July 16, 2008

Testimony of

Mary Amiti[1]
Senior Economist
Federal Reserve Bank of New York

Before the
U.S.-China Economic and Security Review Commission

"Research and Development, Technological Advances in Key Industries, and Changing Trade Flows with China"

[1] The views expressed are those of the author and do not necessarily reflect those of the Federal Reserve Bank of New York or the Federal Reserve System

I would like to thank the Commission for the opportunity to testify today. I want to start off by saying that the views expressed here are my own views and do not necessarily reflect those of the Federal Reserve Bank of New York or the Federal Reserve System.

Over the past 15 years, China's exports have jumped more than tenfold, far exceeding the tripling of world trade that has taken place over the same period. As a result, China has recently surpassed the United States as the world's second largest exporter, just behind Germany. Not surprisingly, this growth has attracted a lot of attention among media, academia, and policymakers. Some key features of China's trade flows highlighted in the recent literature include the increasing sophistication of China's exports, the growth in new product varieties, the increasing fragmentation of global production, and the effect of China's growth on its export prices.

My discussion will address these issues, with a focus on China-US trade. I will begin with some background on the nature of China's trade flows and how this has changed over time. I will then address the following questions:

- Is China climbing the quality ladder?
- What are the driving forces behind changes in China's export prices?

China's trade flows

China has experienced dramatic changes in its export composition. Within manufacturing, it has moved from labor intensive goods such as apparel, textiles, footwear and toys to more sophisticated manufactured machinery goods. Figure 1 shows the changes in China's manufacturing export shares in 1-digit SITC sectors between 1992 and 2007. China increased its share of machinery exports to the world from 15 percent in 1992 to 50 percent in 2007.

Is China Climbing the Quality Ladder?

The strongest overall export growth has been in machinery (SITC 7), and within this broad category the largest export shares are in computers, telecoms, and office machinery. This suggests that China is exporting higher capital intensive, more sophisticated products. However, measuring quality or sophistication of a product is difficult.

The most rigorous approach is to assess detailed information on quality attributes of goods exported, but this information is very expensive to collect and thus is generally unavailable. All that is available are some case studies of a handful of industries. For example, John Sutton (2007) assesses the quality of manufacturing plants in the automobile-component and machine-tool industries in China, as measured by external defect rates. This study shows that for car makers in China that are joint ventures between domestic and foreign firms, the supplier quality is of international standard. However, for suppliers of components in China the study found that the quality was significantly lower. Whilst these studies are informative, it is not possible to draw general conclusions from them.

A well known approach to help reach more general conclusions about the level of sophistication of a country's exports involves classifying goods as "advanced technology products" (ATP), and using this classification to track the changing export shares of goods. In the US, the definition of ATP products reflects their research intensity. However, definitions and classifications differ across countries thus it is difficult to derive consistent measures. For example, China's definition results in a higher export share of ATP products to the US than the US definition yields (see Ferrantino et al, 2007). Further, the goods classified as ATP change over time so it becomes difficult to ascertain whether trade patterns are actually changing or the share of ATP products changes due to a classification change. Despite these limitations, Ferrantino et al (2007) find that the ATP statistics point to an increasing export share of ATP products from China to the world and to the US, concentrated mostly in information and communication technology.

A novel approach developed more recently by Dani Rodrik (2006) to infer the sophistication level of a country's exports involves weighting each product by the average of the income per capita of the countries that export each product. If a particular product is exported by high per capita income countries, then this is considered to be a high productivity product. Based on this measure, Rodrik (2006) argues that China's export bundle is that of a country with an income per-capita level three times higher than China's. That is, China exports many products that are also exported by high income countries.

A related approach to assessing the sophistication of China's exports is to compare the products it exports with those of OECD countries. Using this measure, Peter Schott (2008) finds that the overlap between China's exports to the US and those of OECD countries to the US has increased from 15 percent in 1994 to 21 percent in 2005. This suggests that China is climbing the quality ladder, but note that nearly 80 percent of China's exports continue to be in products distinct from those that are exported by OECD countries.

Within the overlapping product category group, Schott (2008) goes on to consider whether China's exports are of the same quality as those of other countries over the period 1972 to 2005. One approach to assessing the relative quality of products is to compare their unit values, defined as the ratio of export values to quantities.[2] Thus, within the same narrowly defined product category, the question is whether US consumers are willing to pay the same amount for China's products as they are for products of other countries. Schott finds that the answer to this question is no. China exports goods to the US at a discount relative to OECD countries and relative to countries of similar levels of development, and these price gaps have increased over time. For example, this price discount increased from 8 percent in the 1970s to 48 percent in the 2000s.

[2] Using unit value comparisons to gauge quality gaps is common but it should be kept in mind that unit value differences might also capture differences in composition in the products as well as differences in production costs. See Schott (2008) for a discussion.

The increasing overlap between the product categories is interpreted as an indication of tougher competition between China and OECD countries. And the widening price gap over time can be interpreted as developed countries upgrading their quality, perhaps in response to globalization.

If China were climbing the quality ladder, we might expect to see an increase in the skill content of its exports, that is, higher quality products generally require a higher skilled workforce. Amiti and Freund (2008) show that the skill content of China's exports has indeed increased between 1992 and 2005.[3] For example, in 1992, 20 percent of the least skill-intensive industries produced 55 percent of China's export share. By 2005, the export share that these industries produced fell to 32 percent.

These findings imply that China is producing more sophisticated products with more skill intensive production techniques. However, this raises the question of how much value added of Chinese exports is produced in China.

Processing trade

A large and increasing share of China's exports involves assembling duty-free imported inputs for export, a practice known as processing trade, which has risen from 47 percent in 1992 to 55 percent in 2005. The share of processing trade varies widely across industries. Within the high export growth machinery sector, most of this growth is indeed due to growth in processing trade. This can be seen in Figure 2 which graphs total exports of 2-digit SITC machinery categories as a share of total manufacturing exports, in descending order for 2005, and the lighter bars show the portion that is classified as processing trade by China Customs. The large share of processing trade is also evident in ATP exports. Ferrantino et al (2007) find that 90 percent of China's expanding ATP exports to the US are in processing trade.

Thus an increase in the skill content of China's exports could be due to China importing intermediate inputs with higher skill content that it then assembles for exporting. Amiti and Freund (2008) assess this possibility by calculating the skill content of only those exports that exclude processing trade. Interestingly, for China's non-processing exports, this study finds that there was no change in the skill content between 1992 and 2005. Thus all the skill upgrading observed in total exports was due to the higher skill content in the processing trade.

Of course, by excluding processing exports this excludes around half of China's manufacturing exports. Although imported inputs account for a large share of the value of processing exports, some of the value added in processing exports is performed in China.

[3] Because industry skill level data for China were unavailable, Amiti and Freund based the skill intensity ranking of industries on information from Indonesia, another emerging market that is likely to have similar technologies. The skill intensity is measured as the ratio of non-production workers to total employment from the Indonesian manufacturing census at the 5 digit ISIC level for 1992. Using US skill data produces the same conclusions. Note that this approach only gives an indication of shifts between industries, thus we cannot say if there has been any skill upgrading within an industry.

The data requirements to assess the domestic value added of exports are enormous. More recently, a careful study by Koopman, Wang and Wei (2008) calculates the total domestic value added in China's exports. It shows that for processed trade only 26 percent of the export value can be attributed to domestic value added in China. This contrasts with non-processing trade, where the domestic value added is 90 percent. Overall, the domestic value added for China's export is on average around 50 percent.

The finding that the increase in the skill content of China's export is in processing trade, combined with the fact that only a small share of this processing trade is due to domestic value added lends support to the view that China is importing more highly skilled intensive inputs. But this does not rule out the possibility that the Chinese value-added has become more skill-intensive too.

The study by Koopman, Wang and Wei (2008) also shows that there is great variation in the proportion of domestic value added by industry. For example, in textiles only 24 percent of China's exports are classified as processed trade and 76 percent is value added. Yet, in the electronic computer industry it is almost all processing trade, and only 5 percent of the value of these exports is attributed to Chinese value added. This is an important point to keep in mind when assessing the similarity of China's exports with those of developed countries.

China's Export Prices

As China increases its supply of goods on world markets, this is likely to put downward pressure on world prices of these goods and thus lead to a deterioration in China's terms of trade.[4] It has been argued that a large country like China can offset some of these price pressures by exporting new product varieties (growth along the extensive margin) rather than just exporting more of the same product varieties (growth along the intensive margin) particularly if the new product varieties are not close substitutes for other products.

Amiti and Freund (2008) investigate this by decomposing China's export growth over the period 1997 to 2005 along these two margins. They find that China's export expansion was mainly driven by goods that it was already exporting in 1997. At least 80 percent of its export growth stemmed from growth in existing products.

To see what happened to China's export prices over this same period, Amiti and Freund (2008) construct an average export price index for goods that were exported from China to the US (for which reliable price data were available). This index is a weighted sum of the growth rates of the prices of products, where the weights are the products' shares in total value. The index indicated that China's average export prices of goods shipped to the United States fell by 13 percent in current US dollars between 1997 and 2005. In contrast, the price index for exports of these same products from the rest of the world to the United States increased by 6 percent.

[4] Defined as the price of exports divided by the price of imports.

More recent export price movements

More recently, import prices from China to the US have been increasing.[5] The US Bureau of Labor Statistics (BLS) started publishing a monthly US import price index for goods imported from China in December 2003. This index showed an average increase of 4.6 percent in the price of imports from China over the last year. Reports in the media have speculated about the reasons why this turnaround may be occurring. The increasing import prices have been attributed to higher wages in China and the $US/RMB appreciation.

To assess the driving forces behind the recent price increase in import prices from China, I constructed import price indices from China going back to 1997, and decomposed this overall index into end use categories. This index was constructed using annual unit value data (defined as the ratio of the value of imports to quantities) within finely disaggregated HS 10-digit categories using data from the US Census Bureau. This overall unit value index indicates a turning point in 2005 whereas the BLS price index turning point is in 2006. Further, the unit value index shows a higher recent price increase than that reported by the BLS (see Figure 3).

Disaggregating the unit value index by end use categories into industrial supplies, consumer goods and capital goods, my calculations showed that the largest import price increases from China were in industrial supplies (see Figure 4), which comprises 14 percent of US imports from China. Comparing prices of US imports from China with those from the rest of the world within these categories, the data show that import prices from the rest of the world rose even faster than those from China. The relatively higher price increases from the rest of the world may be due to the strong Euro and Canadian dollars, and the relatively lower price increases from China may be due to oil subsidies in China.

Industrial supply prices are increasing with oil price and commodity price rises. The turning point for industrial supply prices occurs in 2003, which coincides with the increasing growth of world oil prices as can be seen in Figure 5. It should also be noted that the imported input content of the plastics industry in China, a major industrial supply, is 76 percent, thus higher global oil and commodity prices would have an effect.

Turning to consumer and capital goods, the unit value indices show a more modest price increase than industrial supplies with a turning point in 2005, which coincides with the beginning of the $US/RMB appreciation. Although consumer goods prices from China have been rising recently, again this increase is lower than import price increases from the rest of the world.

Are higher wages in China driving these price increases? To answer this question requires information on unit labor costs and wage bill shares. Media reports and anecdotal evidence indicate that strong wage pressures in China have led to higher export

[5] Imports from China account for 20 percent of non-oil US imports.

prices. Reports on wages in China vary from around 10 percent annual increases (Standard Chartered, 2007) to around 15 percent annual growth (Chinese official wage statistics). However, to get a measure of unit labor costs also requires productivity growth data, which is even more difficult to measure. Rough estimates using value added per worker at the firm level between 2002 and 2004, show that a 10 percent increase in labor productivity leads to a 4 to 6 percent growth in wages and consequently lower unit labor costs. This estimate is based on a sample of only 8,000 exporting firms, a very small subset of the total number of exporters in China, and for an earlier period. However, if this pattern of labor productivity growing faster than wages is typical across other firms, then unit labor costs would actually be falling and would not therefore be pushing export prices up. In fact, productivity growth that is faster than wage growth is likely to reduce prices, which is consistent with falling China export prices, which turned around recently. To see whether the recent increases in export prices are caused by higher wages requires estimates of productivity growth.

Another important factor to consider in assessing whether wage growth is contributing to higher export prices is the wage share bill. Firm level data for exporters in China in 2004 show that for 90 percent of exporters the wage bill was less than 20 percent of the value of exports, and for 60 percent of exporters' wages were less than 10 percent of the sale price. The largest share of the sale price is due to the cost of materials. Of course, some of these materials are domestically purchased, which also comprise labor costs from China. But, as discussed above, a large share of exports is processing trade which comprises a large share of imported inputs. Thus wages do not appear to be a large share of the overall cost of exports.

Concluding Remarks

China's export growth has been spectacular. It is moving out of the more traditional labor intensive exports to high capital intensive sophisticated goods like consumer electronics. Comparing its export patterns with OECD countries shows an increasing similarity. Yet a large part of China's exports are in processing trade, relying heavily on imported intermediate inputs. The value added in China continues to be in the more labor intensive parts of the production process.

Up until recently, prices of goods exported to the US from China have been falling, exerting downward pressure on world prices. However, in the last few years, there has been a change in this trend with prices from China now rising. The biggest price increases in US import prices from China are in the industrial supplies categories, which is largely due to global increases in oil and commodity prices. The more modest increases in consumer goods prices are likely due to China's exchange rate appreciation against the US dollar. Most importantly, these price increases for US imports from China are still much lower than the price increases for imports from the rest of the world.

References

Amiti, Mary and Caroline Freund (2008), "An Anatomy of China's Export Growth," forthcoming in *China's Growing Role in World Trade*, ed. By Robert Feenstra and Shang-Jin Wei (Cambridge, Massachusetts: National Bureau of Economic Research).

Amiti, Mary and Caroline Freund (2007), "China's Export Boom," Finance and Development, International Monetary Fund, September, vol. 44(3).

Dean, Judy, K.C. Fung and Zhi Wang (2007), "Measuring the Vertical Specialization on Chinese Trade, US International Trade Commission, Working Paper 2007-01-A.

Ferrantino, Michael, Robert Koopman, Zhi Wang, Falan Yinug, Ling Chen, Fengjjie Qu and Haifeng Wang (2007), "Classification of Trade in Advanced Technology Products and its Statistics Reconciliation: The Case of China and the United States," Brookings-Tsinghua Center for Public Policy Working Paper Series 20070906EN.

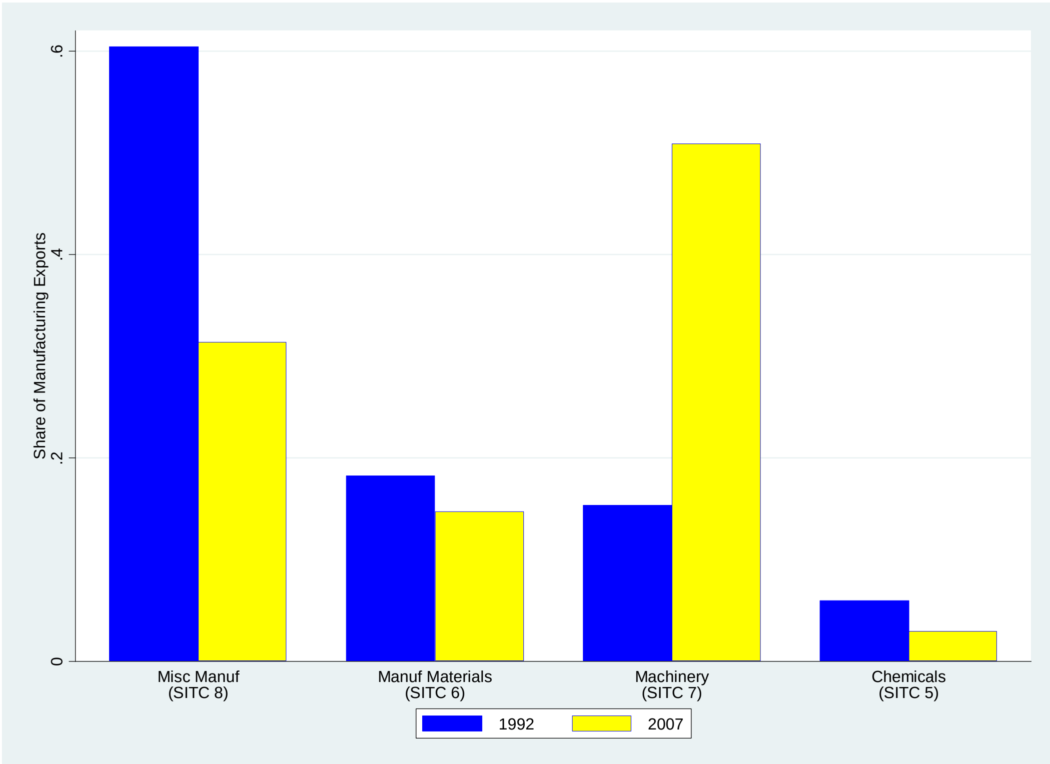
Koopman, Robert, Zhi Wang, Shang-Jin Wei (2008), "How Much of Chinese Exports is Really Made in China? Assessing Domestic Value-Added When Processing Trade is Pervasive," NBER Working Paper 14109.

Rodrik, D. (2006) "What's So Special About China's Exports?" NBER Working Paper 11947.

Schott, Peter K. (2008) "The Relative Sophistication of China's Exports," *Economic Policy*, January pp.5-49.

Appendix: Charts and Tables

Figure 1: Reallocation of Exports Across SITC 1-Digit Manufacturing Industries



Source: UN COMTRADE, and author's calculations.

Note: Column headings include the following industries:

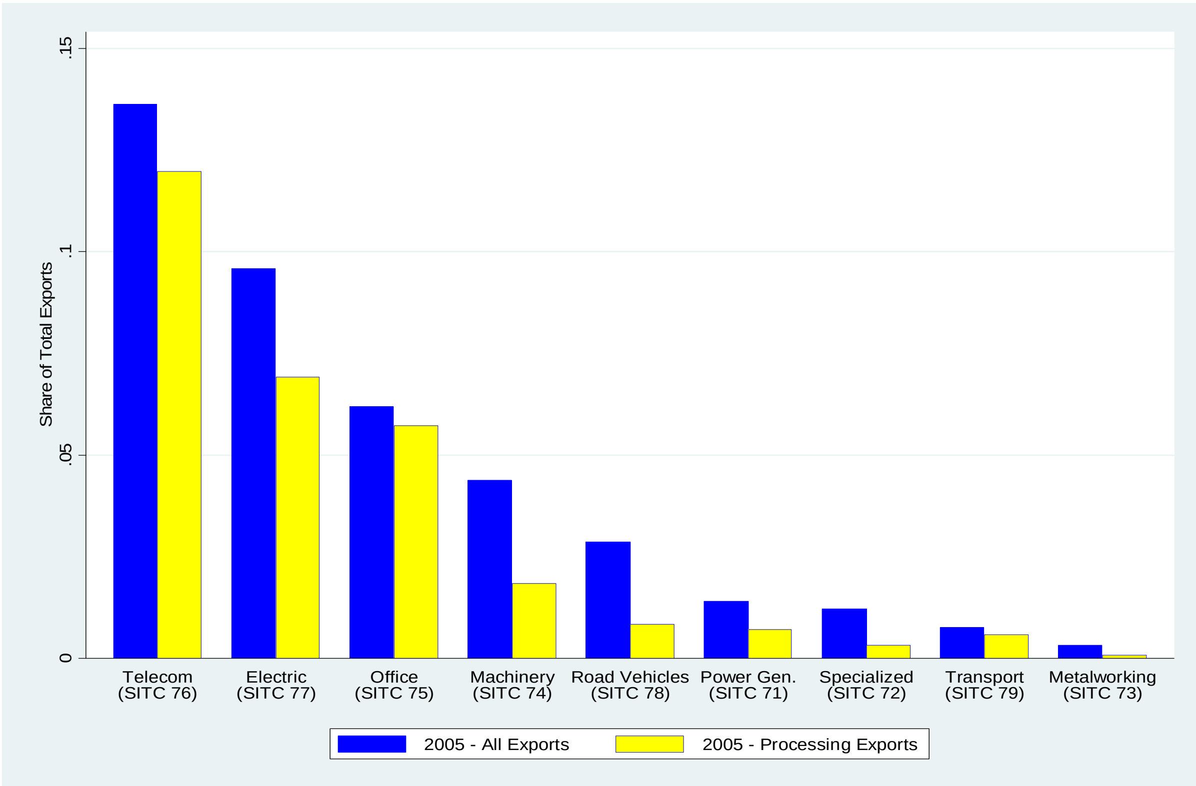
SITC 5: Chemicals, dyes, pharmaceuticals, and perfumes.

SITC 6: Leather, rubber, cork and wood products, textiles, metallic and non-metallic manufactures.

SITC 7: Industrial machinery, office machinery, telecommunications equipment, electrical machinery, transportation equipment.

SITC 8: Prefabricated buildings, furniture, travel goods, clothing, footwear, professional and scientific equipment.

Figure 2: Machinery Exports and Processing Trade



Source: China Customs, Amiti and Freund (2008)
Note: Column headings include the following industries:

SITC 71: Boilers, turbines, internal combustion engines, and power generating machinery.

SITC 72: Agricultural machinery, civil engineering and contractors' equipment, printing and bookbinding machinery, and textile and leather machinery.

SITC 73: Lathes, machines for finishing and polishing metal, soldering equipment, metal forging equipment, and metal foundry equipment.

SITC 74: Heating and cooling equipment, pumps, ball bearings, valves for pipes, and non-electrical machines.

SITC 75: Typewriters, photocopiers, and data processing machines.

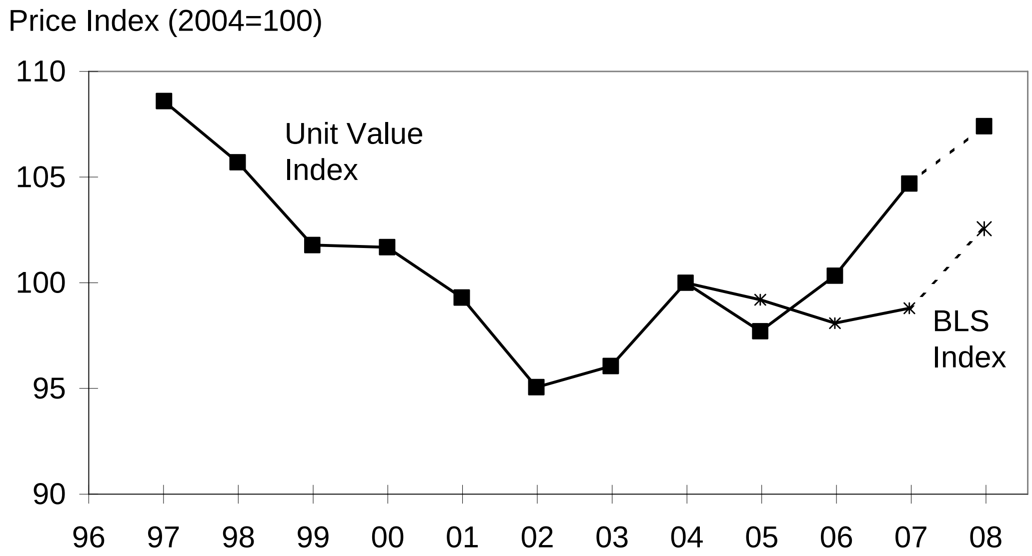
SITC 76: Television receivers, radio receivers, and sound recorders.

SITC 77: Equipment for distributing electricity, electro-diagnostic apparatus, and semiconductors.

SITC 78: Automobiles, trucks, trailers, and motorcycles.

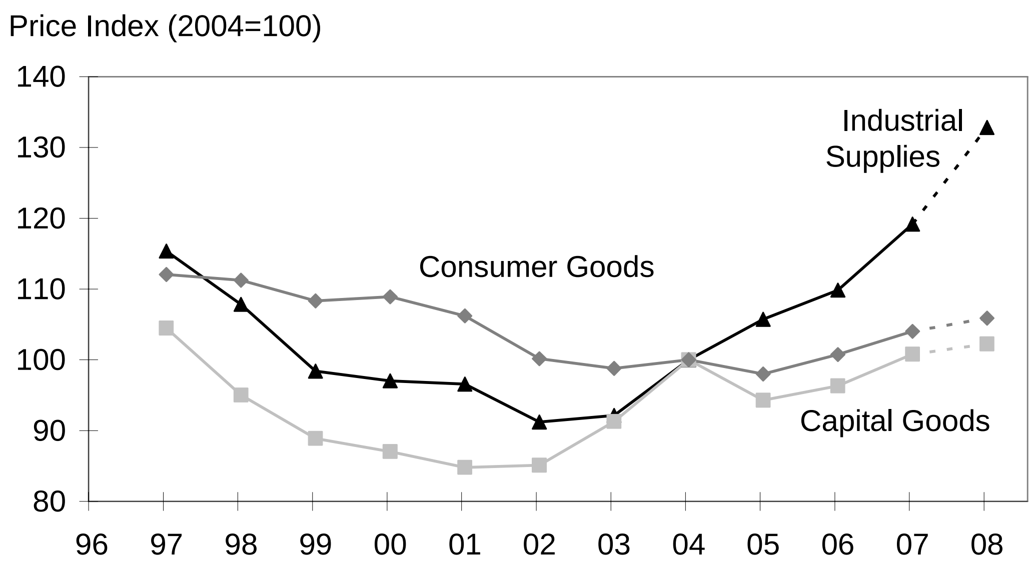
SITC 79: Railroad equipment, aircraft, ships, boats, and floating structures.

Figure 3: US Import Price Indices for China Imports



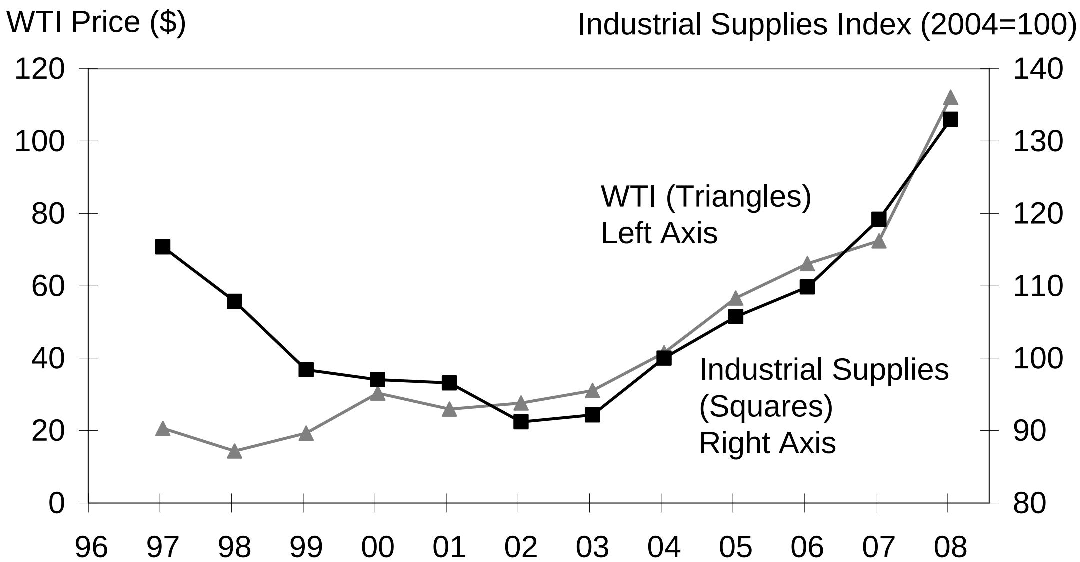
Source: BLS, US Census Bureau, and author's calculations

Figure 4: US Import Price Index for China Imports by end use



Source: US Census Bureau and author's calculations

Figure 5: Industrial supplies import prices and oil prices



Source: Federal Reserve Board of Governors, US Census Bureau, and author's calculations