the problem we highlight here? The answer to this question depends crucially on the intended use of the data. These problems seem less severe at more aggregate classifications; analysis at the two-digit level, which is common in the multisectoral applied general equilibrium literature, may not be severely affected. For questions specifically about code turnover, it seems that the problems are too severe, and the prudent choice is to remove the transition year from the sample period, as we have done in this paper.

7. Conclusions

A new generation of models has made significant progress in addressing long-standing questions regarding the pattern of trade and the effects of trade policy. The key to their results is the idea that the mix of goods a country trades — the extensive margin — changes in response to changes in the economic environment. In this paper, we have looked at the data from several episodes in which these models predict changes in the extensive margin, and we have found that in many of them, the changes in the extensive margin are large and important. We have also found that the extensive margin does not change much over the business cycle. In our analysis, we develop a methodology for studying changes in bilateral trade due to countries exporting goods that they did not export previously, or exported only in small quantities. Our work, which analyzes exports by the type of good, is complementary to both the work that uses the industry as a unit of account and the firm-level analysis as exemplified by Eaton, Kortum, and Kramarz (2008). Our approach differs fundamentally from previous studies, such as Hummels and Klenow (2005), in that we judge a good to be traded (or not) based on a relationship-specific cutoff rather than a cutoff that is invariant across bilateral relationships.

Our results are challenges to theorists developing models of international trade. Trade models should be able to account not only for the rapid growth of exports on the extensive margin during trade liberalization episodes and structural change episodes, but also for the lack of growth on the extensive margin over the business cycle. Kehoe (2005) shows that multisectoral applied general equilibrium models built to analyze the NAFTA did a poor job in predicting the impact of trade liberalization on different sectors. These models are incapable of generating growth in exports on the extensive margin. More research is needed to develop models capable of predicting the sectoral impact of episodes like the NAFTA. We speculate that successfully modeling the increase in trade on the extensive margin will be the key element in this model development.

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Table 1

Share of least traded goods: Trade liberalization

period	trade flow	share of total exports
1989–1999	Canada to Mexico	0.307
1989–1999	Mexico to Canada	0.232
1988–1998	Canada to United States	0.163
1988–1998	United States to Canada	0.130
1989–1999	Mexico to United States	0.153
1989–1999	United States to Mexico	0.117

Table 2

Share of least traded goods: Structural transformation

period	trade flow	share of total exports
1975–1985	Chile to United States	0.244
1975–1985	United States to Chile	0.544
1995–2005	China to United States	0.247
1995–2005	United States to China	0.200
1975–1985	Korea to United States	0.604
1975–1985	United States to Korea	0.513

Table 3

Share of least traded goods: Business cycle fluctuations

period	trade flow	share of total exports
1989–1999	Germany to United States	0.118
1989–1999	United States to Germany	0.108
1989–1999	Japan to United States	0.112
1989–1999	United States to Japan	0.122
1989–1999	United Kingdom to United States	0.104
1989–1999	United States to United Kingdom	0.105

Table 4

Decomposition of trade growth under different cutoff values

(growth)

country pair	least traded goods	$0 cutoff		$50,000 cutoff		10% least traded cutoff	
	growth in export share	extensive margin	intensive margin	extensive margin	intensive margin	extensive margin	intensive margin
Canada to Mexico 1991–1999	1.039	0.063	0.102	0.148	0.017	0.506	–0.341
Mexico to Canada 1989–1999	0.839	0.144	0.706	0.213	0.637	0.379	0.471
Canada to U.S. 1989–1998	0.430	–0.004	0.045	0.001	0.040	0.214	–0.173
U.S. to Canada 1988–1998	0.259	0.000	0.039	0.000	0.039	0.109	–0.070
Mexico to U.S. 1989–1999	0.428	0.015	0.617	0.021	0.611	0.231	0.400
U.S. to Mexico 1991–1999	–0.004	0.003	0.089	0.001	0.092	0.178	–0.085

Table 5

Decomposition of trade growth under different cutoff values

(levels)

country pair	year	$0 cutoff		$50,000 cutoff		10% least traded cutoff			
		extensive margin	intensive margin	extensive margin	intensive margin	extensive margin	intensive margin	cutoff value (thousands, USD)	cutoff trade share (percent)
Canada to Mexico	1991	0.904	0.020	0.797	0.023	0.456	0.039	1,165.8	0.244
	1999	0.963	0.022	0.924	0.023	0.756	0.028		
Mexico to Canada	1989	0.829	0.015	0.716	0.018	0.428	0.030	3,184.8	0.221
	1999	0.958	0.031	0.887	0.034	0.625	0.048		
Canada to U.S.	1989	0.998	0.182	0.991	0.183	0.623	0.291	76,122.4	0.093
	1998	0.994	0.190	0.992	0.190	0.772	0.245		
U.S. to Canada	1988	1.000	0.657	1.000	0.657	0.819	0.802	54,360.8	0.078
	1998	1.000	0.683	1.000	0.683	0.914	0.748		
Mexico to U.S.	1989	0.969	0.058	0.954	0.059	0.641	0.087	29,165.7	0.106
	1999	0.984	0.107	0.974	0.108	0.807	0.130		
U.S. to Mexico	1991	0.997	0.686	0.996	0.687	0.793	0.862	26,921.8	0.081
	1999	1.000	0.751	0.997	0.753	0.948	0.792		

Table 6

	U.S. imports from Canada				U.S. exports to Canada			
	U.S.-collected data		Canada-collected data		U.S.-collected data		Canada-collected data	
	births	deaths	births	deaths	births	deaths	births	deaths
1981	21	6	2	4	3	2	8	6
1982	12	20	4	1	1	1	5	3
1983	13	18	4	0	1	2	1	7
1984	21	7	0	0	2	2	3	2
1985	18	19	0	2	11	13	3	2
1986	14	10	0	3	6	7	2	4
1987	9	14	2	1	3	5	4	5
1988	14	7	**332**	**11**	12	1	**34**	**21**
1989	**57**	**24**	7	20	**77**	**11**	3	9
1990	17	16	15	24	6	4	7	3
1991	9	13	9	13	1	3	2	2
1992	13	13	11	13	5	4	4	3
1993	13	14	13	12	1	7	1	2
1994	14	14	14	15	8	0	4	3
1995	18	11	18	9	1	4	2	4
1996	7	7	7	9	5	3	3	4
1997	9	11	24	4	3	4	5	4
1998	11	8	8	12	3	4	3	2
1999	9	13	5	8	4	3	5	3
2000	8	9	8	5	3	1	4	2
Average	13.2	12.1	7.9	8.2	4.2	3.7	3.6	3.7
Trans/Avg	4.3	2.0	41.8	1.4	18.5	3.0	9.4	5.7

Note: “Average” is the average for that column over all years except for the transition year, which is 1988 for Canada and 1989 for the United States. “Trans/Avg” is the value in the transition year divided by the amount reported in “Average.”

Figure 1

Composition of exports: Canada to Mexico

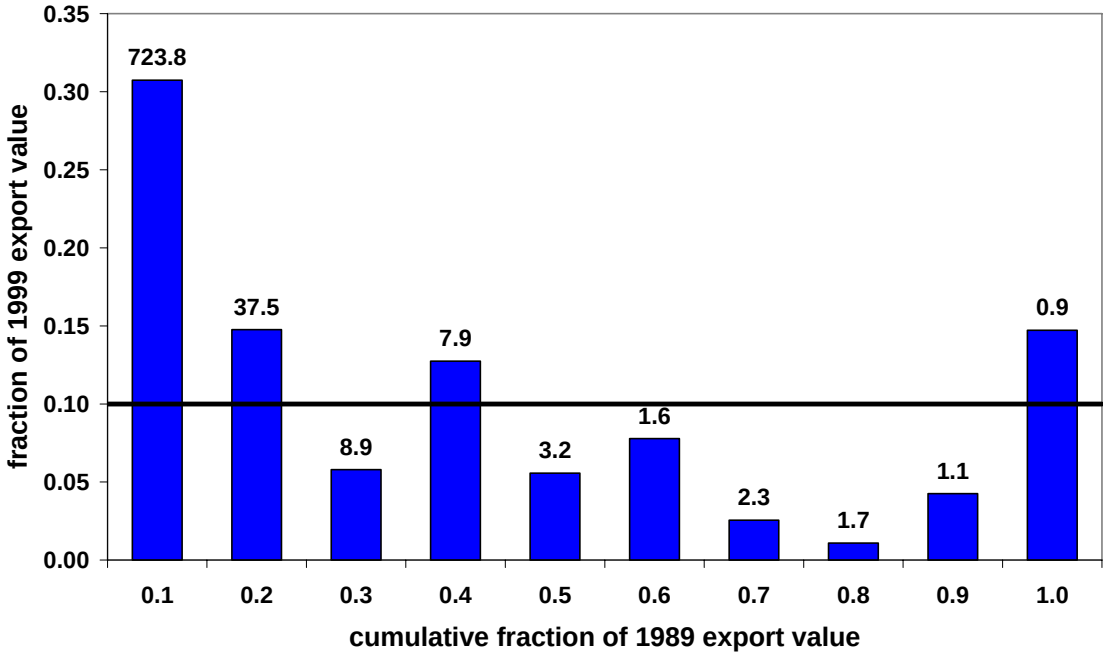

Figure 2

Composition of exports: Mexico to Canada

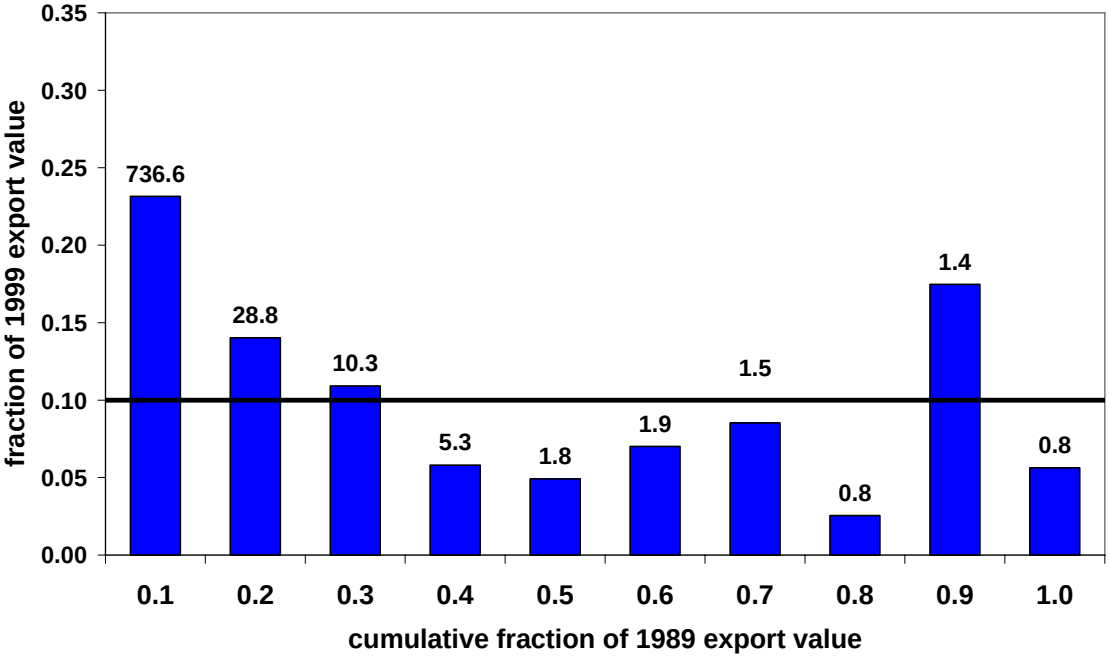

Figure 3

Least traded goods: Mexico and Canada

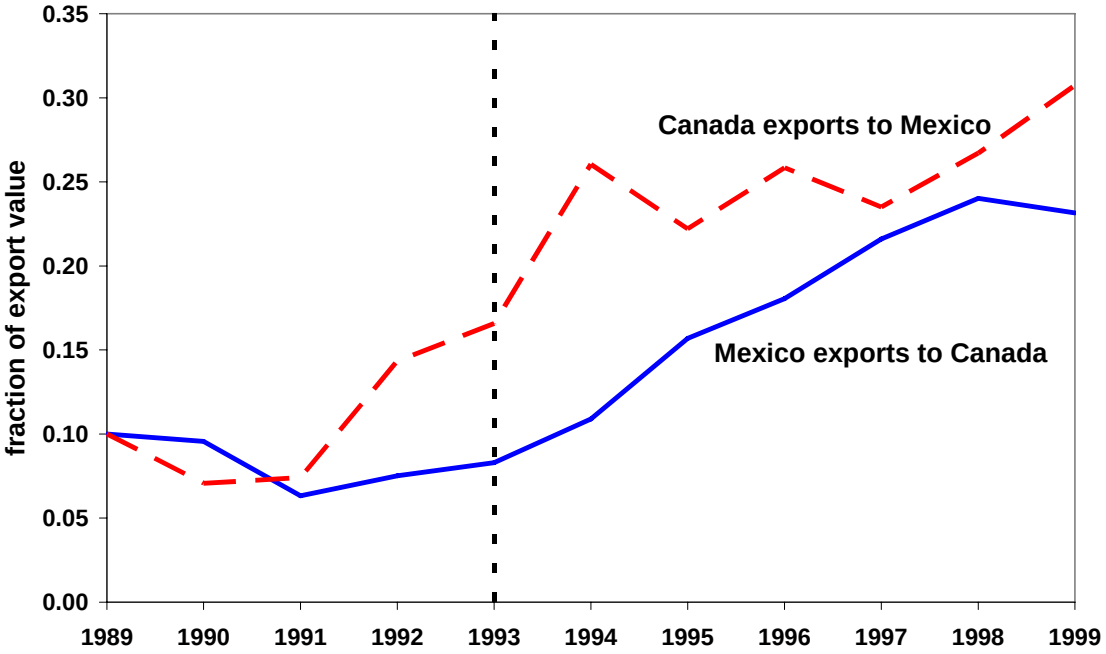

Figure 4

Composition of exports: China to United States

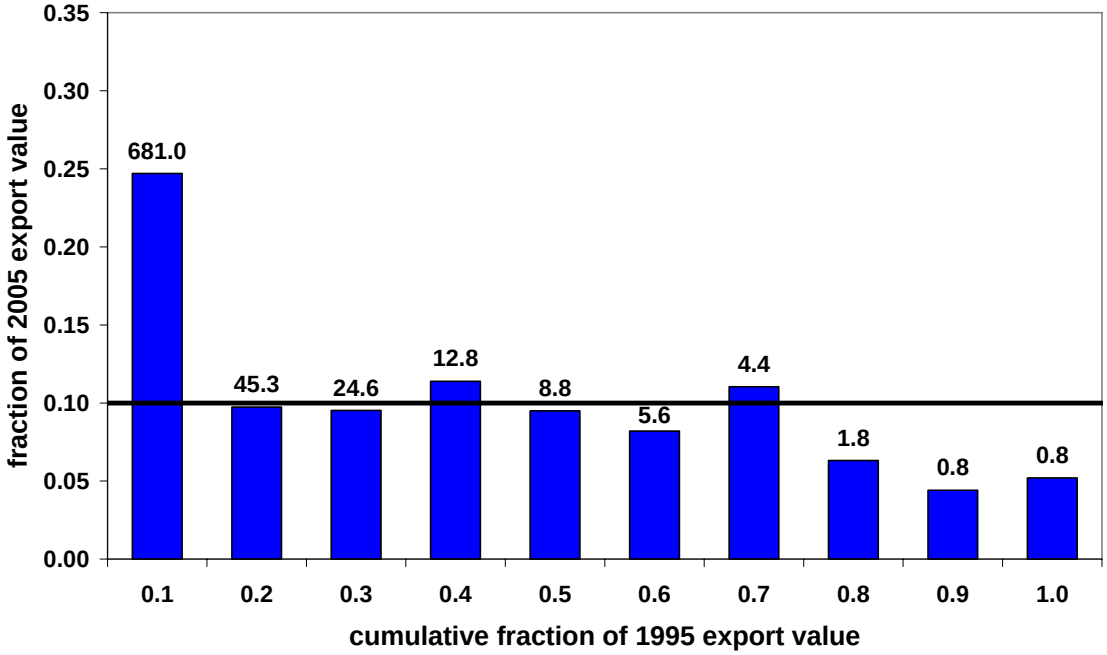

Figure 5

Composition of exports: United States to China

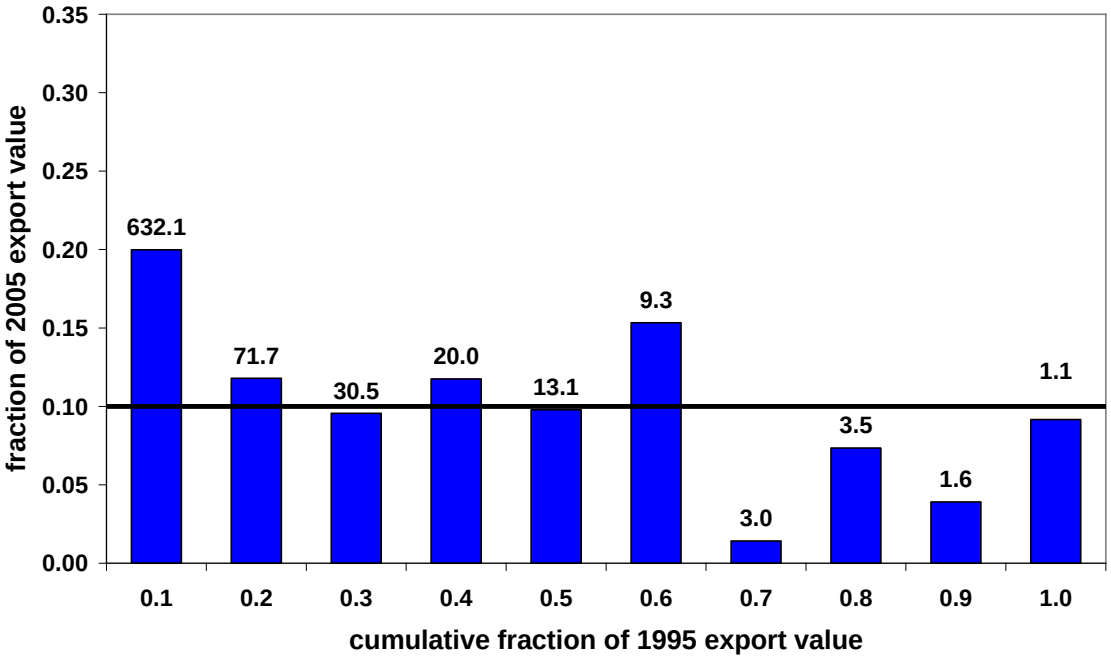

Figure 6

Least traded goods: China and United States

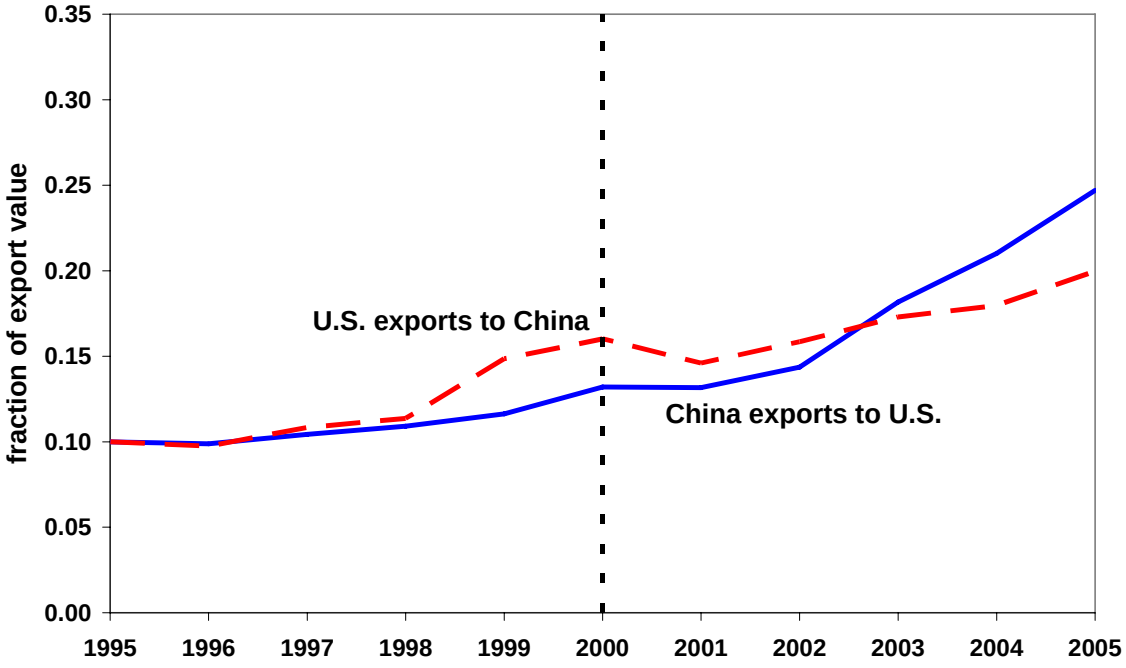

Figure 7

Least traded goods growth over longer time horizon

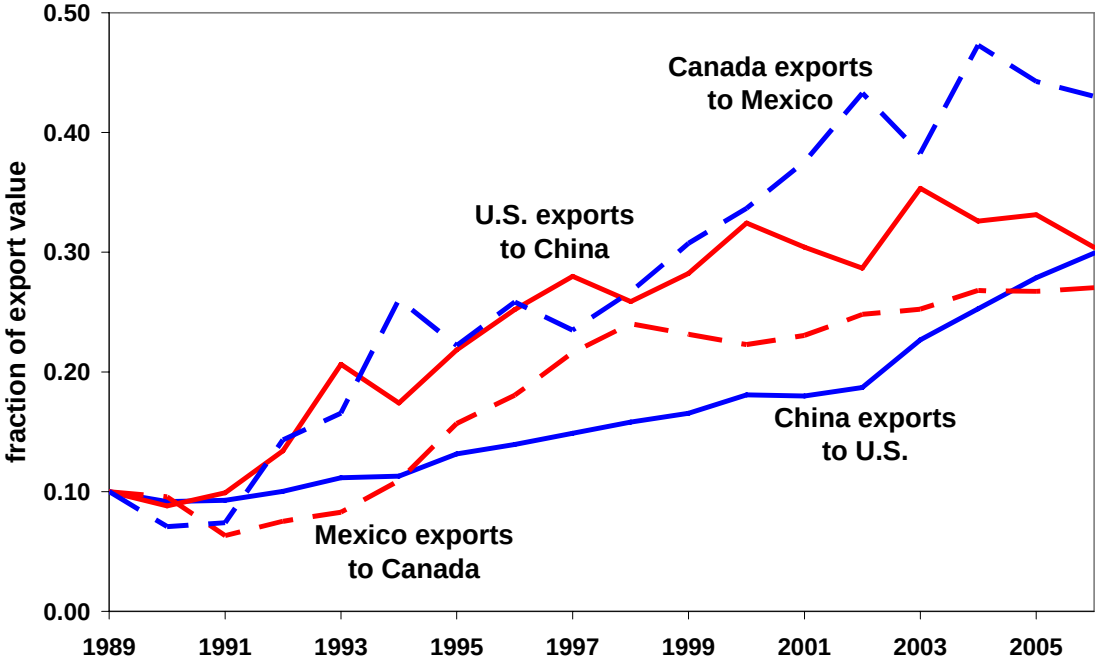

Figure 8

Composition of exports: United Kingdom to United States

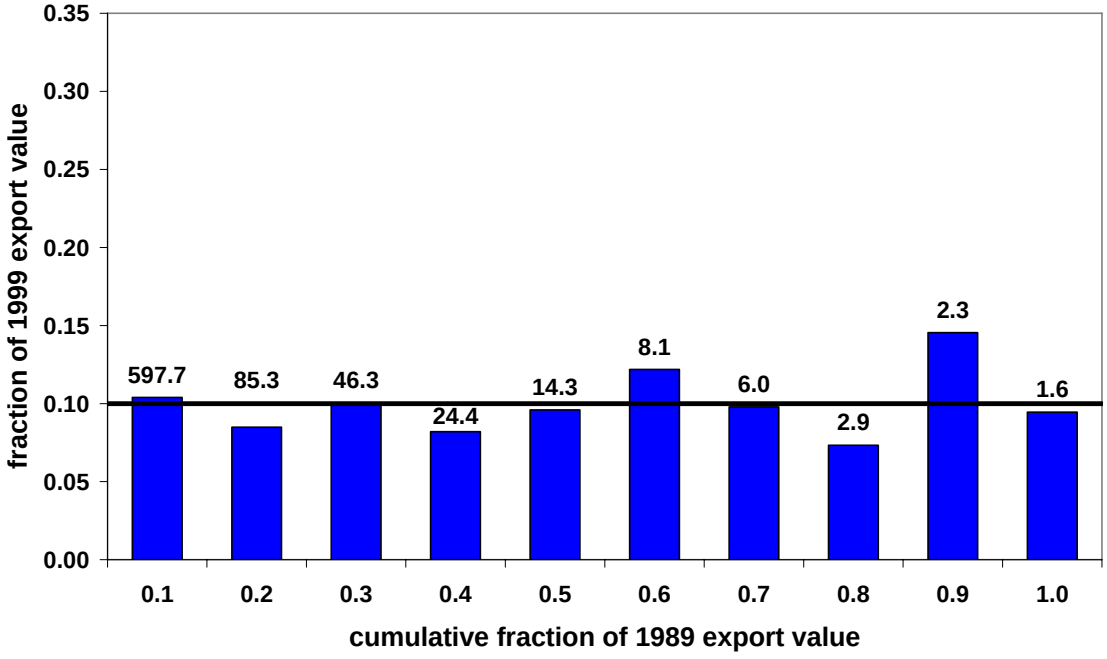

Figure 9

Composition of exports: United States to United Kingdom

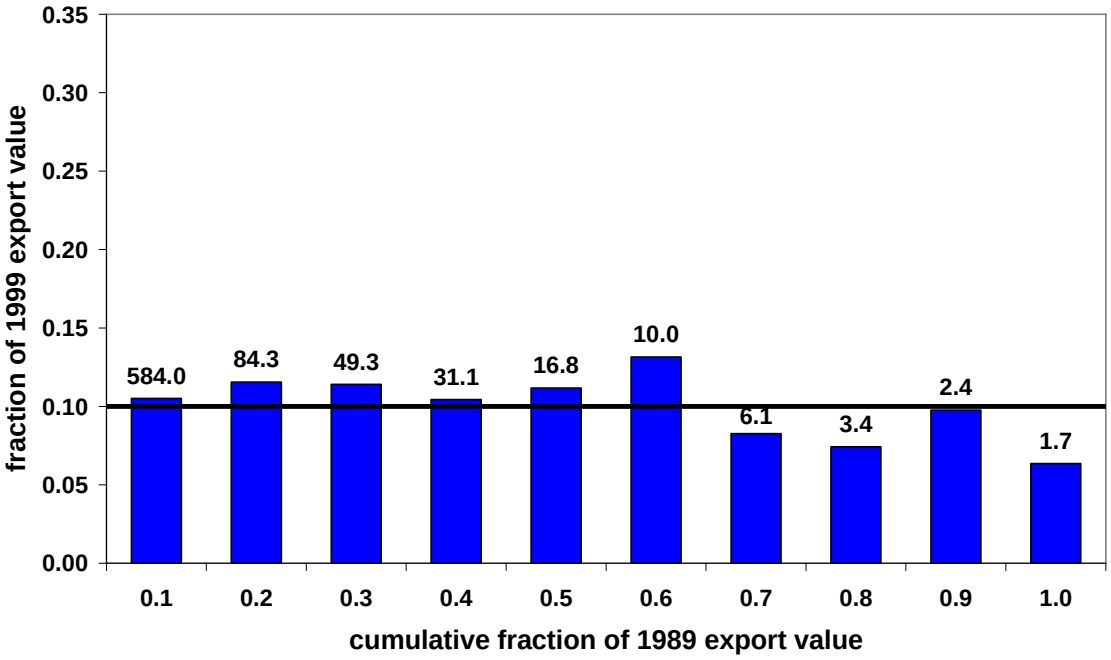

Figure 10

Least traded goods: United States and United Kingdom

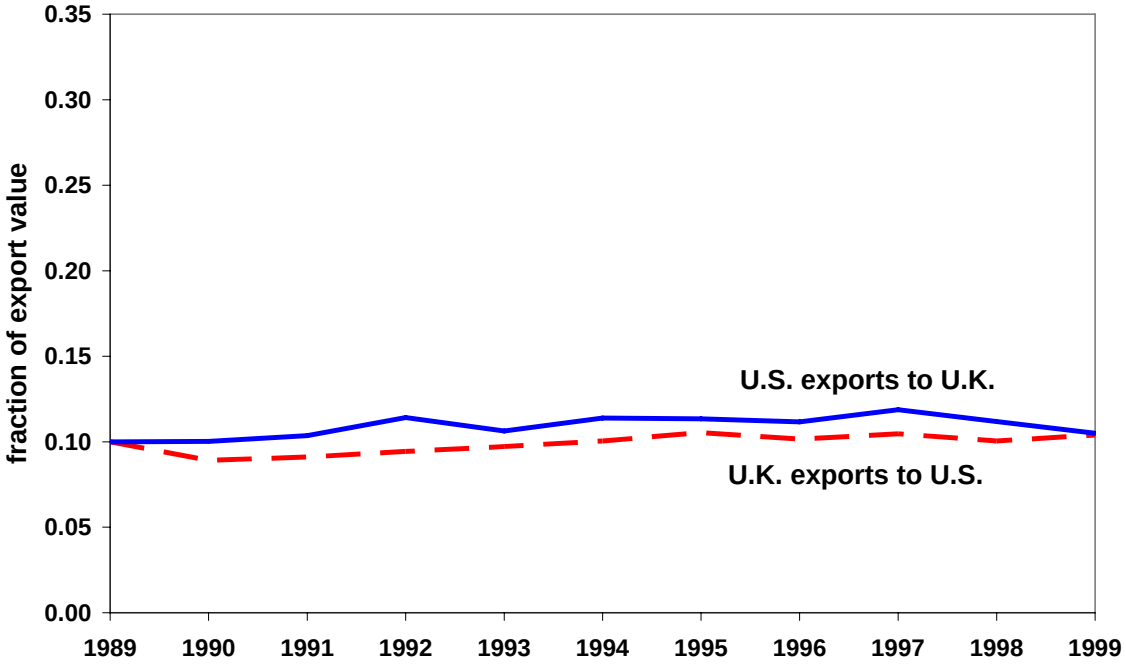

Figure 11

Change in U.S. tariff rates on Chinese imports, 1995–2005

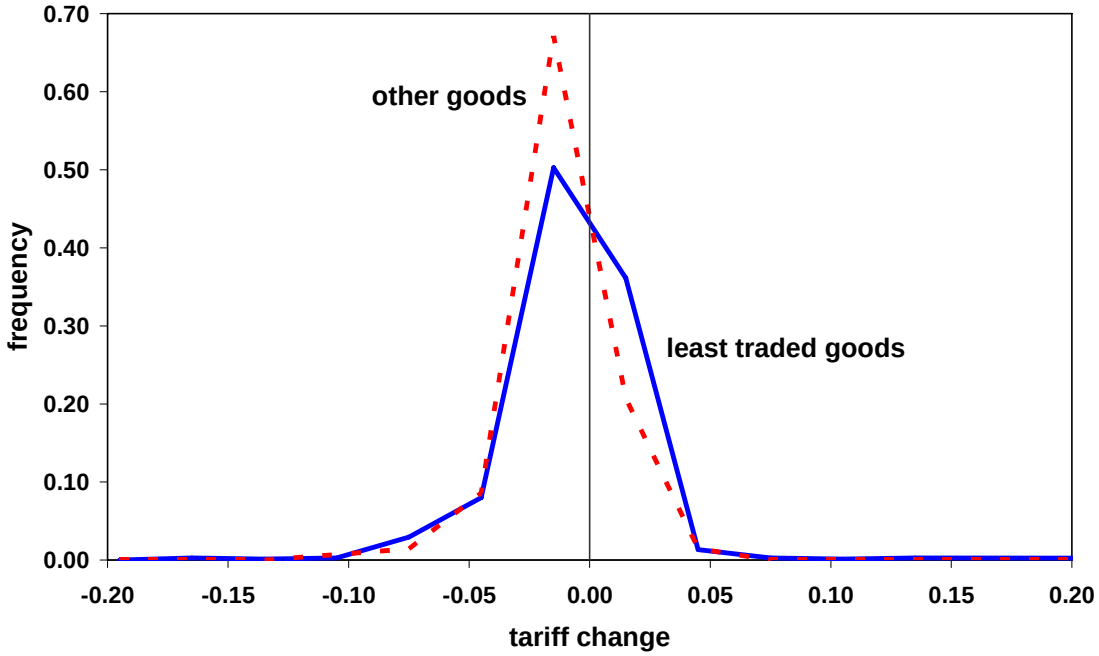

Figure 12

Prices of least traded goods relative to other goods: Canda and Mexico

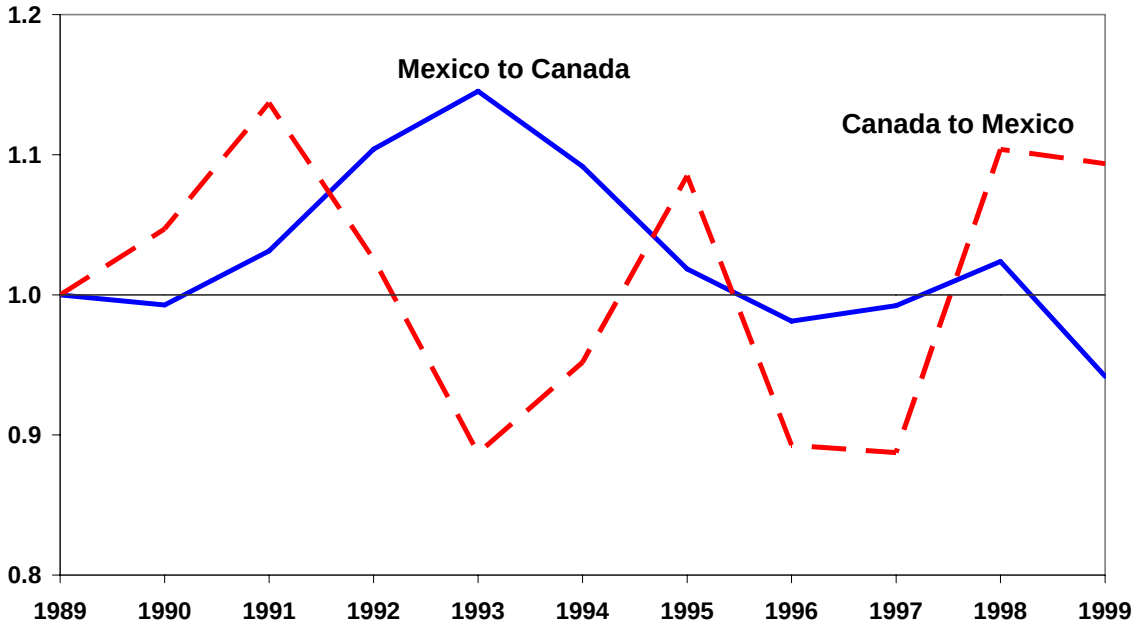

Figure 13

Prices of least traded goods relative to other goods:
China and United States

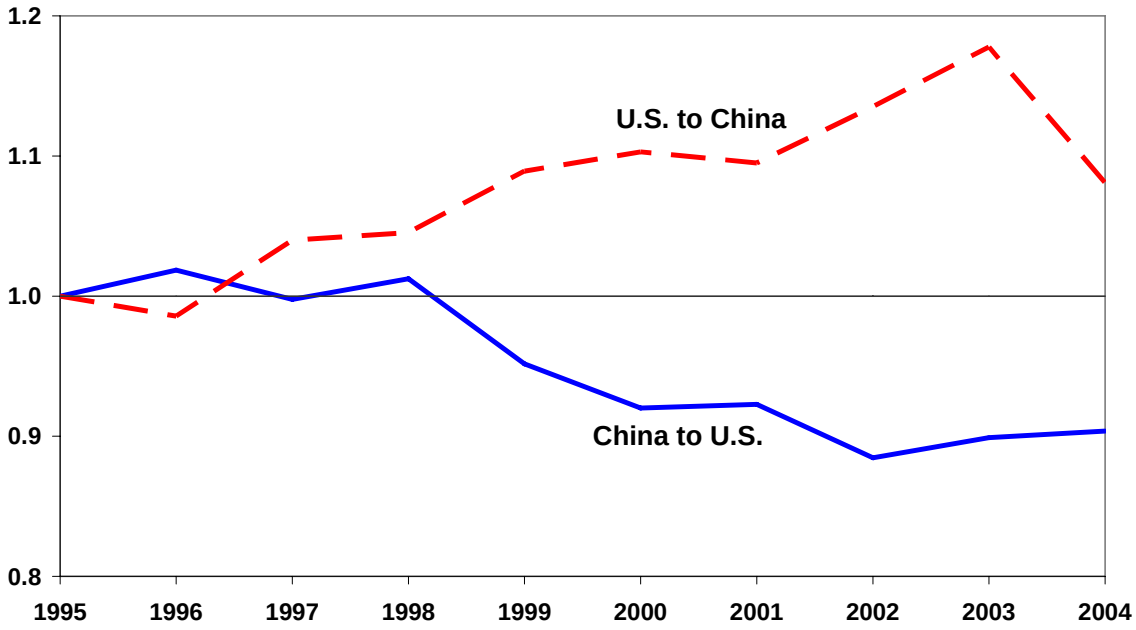

Figure 14

Composition of exports: United States to China

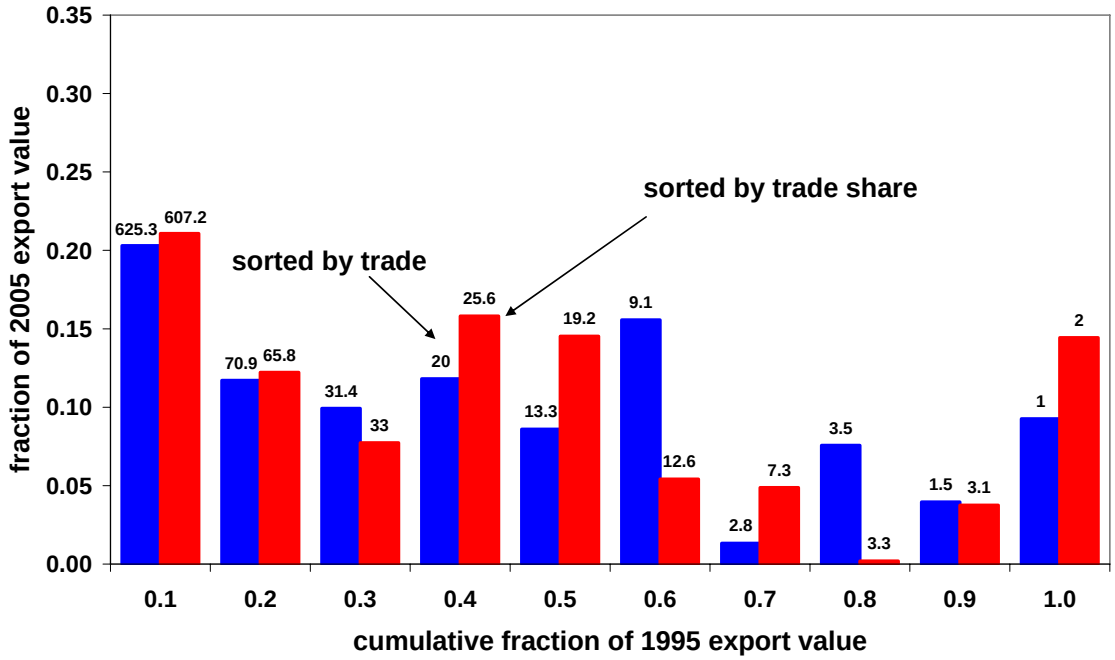

Figure 15

SITC codes: U.S. exports to China

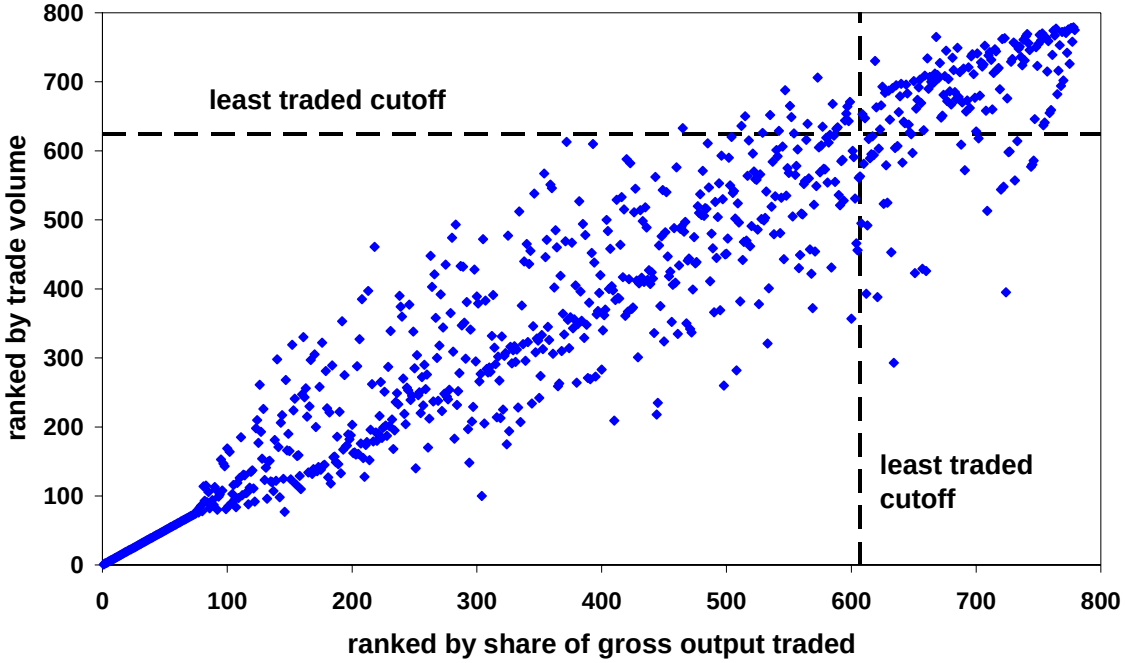

Figure 16

7493 Transmission shafts, cranks, bearing housings