Current Policy Perspectives

FEDERAL RESERVE BANK OF BOSTON™

No. 14-3

The Competitiveness of U.S. Manufacturing

Federico J. Díez and Gita Gopinath

Abstract

We study the competitiveness of U.S. manufacturing. For the period 1999–2012 we find little support for a significant offshoring reversal. We show that the share of domestic demand that is met by imports and the terms of trade show no signs of reversal, even in sectors dominated by imports from China. We do, however, find some evidence consistent with the U.S. shale-gas energy revolution raising the competiveness of U.S. energy-intensive sectors.

JEL codes: F41, F62, L60

Keywords: competitiveness, U.S. manufacturing, reshoring, onshoring

Federico J. Díez is an economist in the research department at the Federal Reserve Bank of Boston. Gita Gopinath is a professor in the economics department at Harvard University and a visiting scholar in the research department at the Federal Reserve Bank of Boston. Their email addresses are federico.diez@bos.frb.org and gopinath@harvard.edu, respectively.

This brief, which may be revised, is available on the web site of the Federal Reserve Bank of Boston at http://www.bostonfed.org/economic/ppdp/index.htm.

We thank Yifan Yu for superb research assistance. All remaining errors are our own.

This version: June 2014

1 Overview

U.S. manufacturing as a share of GDP has witnessed a secular decline over the last few decades. An important factor behind this decline is the substitution of domestic production with imports from low-cost developing countries, such as China. As developing countries undertook reforms to raise productivity in manufacturing, they were able to exploit their cost advantage in labor to take over a larger fraction of global production in manufacturing.

More recently, there have been suggestions of a revival in U.S. manufacturing, as its share in GDP has increased every year in 2010–2012. One channel through which revival can arise is from the increase in global demand for manufacturing arising from faster-growing emerging markets, like the BRICS.[1] This "demand channel" can raise U.S. manufacturing output. A second source of revival is a shift in demand towards U.S.-produced goods, away from other producers, because of a decrease in the relative price of U.S. goods. As wage costs have increased in developing countries, in line with rising per capita incomes, the cost advantage of developing countries has eroded. With this development and because U.S. unit labor costs have been relatively stable in the last few years, it has been increasingly suggested that U.S. manufacturing may be closing the competitiveness gap against its trading partners. Also, the shale gas revolution in the United States has given rise to expectations that, as energy costs decline, U.S. manufacturing should become more competitive. There have been suggestions that this "competitiveness channel" is at work, with anecdotal evidence that the phenomenon of offshoring of manufacturing has given way to onshoring or reshoring.[2]

[1] BRICS is the group of major emerging countries composed of Brazil, Russia, India, China, and South Africa.

[2] There are several examples of U.S. firms that recently decided to move production back from abroad. These include Apple's new plants in Texas and Arizona, General Electric moving

In this paper, we focus on the "competitiveness channel" and explore whether the evidence is consistent with a rise in the competitiveness of U.S. manufacturing. The main findings can be summarized as follows.

First, there is suggestive evidence that U.S. manufacturing may be experiencing a revival. Both the share of manufacturing in GDP and the share of U.S. exports in world exports show signs of improvement in recent years. The labor cost-based real effective exchange rate (REER) has depreciated by 17 percent since 2005.

Second, on closer scrutiny, there is less evidence of a significant offshoring reversal. At the aggregate level, the share of domestic demand that is met by imports and the terms of trade show no signs of reversal, in the period 1999–2012. This is true even for sectors dominated by imports coming from China, where one would expect the argument about increasing foreign labor costs to play a role.

Third, there is some evidence of the energy channel at work. Industries that have greater dependence on energy inputs experienced a relatively larger decline in their import ratios: a greater share of domestic demand was met with domestic production. This is consistent with the U.S. energy revolution raising the competitiveness of U.S. energy-intensive sectors.

Fourth, there is a weak link between REER movements and the terms of trade (TOT), consistent with the literature on low pass-through. Finally, the pass-through of demand shocks (demand channel) is faster than the pass-through of relative cost shocks (competitiveness channel).

The rest of the paper is organized as follows. Section 2 describes all the data sources we combine in our analysis. Section 3 presents the suggestive macroeconomic evidence that would indicate a manufacturing revival. Section 4 contains the

back the manufacture of washing machines and refrigerators to Kentucky, and Otis bringing back elevator production from Mexico to South Carolina.

core of our analysis: we introduce the share of domestic demand met with imports and we conduct numerous robustness checks. Finally, Section 5 concludes.

2 Data

We use data from several sources. For our suggestive macroeconomic evidence, we use data from the Bureau of Economic Analysis (BEA) to examine the share of manufacturing within GDP, data from the World Trade Organization (WTO) for the share of U.S. manufacturing exports in world exports, and data from the Organisation for Economic Cooperation and Development (OECD) for the real effective exchange rate.

The data for the imports-to-domestic demand ratio are from the BEA and the U.S. Census. We combine two databases. First, from the national accounts from the BEA we obtain data on gross output for 3-digit NAICS manufacturing industries (19 industries) for the period 1999 to 2012. Second, from the Foreign Trade Division we obtain detailed data on exports by industry and country of destination.

Finally, the price indices are constructed using data from the Bureau of Labor Statistics (BLS).

3 Suggestive Aggregate Evidence

There are a few macroeconomic facts that suggest that U.S. manufacturing might be experiencing a revival. We describe these factors next.

First, U.S. manufacturing as a share of GDP increased for three consecutive years in 2010–2012, yielding a participation gain of almost one percentage point

of the GDP. Figure 1 shows that the secular decline in manufacturing as a share of GDP is a 60-year-old phenomenon. The 2010–2012 period is the first time in several decades that manufacturing has been growing consistently faster than the overall U.S. economy.

Second, U.S. manufacturing exports as a share of world manufacturing exports have also shown a relative gain in recent years. Figure 2 shows that the share fell sharply between 2000 and 2008, with U.S. manufacturers losing 4.5 percentage points of world market share. This can mostly be explained by the surge of manufacturing exports from Southeast Asian and Asian countries (particularly China). Since then, the decline has subsided, and last year there was a slight 0.35 percentage point increase. While Figure 2 certainly does not indicate a revival of U.S. manufacturing exports, it does suggest that the decline may have ended and that the competitiveness of U.S. manufacturers might be such that one can expect moderate growth in U.S. share of world exports of manufactured goods.

Finally, the U.S. dollar has strongly depreciated relative to the currencies of the U.S. main trading partners. In Figure 3 we examine the evolution of the real effective exchange rate, that is, the exchange rate weighted by U.S. trading partners, and deflated using manufacturing unit labor costs (ULC). The figure indicates that the ULC-adjusted effective exchange rate has shown a declining trend over the past 10 years, with a cumulative real dollar depreciation of 30 percent since 2001. Thus, according to this commonly used measure, U.S. manufacturers should be enjoying an exchange-rate-driven significant gain in competitiveness.

This evidence, while suggestive of a revival in manufacturing competitiveness, may be a temporary phenomenon with no clear trend. The increase in the share of manufacturing in GDP could reflect the temporary collapse of the financial services

sector following the Great Recession.[3] The increase in the share of U.S. exports in world exports may reverse if the U.S. leads growth in the developed world. The depreciation of the manufacturing REER may imply little for prices of actual traded goods, given the evidence on low pass-through. In the next section, we investigate further other indicators that may speak directly to the competitiveness of U.S manufacturing.

4 U.S. Manufacturing Competitiveness

4.1 Share of Imports in the Domestic Demand for Manufactures

One measure that directly speaks to competitiveness is the share of imports in domestic demand for manufacturing. That is, we measure the ratio,

$$\frac{Imports}{Shipments - Exports + Imports}.$$

This measure controls for overall demand in a sector and computes the fraction of that demand that is met by imports versus the share that is met by domestic production. An offshoring reversal should show up as a decline in this share. We compute this measure using gross output as a proxy for shipments and we plot the manufacturing aggregate-level ratio in Figure 4.[4]

[3] Indeed, the most recent data indicate that the share declined slightly in 2013, consistent with recovery in the financial sector.

[4] Trade statistics on imports and exports are based on sales and not on value-added measures. To this extent there can be complicated measurement issues such as what portion of imports is truly foreign production value added, and similar concerns can arise for U.S. exports. Given that we are interested in time trends, our statistics are less affected by errors in measurement of the levels of exports and imports, but nevertheless issues can arise if there have been important time trends in the extent of round-tripping of products. Also, these measurement issues do not apply similarly to all sectors.

Figure 4 depicts the trend of offshoring of manufacturing over the last decade, with import shares rising from 20 to 29 percent. Importantly, using this measure we do not see anything suggestive of a reversal in offshoring. It could be that any evidence would show up only in the year 2013, but commensurate with the substantial trend depreciation of the REER over the last several years, we do not see any significant increase in the role of domestic production in meeting domestic demand for manufacturing.

Figure 5 plots the relative price of imports to producer prices, the price counterpart of the import ratio graphed in Figure 4. Consistent with the increase in import share until recently, we find a decline in the price of imports relative to domestic prices.[5]

It is worth mentioning that we do observe greater variation in the import ratios at the 3-digit industry level. Indeed, as shown in Figure 6, there is great heterogeneity in the ratio across industries, both in terms of levels and in terms of the evolution. For instance, while the import ratio for apparel products is almost 90 percent, it is less than 20 percent for petroleum and coal products. Likewise, while the ratio increased by over 20 percentage points for electronics, the increase for machinery or transportation equipment was only around 8 percent points. We find it reassuring that, in light of the energy revolution, the import ratio is decreasing for energy-intensive industries like petroleum and coal products and for chemical products. We explore these issues further in Section 4.5.

[5]The BLS provides the NAICS manufacturing data starting in 2005.

4.2 Import Prices and the REER

The REER suggests that the relative labor cost of production has declined over the last decade; however, there was no significant change in import shares as Figure 4 showed. This could firstly imply that the constructed REER mismeasures true costs of production. This is possible given the difficulty in measuring labor costs for a country like China. Secondly, it could capture the low pass-through of relative cost changes into the prices that customers face. There is substantial evidence of this, as surveyed in Burstein and Gopinath (2013).

In Figure 7 we plot the terms of trade (TOT). Since the BLS provides NAICS manufacturing import and export price indices going back only to 2005, we construct the terms of trade as the price of manufacturing exports over the price of manufacturing imports, where manufacturing is composed of the end-use categories capital goods, consumer goods, and vehicles. As evident in Figure 7 (and contrary to Figure 3) the TOT have risen over the last decade and have stabilized only since the Great Trade Collapse of 2008–2009. More specifically, the terms of trade have increased steadily since the second half of the 1990s, but have remained flat since 2010. This implies that any increase in competitiveness that shows up in prices is only a very recent phenomenon.

The disconnect between the REER and the TOT is evident in Figure 8, which superimposes the TOT and the REER. As is evident, the volatility of the TOT is substantially lower than that of the REER. This is consistent with the large body of evidence on low and delayed pass-through.

In Table 1 we report the correlation between relative quantities and prices. As can be seen, the correlation using the REER has the "wrong" sign. A real depreciation of the dollar is associated with an increase in the import share. On

the other hand, the terms of trade have the "right" sign for correlation with the import ratio.

Table 1: Import Prices and REER Correlations

	Import Ratio	*REER*	P_x/P_m *end-use*
Import Ratio	1	-0.71	0.96
REER		1	0.08
P_x/P_m *end-use*			1

The weak relation between relative prices and quantities was evident in the Great Trade collapse of 2008–09. As documented in Gopinath, Itskhoki, and Neiman (2012), except for the commodity prices that fell dramatically during the trade collapse, most of the downward decline in imports and exports was accounted for by quantity adjustments, and prices were relatively stable. While the trade collapse was much steeper among differentiated durable manufacturers than among nondurables, prices in both categories barely changed.

Another issue with testing the relation between prices and quantities is that the BLS-constructed import price index does not capture price changes associated at the time of introduction or when it is discontinued, but only captures price changes of goods that were in the sample on both dates. This index construction problem makes it harder to measure the impact of structural shifts such as offshoring and onshoring on prices.

4.3 Trade with China

The argument for the gain in competitiveness by the U.S. manufacturing sector relies on the increasing labor costs of those countries that act as chosen locations for the offshoring process. Since China has played a major role in this phenomenon, in this subsection we focus on the U.S.-China trade links.

Figure 9 plots the ratio of imports from China to total trade with China (imports plus exports). The high value of the ratio is indicative of the so-called imbalance in trade with China, with the United States mainly importing from China. However, there is some evidence that this imbalance has eroded to some extent with the share of imports declining from 86 percent in 2005 to 80 percent in 2012. This could reflect the faster GDP growth in China relative to that in the United States over the 2005–2012 period. Moreover, when we focus on manufacturing trade only, we observe that the imbalance is even higher, and the same general pattern is evident (with a decrease from 89 to 86 percent between 2005 and 2012).

In Figure 10, we plot the import-to-domestic demand ratio for sectors where China has a significant share in imports. Specifically, we plot the evolution of the average import ratio for those (10) 6-digit industries for which Chinese imports accounted for at least 40 percent of domestic demand in 2011.[6] We find these sectors reliance on China as a supplier has increased throughout the decade at an even faster pace than for the overall manufacturing sector. It is worth noting that this finding is at odds with the argument that U.S. manufacturing might be enjoying a revival due to increasing labor costs in countries like China.

[6]In order to look at a higher level of industry disaggregation, we construct the ratios using data on industry shipments from the Annual Survey of Manufacturers. At the moment, these data are only available through 2011.

4.4 Labor Intensity and TOT Movements

Next, we examine the relation between labor intensity and TOT movements to see whether there is any systematic relation between the two. We already showed that the relative price of imports is decreasing (P_m/P_x), consistent with the increasing import shares, and that, according to the REER, labor costs are declining in the U.S. relative to rest of the world. Thus, if relative labor costs of production are an important driver of the TOT, we should expect to see that sectors defined as being more labor intensive witnessed the smaller decline in P_m/P_x. The data suggest that this is not the case.

Indeed, we look at 3-digit NAICS data on price indices of imports and exports and combine them with several measures of labor intensity. In Table 2 we report the correlation between P_m/P_x and alternative measures of labor intensity. We find that not only is their correlation close to zero, but it has the "wrong" sign.

Table 2: Labor Intensity and TOT Correlations

Correlation with	P_m/P_x
Annual payroll / value added	-0.103
Production workers wages / value added	-0.101
Annual payroll / total value of shipments	-0.035
Production workers wages / total value of shipments	-0.042
Annual payroll / value of products shipments	-0.017
Production workers wages / value of products shipments	-0.025

4.5 Energy Requirements and Import Shares

Finally, we look at the effects of the energy revolution on the import share of domestic demand. Since shale-gas extraction took off in 2007, the U.S. economy has been predicted to become less dependent in the near future.[7] Therefore, one would expect to observe some offshoring reversal in those industries that rely more heavily on oil and gas products.

In order to analyze this, we use input-output tables to construct energy requirement coefficients for each 3-digit manufacturing industry. Specifically, these coefficients are constructed as the ratio of energy inputs to total intermediate inputs used by an industry, where the energy inputs are defined as the sum of the "oil and gas extraction" and "petroleum and coal products" inputs used by that industry. We then combine these energy requirement coefficients with the 2012–2010 changes in the industry-level import ratios (from section 4.1).

We conjecture that those industries with relatively higher energy requirements should present declining import ratios. However, since this revolution is only starting, these effects will be only preliminary.

In Figure 11 we observe that, indeed, there is a negative relationship between both variables (their correlation is -0.42), implying that those industries that have greater dependence on energy goods experienced a relatively larger decline in their import ratios. That is, a greater share of their domestic demand was met by domestic production.[8]

[7] A report from the International Energy Agency expects that the United States will meet all of its energy needs with domestic resources by 2035.

[8] In Figure 11, we dropped industry 324, petroleum and coal products, as an outlier, since its energy requirements are obviously extremely high. The negative relationship found in the figure, however, is robust to the inclusion of industry 324.

5 Conclusion

For the sample period 1999–2012 we find little evidence of significant gains in competitiveness in U.S. manufacturing. Indeed, the data show that U.S. demand for manufactures increasingly shifted from domestic to foreign producers for the period 1999–2012 despite the substantial depreciation of the U.S. REER. This might be due to the weak link between the REER movements and the TOT (consistent with the literature on low pass-through). On the other hand, there is some evidence that the U.S. energy revolution has raised the competitiveness of U.S. energy-intensive sectors.

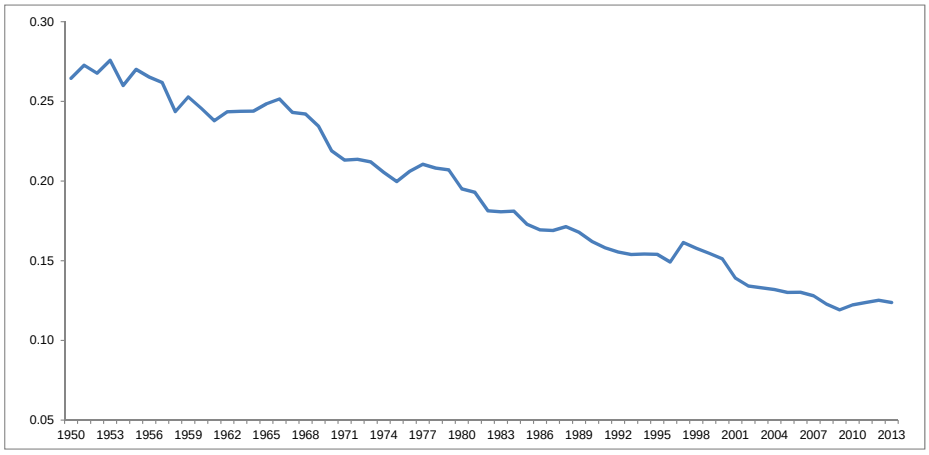
It is, however, important to note that both the labor cost channel and the energy channel are relatively young phenomena, so it is possible that with a few more years of data we may see a distinct break from the historical trend of rising import shares for the United States.

References

Burstein, Ariel, and Gita Gopinath. 2013. "International Prices and Exchange Rates." Forthcoming in *Handbook of International Economics*, Volume 4, eds. Elhanan Helpman, Kenneth Rogoff, and Gita Gopinath. Elsevier.

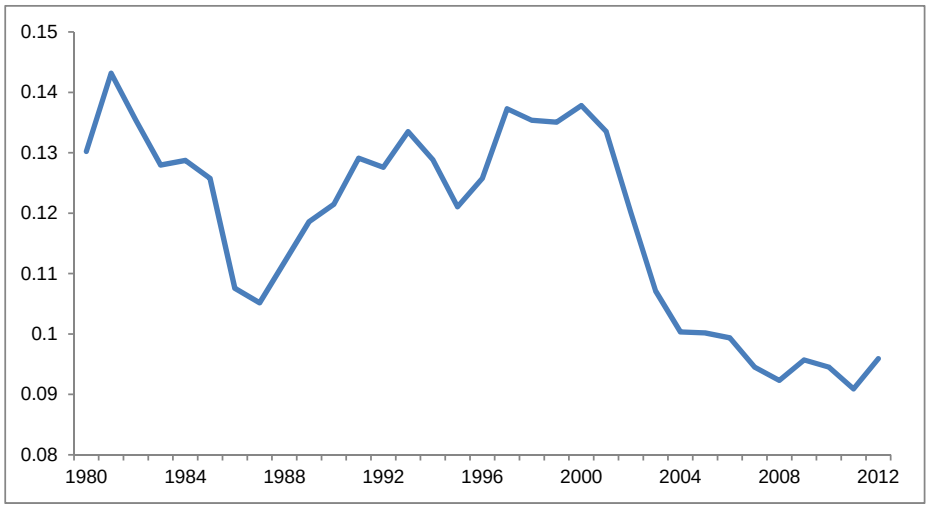
Gopinath, Gita, Oleg Itskhoki, and Brent Neiman. 2012. "Trade Prices and the Global Trade Collapse of 2008–09." *IMF Economic Review* 60: 303–328.

Figure 1: Manufacturing Share of U.S. GDP



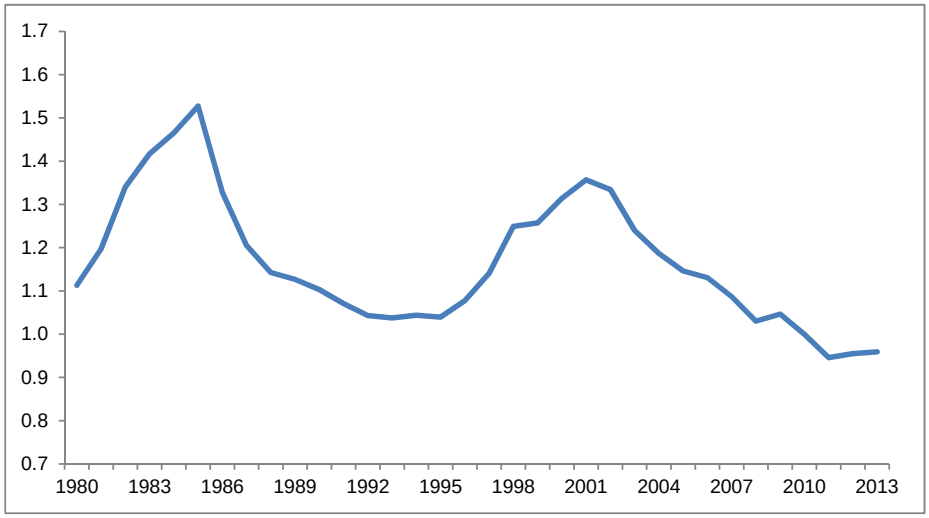
Source: authors' calculations and U.S. Bureau of Economic Analysis.

Figure 2: U.S. Manufacturing Exports as a Share of World Manufacturing Exports



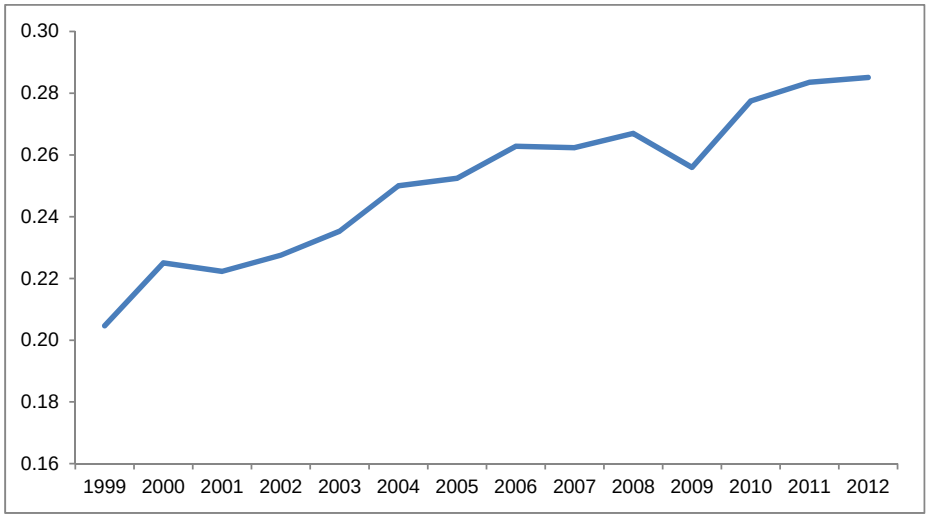
Source: authors' calculations and World Trade Organization.

Figure 3: ULC-adjusted Real Effective Exchange Rate



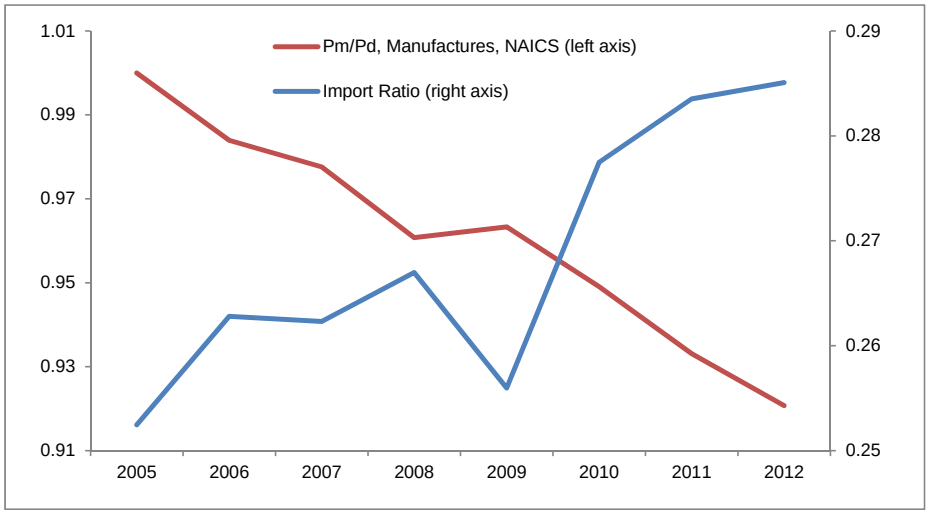
Source: Organisation for Economic Cooperation and Development.

Figure 4: Ratio of Manufactures Imports to Domestic Demand



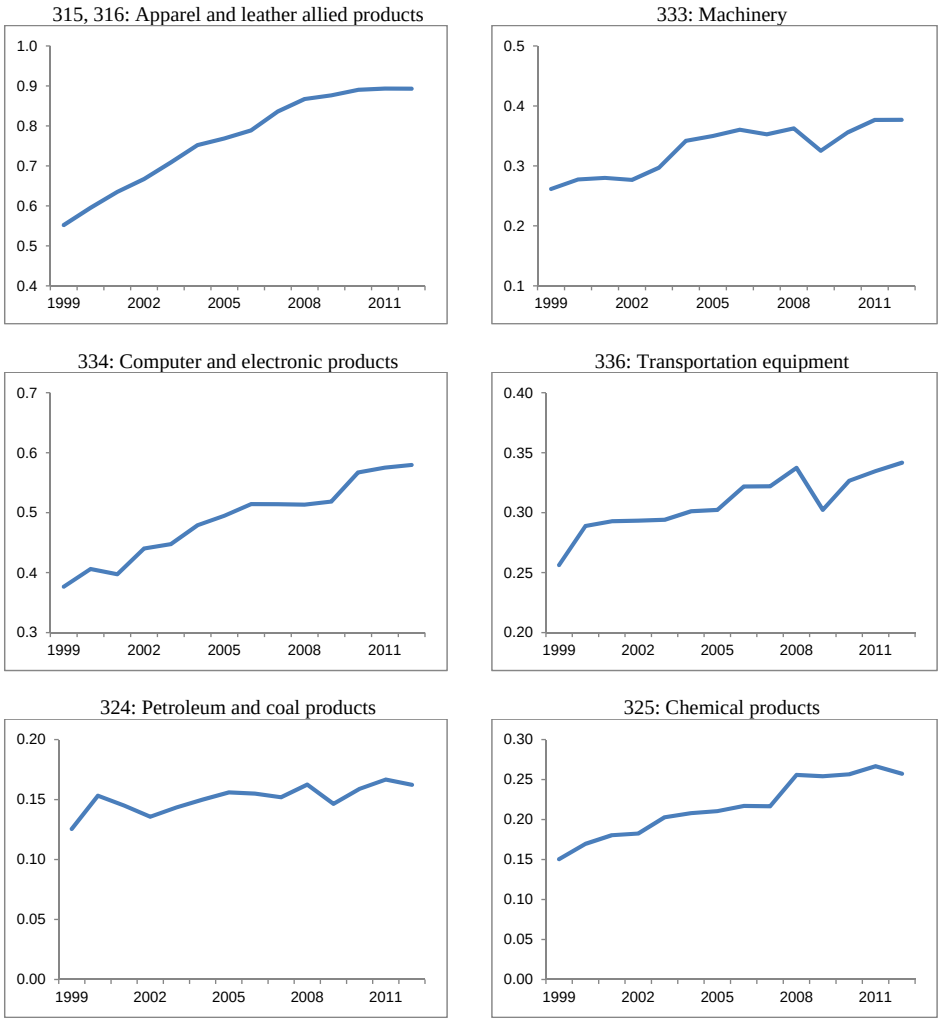
Source: authors' calculations, U.S. Census, and U.S. Bureau of Economic Analysis.

Figure 5: Import Ratio and P_m/P_d



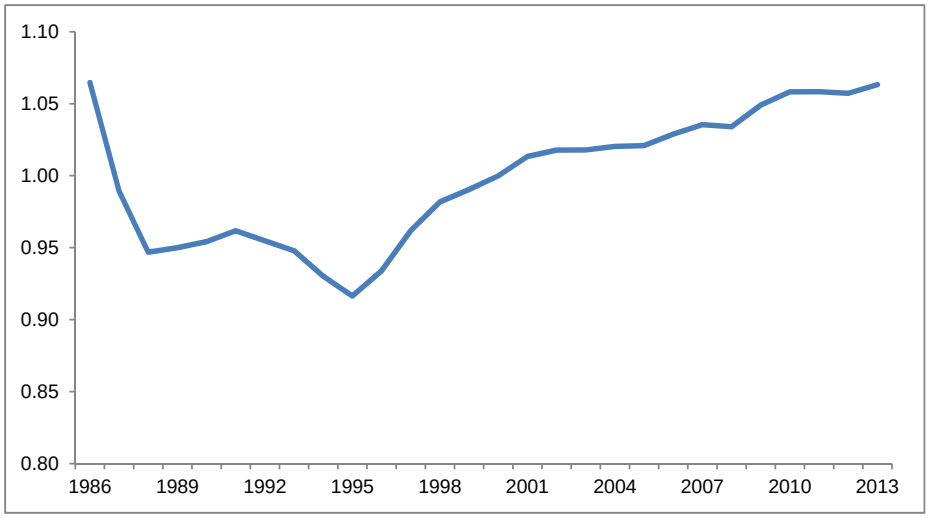
Source: authors' calculations and Bureau of Labor Statistics.

Figure 6: Manufactures Imports to Domestic Demand Ratio
(Selected Industries)



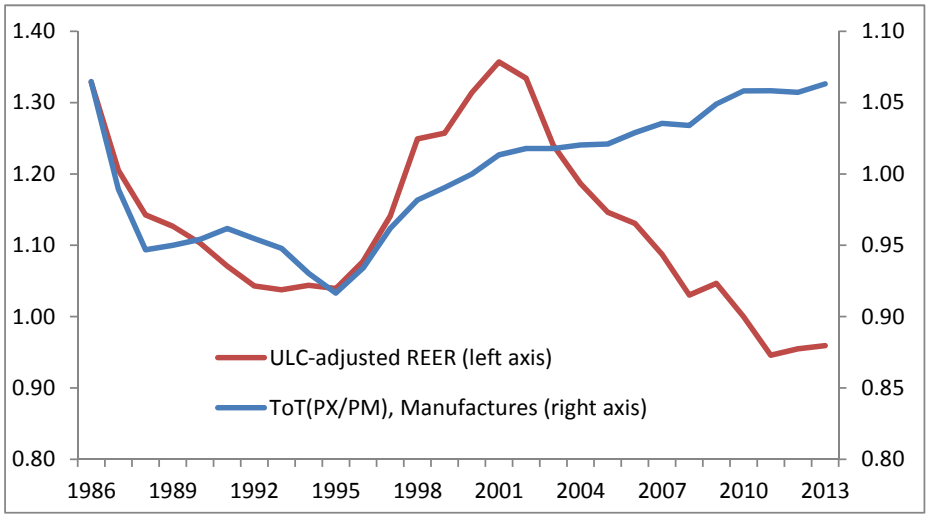
Source: authors' calculations and U.S. Census.

Figure 7: Manufacturing Terms of Trade



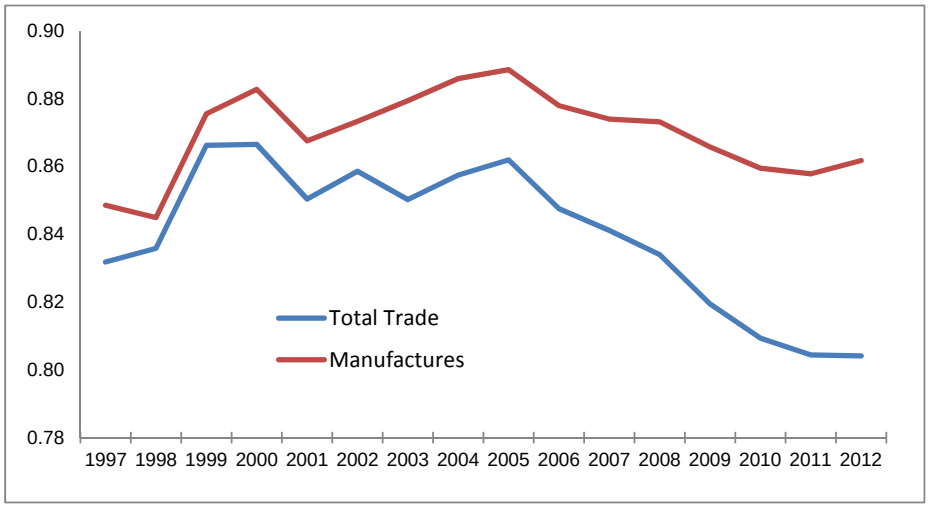
Source: authors' calculations and Bureau of Labor Statistics.

Figure 8: Manufacturing Terms of Trade and REER



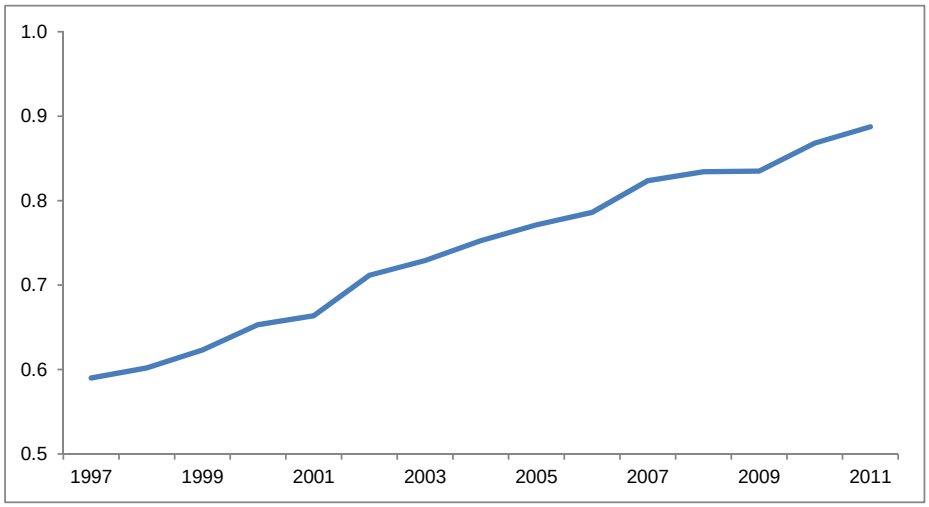
Source: authors' calculations, Bureau of Labor Statistics, and Organisation for Economic Cooperation and Development.

Figure 9: Imports from China / Total Trade with China



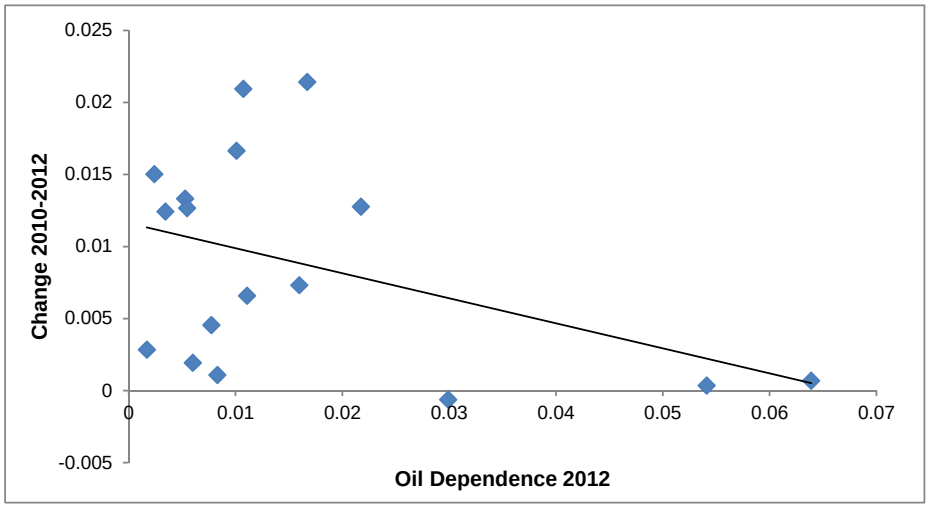
Source: authors' calculations and U.S. Census.

Figure 10: Import Ratio for Industries with Large Chinese Imports



Source: authors' calculations and U.S. Census.

Figure 11: Change in Import Ratios and Energy Requirements



Source: authors' calculations, U.S. Census, and U.S. Bureau of Economic Analysis.