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China's Rise and American Welfare

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The strong performance of China over the past decade, and forecasts that it could be sustained in the decades ahead, does not meet acclaim in all quarters, especially the United States. American international economic policy has traditionally presumed that foreign economic growth is in America's economic interest. As President Kennedy once put it, "a rising tide lifts all boats." But when it comes to China's rise, many are not so certain. The American public is primarily worried about jobs, and when emerging economies grow rapidly by exporting more manufactured goods (China) and services (India), they provoke concerns in the public that they are creating unemployment and reducing wages. Some prominent economists have added to these concerns. Nobel Laureate Paul Samuelson (2004) suggested that Chinese growth could reduce American welfare by lowering its gains from trade, and Lawrence Summers, the former head of President Obama's National Economic Council, argued that Chinese growth hurts the United States by raising world oil prices.

These concerns are consequential for all who seek effective global cooperation. If foreign growth does threaten US prosperity, the possibilities for such cooperation are in jeopardy. While it could still be in the US interest to promote growth in developing countries for altruistic or national security reasons, such cooperation becomes much less attractive if it is viewed as coming at the expense of US economic welfare.

In my recent book with Lawrence Edwards (Edwards and Lawrence 2013) we have studied this question. Our analysis suggests that some of these concerns are misplaced and that trade with emerging economies such as China has been found guilty of many outcomes for which it is not responsible. Many Americans blame imports and the US trade deficit for shrinking employment in manufacturing, for example. Trade has certainly played a role, but we find that rapid productivity growth and American spending choices are far more important. Many think trade with China will make Americans poorer because China has become a more formidable competitor. But we find that Chinese growth actually raises American living standards because, for the most part, it is not (yet) competing head-to-head with most US exporting industries, and it provides America with imports at relatively low prices. Many think that rapid demand growth in emerging economies is the main reason for the rise in oil prices over the past decade, but we find that the failure by advanced economies to increase domestic production was the more important factor and that the United States has become more self-sufficient in oil and thus less vulnerable to higher oil prices.

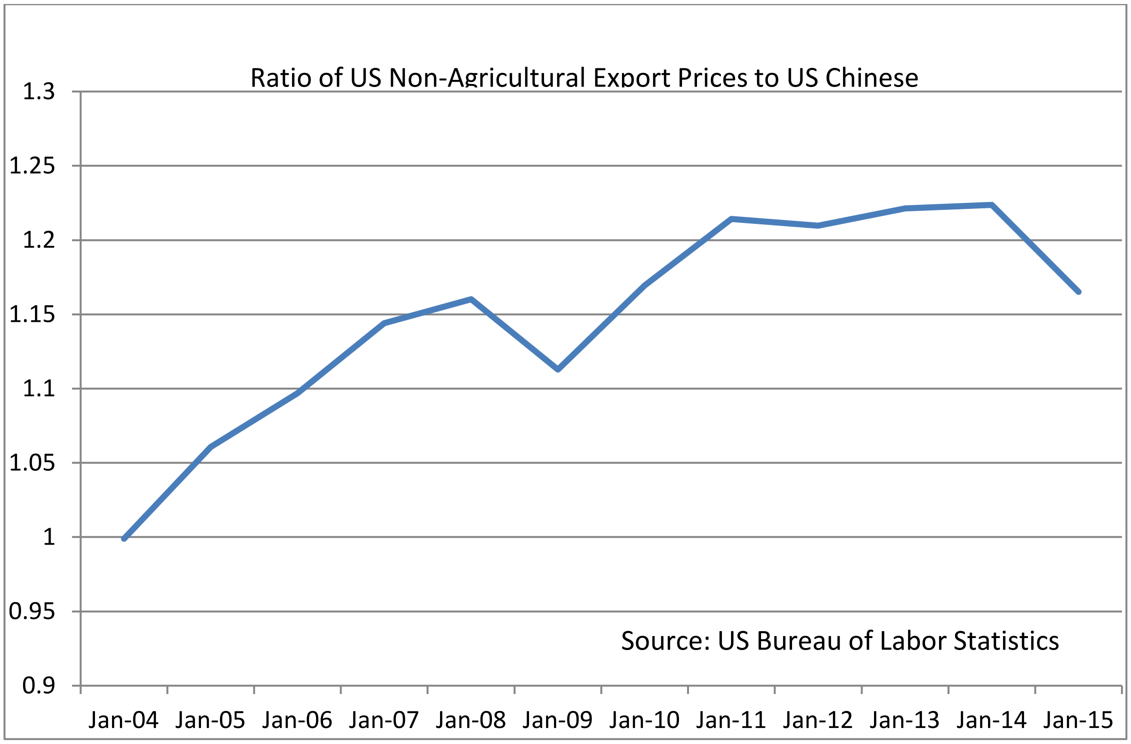
To be sure, trade presents challenges. Some imports from emerging economies have caused harm, as trade-related job losses hurt specific communities and are costly for displaced workers. But as I will demonstrate, in the long run there are benefits to America that more than offset these costs, and thus the correct response to these problems is not to raise trade barriers but to improve aid to workers who are displaced and equip them with the skills to compete.

In this paper I present evidence that supports these conclusions. In section I, I consider whether the United States and China are competitive or complementary in their trade patterns. In section II, I consider the impact of Chinese imports on the US employment; in section III, the impact of trade on wages and the costs of dislocation; and finally in section IV, I undertake an exercise that shows the high benefit-to-cost ratio of US trade with China.

Section I: Is US-China Trade Competitive or Complementary?

Paul Samuelson (2004) famously argued that Chinese growth might not be favorable for the United States if China developed in a way that drove down US exports prices and raised US import prices. However this does not appear to have been the case over the past decade. Indeed, figure 1 shows the relative price of US exports of nonagricultural goods compared with the prices of goods that the US imports from China. What is clear is that between 2004 and 2011 there was a strong upward trend in US terms of trade—although in recent years, the gains have ceased growing.

Figure 1 US terms of trade with China



While US imports from China have grown rapidly, an important issue is the degree to which the United States and China compete directly in export markets. One way to determine this is to explore whether the products they export overlap. To do this Edwards and Lawrence (2013) have developed similarity indexes that subtract the export shares of each product in the exports of each partner and then to sum them. Thus, this involves (1) calculating shares of each commodity, (2) summing the absolute difference in these shares, (3) dividing the result by 2, and (4) subtracting that result from unity.

If X_i is the share of commodity i in imports from country X and Y_i the share of commodity i in imports from country Y, then we first calculate the absolute difference in the share of each commodity.

$$\left| X_i - Y_i \right| . \quad (1)$$

We then divide the sum of these differences by 2 and subtract the resulting value from 1 to provide a similarity index SI_{XY} between X and Y that equals zero when the two series are completely different and 1 when they are completely similar.

$$SI_{XY} = 1 - \sum_i \left| X_i - Y_i \right| / 2 \quad (2)$$

We have calculated the export similarity of each country reported with the exports of countries in the Organization for Economic Cooperation and Development (OECD) using data at the 10-digit HS level. These calculations show Vietnam as the most different exporter compared with the advanced countries and also that while China became more similar between 1990 and 2006 with its index rising by 0.10, the composition of Chinese exports remained very different from that of the developed countries. Table 1 also shows overlap at the 6-digit level with US exports in the second panel. Again, we see that the mix of Chinese exports was very different from that of the United States and considerably less similar to developed countries such as Japan, Germany, and Canada.

Table 1 Export similarity indices for manufactured goods

(A value of 0 implies no similarity; higher numbers imply greater similarity.)

Export similarity with high-income OECD country exports to US, HS 10 digit data					**Export similarity with US exports, 6-digit data**			
	1990	**2000**	**2006**	**Change 1990-2006**	**1990**	**2000**	**2006**	**Change 1990-2006**
Vietnam		0.03	0.08			0.04	0.07	
Hong Kong	0.22	0.19	0.18	-0.04	0.21	0.21	0.2	-0.01

India	0.08	0.13	0.18	0.1	0.09	0.15	0.21	0.12
Singapore	0.18	0.18	0.19	0.01	0.22	0.24	0.24	0.02
ASEAN-4	0.18	0.23	0.19	0.01	0.17	0.26	0.24	0.07
China	**0.15**	**0.25**	**0.25**	**0.1**	**0.11**	**0.24**	**0.26**	**0.15**
Taiwan	0.27	0.28	0.26	-0.01	0.27	0.33	0.31	0.04
Other developing countries	0.22	0.24	0.26	0.04	0.22	0.23	0.27	0.05
France	0.31	0.33	0.32	0.01	0.38	0.39	0.4	0.02
Mexico	0.33	0.41	0.39	0.06	0.3	0.37	0.37	0.07
United Kingdom	0.41	0.44	0.43	0.02	0.45	0.47	0.43	-0.02
Korea	0.28	0.34	0.44	0.16	0.23	0.3	0.34	0.11
Other developed countries	0.49	0.51	0.54	0.06	0.41	0.43	0.45	0.04
Japan	0.61	0.6	0.55	-0.06	0.42	0.46	0.4	-0.02
Germany	0.5	0.54	0.56	0.06	0.41	0.47	0.47	0.06
Canada	0.53	0.55	0.56	0.04	0.39	0.43	0.45	0.06

Source: Edwards and Lawrence (2013)

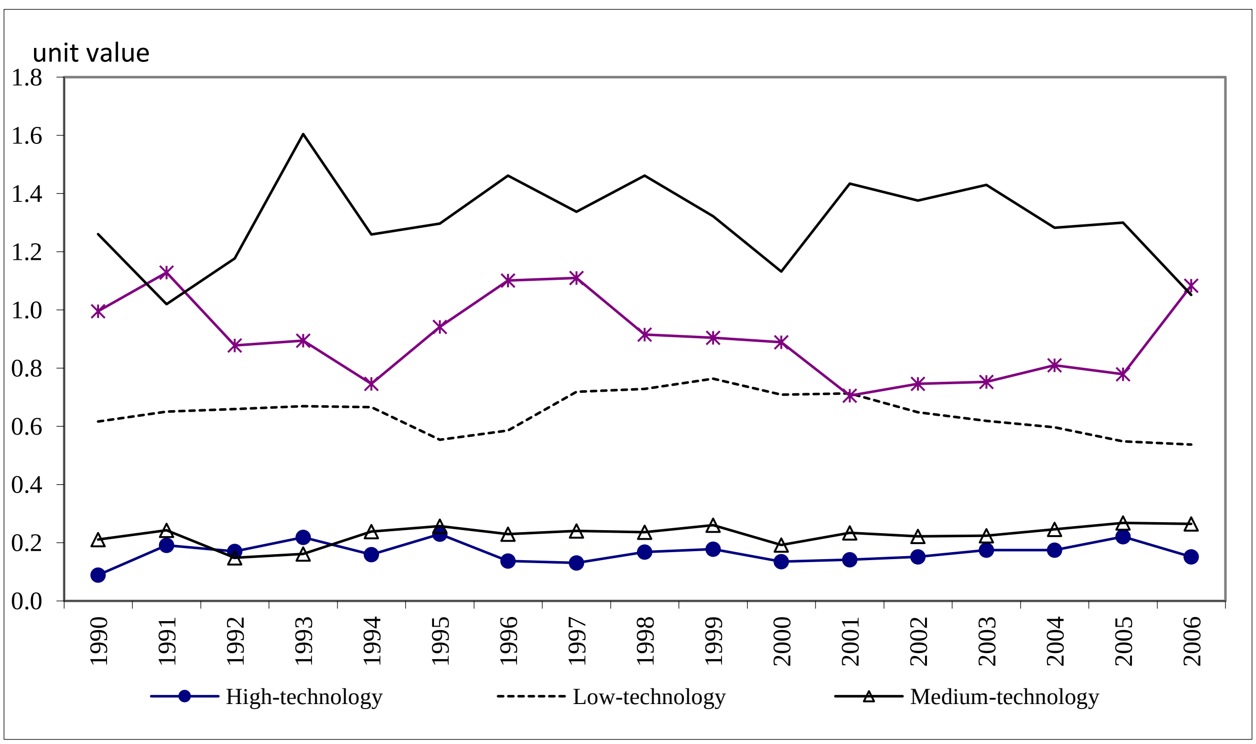
The data reveal the weak overlap in the export bundles of developing countries with the United States and other developed countries. Products that accounted for 50 percent of US imports from China in 2006 made up just 8 percent of US imports from high-income OECD countries and 11 percent of US exports. In contrast, these products accounted for 52 percent of US imports from the Association of Southeast Asian Nations (ASEAN 4, Indonesia, Malaysia, the Philippines, and Thailand), 37 percent from Vietnam, but less than 10 percent from India and the category for other developing countries. Interestingly, these products made up 27 percent (Hong Kong) to 56 percent (Singapore) of US imports from selected high-income Asian economies, suggesting that the head-to-head competition is taking place between China and other countries within the Asian region rather than with other high-income economies, including the United States. A similar story is evident if we look at products accounting for 80 percent of US Chinese imports. These constituted just 21 percent of US imports from high-income OECD countries and 23 percent of US exports in 2006, but up to 76 percent of US imports from the ASEAN 4 and over 47 percent from the selected high-income Asian economies. It is clear that by and large the goods the United States imports from China are very different from those that it exports or that are exported to the United States by high-income countries outside of Asia. *Most Chinese exports are not competing with the bulk of US or other developed-country exports, but they are competing with the rest of Asia.*

There has been some convergence in the composition of developed- and developing-country exports, but are the developing countries producing the same products in the categories in which exports overlap? To answer that question we turn to unit value data, which are obtained by dividing trade values in a particular category by a measure of quantity such as dozens or kilograms. If US exports or imports from developed countries are similar to exports from developing countries in quality, composition, and price, we would expect them to have similar unit values. But in fact the unit values of US imports from developing countries are actually substantially lower than those of equivalent products imported from high-income OECD countries and products exported by the United States. Further, unlike the export similarity indices that indicate rising across-product similarity in developing-country exports with US exports, the unit value ratios reveal no such convergence. All told, these results suggest that although developing countries are increasingly exporting in categories in which developed countries also specialize, they are selling different and cheaper types of products.

But there is an important qualification to this conclusion. Sanjaya Lall (2000) has classified products at the 3-digit level of the SITC level into primary products and resource-based, low-technology, medium-technology, and high-technology manufactures. High-income country exports to the United States are concentrated in medium- and high-technology manufactures, and there has been little change in this structure over the full period. Contrast this with Chinese exports to the United States. In 1990, 74 percent of US imports of manufactured goods from China were made up of low-technology products (mainly clothing) and only 7 percent of high-technology products. By 2006, high-technology products accounted for 35 percent of US imports of manufactured goods from China, with all of the increase attributable to electronics and electrical products. The share of high-technology products in US imports from other low- and middle-income countries also rose, but at a slower pace, from 18 to 25 percent. The rising "technology intensity" of developing-country exports (especially China) to the United States appears to confirm concerns about head-to-head competition with the United States in those products where America has a comparative advantage. However, import values obscure a high degree of within-product specialization. We therefore reevaluate the apparent rise in sophistication of developing-country exports to the United States using unit value data.

Figure 2 presents the weighted-average unit value of US imports relative to US exports of manufactured goods for the period from 1990 to 2006. The relative prices of resource-based, low-technology, and primary manufactures range between 0.5 and 1.4 for China. This is to be expected, as these products, particularly resource-based ones, tend to be relatively undifferentiated. Medium- and high-technology products are different. The unit values of US imports from China of these products lie between 15 and 30 percent of the equivalent products exported by the United States. Further, remarkably, there was no significant movement in these relative prices over the entire 16 years covered in the sample. Looking at the average for all developing countries, the level of relative prices is slightly higher than for China alone, but there is also no change in the trend over time.

Figure 2 China's export prices relative to the Prices of US exports, 1990–2006



Source: Edwards and Lawrence (2013)

Note: Individual country averages are calculated using total US exports as weights. Weighted averages for regions are calculated by aggregating the country-level average using total bilateral import values as weights. The group “Primary products” reflects manufactures (NAICS 331–333) classified as primary products by Lall (2000).

Source: Authors’ calculations based on 6-digit Harmonized System data.

In sum, although they have become more similar over time as judged by export shares, the United States and developing countries specialize in product categories that for the most part do not overlap. Moreover, even when exports are classified in the same category, there are large and systematic differences in unit values (average prices) that suggest the products made by developed and developing countries are not very close substitutes—developed-country products are far more sophisticated. This finding cannot be dismissed as simply the result of developing countries producing more intermediate products in each category—in other words, as simply reflecting global supply chains. We find it holds as well in categories that include only finished goods. These differences in prices are not apparent for all types of products, however. Export prices of developed and developing countries of primary-commodity-intensive products are typically quite similar. Think steel or copper. Prices of standardized (low-tech) manufactured products exported by developed and developing countries are somewhat similar. Think clothing. By contrast, the medium- and high-tech manufactured exports of developed and developing countries differ greatly. Think autos, pharmaceuticals, and electronics.

High-tech products are characterized by a greater scope for product differentiation, enabling US producers in these sectors to better insulate themselves from foreign competition from emerging-market exporters. Further, as we demonstrate in our book, the average quality of developing-country exports is low compared to exports from high-income countries, particularly in high-tech products. Therefore, not only are the prices of developing-country exports on average low, but the quality of these exports is relatively low too. Moreover, the average gap in quality between the exports of developing countries as a group and US exports has not narrowed over time.

All told therefore, the detailed analysis of trade composition and unit values confirms the aggregate behavior of the US terms of trade with China. They suggest that the concerns raised by Paul Samuelson certainly do not apply to US trade with China in the past. It is of course possible that the favorable terms of trade trend could change in the future. It is also likely that as they grow, developing countries will move into the production of more sophisticated products, and that as wages rise in China, the country's most labor-intensive manufactured exports will become more expensive. But given the fact that per capita incomes of China and India are still far less than those of the United States, these developments are likely to reach significant magnitudes only several decades from now. If we assume, for example, that the United States grows at 2.7 percent per year between 2010 and 2030, while China and India average growth of 6.7 and 7.4 percent, respectively, then China and India will respectively reach 59.7 and 26 percent of US per capita incomes on a purchasing power parity basis only by 2030.

As large developing countries converge more closely to developed-country per capita levels, the mix of goods and services they export could shift to resemble more closely the exports of today's industrialized countries in both composition and sophistication. While some changes of this nature are already apparent, especially in leading emerging economies such as Korea and Taiwan, if the experience is similar to the earlier convergence of Europe and Japan to US per capita income levels, the challenges are only likely to occur on a sizable scale quite far into the future. Moreover, this convergence in income levels will give rise to two countervailing forces. On the one hand, it could, as Samuelson has argued, reduce America's gains from trade by raising import costs and providing more competition for US exporters. On the other hand, convergence could also lead to more intra-industry trade of the kind that is typical between countries at similar income levels. This would generate more gains from trade for the United States by increasing product variety through more opportunities to exploit economies of scale. The net impact of these two effects could in principle go in either direction.

Section II: Lost Jobs: The Role of US Imports from China in the Dislocation of American Workers.[1]

[1] This section draws heavily on Lawrence (2014).

While the concerns of economists have been on welfare, the concerns of the US public about trade with China have focused on jobs. And over the past decade, US imports from China have grown rapidly at a time when US employment in manufacturing has fallen dramatically and the United States has experienced two large recessions. In practice, however, it is not easy to translate import volumes into estimates of the impacts of the aggregate adjustment costs imposed on individual workers. Nonetheless, an extreme estimate of displacement can be obtained by assuming: (a) that every dollar that Americans spend on Chinese imports substitutes for a dollar they were spending on similar products made in the United States; and (b) that the labor that was producing that US output was actually laid off. Such an approach would provide an upper-bound estimate of worker displacement by ignoring the possibility that adjustment could occur through voluntary attrition and ignoring that import growth could occur because of additional demand for imports, rather than the displacement of a given level of spending on domestic products.

One way to obtain this upper-bound estimate is to use an input-output table that indicates for each dollar of final demand, the employment that is required from every US industry. Since most Chinese imports are manufactured products and the manufacturing sector has been a focus of particular concern, I start by considering US manufacturing employment. As shown in Table 2 using the input-output tables for total employment requirements provided by the Bureau of Labor Statistics indicates that, in 2000, replacing manufactured imports from China would have required 695,000 US manufacturing jobs. In 2007, a similar calculation indicates that replacement of manufactured imports would have required 2.02 million US manufacturing jobs.[2] This suggests that between 2000 and 2007 the US manufacturing labor content equivalence of the growth of Chinese imports averaged an increase of 188,000 manufacturing jobs per year.[3] Since 2007, US manufactured goods imports from China have continued to increase, rising from $315 billion in 2007 to $356 billion and $450 billion in 2010 and 2012 respectively. But the growth in output per worker in the United States implies that, despite the 43 percent rise in

[2] Between 2000 and 2007 value-added per full-time employee in US manufacturing increased from $81.6 thousand to $122.3 thousand. Thus although the value of imports from China tripled, the employment equivalence increased by only 109 percent.

[3] Robert Scott (2010) undertakes a similar analysis and obtains somewhat larger job content estimates. Whereas my approach assumes that had domestic products been more expensive, Americans would have purchased a smaller volume of them (i.e., a unitary demand elasticity), his approach implicitly assumes a zero demand elasticity. He estimates that between 2000 and 2010 the average increase in Chinese manufacturing jobs content was 200,000 per year. “Between 2001 and 2011, the trade deficit with China eliminated or displaced more than 2.7 million U.S. jobs, over 2.1 million of which (76.9 percent) were in manufacturing.”

imports from China between 2007 and 2012, the manufacturing employment content of these imports was just 90,000 higher in 2012 than in 2007. This is a good example of the powerful role that increased productivity growth has played in reducing employment growth in US manufacturing. In sum, over the period 2000 to 2012 this implies an annual average change of 116 thousand per year. In addition, over the same period there was an increase in the employment equivalence of 55 thousand outside manufacturing, for a total of both manufacturing and non-manufacturing jobs of 192 thousand jobs per year.

Table 2

US Employment Equivalence of US Manufacturing Imports from China, 2000 - 2012.

	2000	2007	2010	2012	Annual change over: 2000-2007	2007-2012
Manufacturing Imports from China ($ Billions)	$97	$315	$356	$450		
US Employment Equivalence (millions)*						
Manufacturing jobs	0.70	2.02	2.01	2.10	0.189	0.018
Total jobs	1.29	3.03	2.90	3.35	0.249	0.090

Note: * Estimated using input-output tables
Source: USITC Data Web and BLS
http://www.bls.gov/emp/ep_data_input_output_matrix.htm

Demand versus Supply

This use of *ex post* data to infer impacts on actual changes in US employment is problematic, however, because it estimates the job content of *all* import growth and fails to distinguish the reason imports have increased, in particular whether demand or supply has shifted. When Americans increase their spending, sales of both domestic and imported products will increase and there might be no actual decline in US employment -- indeed imports and domestic employment might both increase. On the other hand, if imports increase because the foreign supply curve shifts outwards, and import growth reflects an increase in the foreign share of a given amount of domestic spending, domestic employment opportunities would actually be lost. In the case of an expansion in US demand, job opportunities might be reduced in the hypothetical sense that Americans might have bought more domestic products had imports not existed. But if the concern relates to actual dislocation, it is preferable to undertake estimates in which causation is explicitly accounted for and supply and demand shocks are explicitly distinguished.

In this regard, the work of Acemoglu et al. (2014) on Chinese imports is especially helpful. These authors invest considerable effort to isolate the employment impacts that can be ascribed to supply rather than demand shifts. They use Chinese exports to third countries to capture import growth that reflects Chinese productivity growth rather than an increase in US demand. Using input-output analysis, they supplement this direct impact on specific industries with estimates of additional effects on downstream industries, which lose inputs, and upstream industries, which lose customers. This leads them to conclude that the overall job loss in manufacturing between 1999 and 2011 was 985 thousand and between 1999 and 2007 they estimate the job loss as actually large 1054 thousand. (i.e., somewhat more than for the longer period). These annual estimates are about 30 percent less than the input-out estimates of manufacturing jobs obtained in the input-output analysis I report in Table 1. Between 1999 and 2011 *overall* US employment in manufacturing declined by 5.4 million. This suggests that absent imports from China, under the assumption the United States would have replaced its Chinese imports with local production, the **decline** in manufacturing employment would have been less by 18 percent. In other words the broad US experience of declining employment in manufacturing would actually have been quite similar (even if somewhat smaller) without Chinese import growth. Acemoglu et al. do obtain somewhat higher estimates than I do for the non-manufacturing employment -- another 994 thousand, so that their estimate is only 15 percent smaller than my total input-output estimates of jobs lost.

Voluntary and Involuntary Separations

In this context, the distinction between employment opportunities and the actual experience of job loss is important. The estimates obtained by Acemoglu et al.do not tell us precisely how many workers may actually have experienced involuntary unemployment. Some of the reductions in the employment (positions) in manufacturing could be accomplished through voluntary attrition and some through the suppression of additional hiring or new plant births that might otherwise have taken place.[4] The Job Opening and Labor Turnover Survey (JOLTS) conducted quarterly by the Department of Labor suggests that in the overall economy, voluntary separations (quits, retirements, deaths) typically account for a high share of job separations. The estimates are sensitive to demand conditions. For example, voluntary separations accounted for

[4] This point is emphasized by Pierce and Schott (2012).

48 and 31 percent of manufacturing separations in the recession years of 2001 and 2009, respectively, while they were much larger, some 61 percent of separations, during the expansion years of 2005 and 2006. A conservative parameter for the share of separations that might be voluntary would be the lowest annual average for manufacturing over the past decade, namely 31 percent. Using the Acemoglu numbers this would imply total job losses of 1,365 thousand between 1999 and 2011 of which about half are manufacturing.

What share of overall US displacement was accounted for by Chinese trade? One benchmark to answer this question is the Displaced Worker Survey, compiled by the Bureau of Labor Statistics using US household data. This survey focuses on workers who lose permanent jobs for reasons beyond their control (such as plant closings and insufficient demand.) Between 2001 and 2007, the displaced worker surveys report that 688 thousand workers on average were displaced annually from manufacturing, roughly a fifth of all workers displaced over those years. The adjusted input-output estimates of manufacturing losses of 133.5 for the period 2000 to 2007 would imply that Chinese trade was responsible for about 19 percent of worker displacement from manufacturing over this period.

Beyond Manufacturing

While much of the discussion about displaced workers has concentrated on manufacturing, this ignores the substantial displacement that occurs outside the manufacturing sector. Between 2001 and 2007, the average *annual* number of displaced workers in the displaced worker survey was 2.87 million. The input-output estimates in Table 2 indicate that the overall US employment equivalence of the increase in Chinese imports between 2000 and 2007 of 249 thousand per year was 31 percent larger than the equivalence of the increase of 189 thousand per year in manufacturing employment alone. This would imply that Chinese trade displaced 127 thousand US workers annually, or 4.4 percent of total annual displacements (1.31 multiplied by 97 thousand) during this period. Clearly, while 4.4 percent is a significant number, an overwhelming share of displacement in the US economy is not due to Chinese trade.

Acemoglu et al. obtain larger estimates of employment losses outside of US manufacturing. Between 2000 and 2007, they estimate a total loss of an additional 994 thousand in non-manufacturing for 1999 through 2011. They also obtain a larger number for the shorter period between 1999 and 2007 of 2024 thousand jobs lost in total. All told therefore their total number of jobs lost between 1999 and 2011 is 166,000 per year and 253 thousand per year between 1999 and 2007. This latter number is 10 percent of the overall number of workers who were displaced annually between 2001 and 2007.

If, however, we assume that 30 percent of the declines due to trade could be accomplished through voluntary attrition, we obtain an estimate of 7 percent of all US dislocated workers between 2000 and 2007 using their estimates. Since their estimates of job loss between 2000 and 2011 are similar to those between 2000 and 2007, the share of overall US worker displacement over this longer period due to Chinese trade would be much less than 10 percent, even before correcting for voluntary attrition.

Section III: The Impact of Chinese Imports on Wages and Costs of Adjustment

When considering the wage effects of Chinese trade, it is important to distinguish between the part of wages that reflect general returns, in other words payments for attributes that are valued regardless of the job (e.g., a college versus a high-school education), and the part of wages that represents payments for specific skills that can be realized only in particular jobs or occupations (e.g., butchers or airplane mechanics). If workers at various skill levels and capital were homogenous and fully mobile, trade with China could affect wages at different skill levels and the returns to capital with general attributes regardless of the industry or location where they are employed. Thus increased trade with China could, in principle, depress the relative wages of unskilled workers relative to skilled workers across the US economy and the returns to labor relative to those of capital in all industries. On the other hand, if wages mainly reflect returns that are specific to particular jobs, firms, and occupations, most of the effects would be felt by workers who are directly affected by Chinese competition.

In addition, if workers are fully mobile and their skills sets are entirely general, displaced workers would obtain new jobs at the same wages as they were previously earning, and the costs of job loss would be incurred only during unemployment. But if earnings are the result of specific returns, in addition to costs incurred as a result of unemployment, workers could experience substantial and more permanent reductions in earnings even after finding new jobs. Trade economists have applied models emphasizing either general or specific returns to factors of production. Much of the early work on the effects of trade on wages in the 1980s and 1990s was interested in the role of trade in changing the returns to skilled and unskilled workers throughout the US economy, in other words, the impact on wage inequality. Accordingly such studies used models that assumed that workers were perfectly substitutable and mobile. In the 1980s and 1990s, studies based on these approaches suggested that some of the blame for wage inequality (between 10 and 20 percent) could be placed on trade (Cline 1997). More recently, however, studies applying these methodologies to data since 2000, as surveyed by Edwards and Lawrence (2013), do not find large impacts on economy-wide skill differentials that could be attributed either to imports in general or Chinese imports in particular.

As surveyed comprehensively by Harrison, McLaren, and McMillan (2010), recent studies have also considered the effect of trade on specific wages at the level of firms, occupations, regions, and industries. All told, while there is mixed evidence of a wage-loss impact on other workers, especially those who are unskilled and share an occupation, industry, or location with workers who are displaced by imports, the studies find that the significant losses are mostly borne by the workers who are actually displaced. Research on the impact of trade confirms that human capital is partly specific to industries and occupations (see, in particular, Jacobson, LaLonde, and Sullivan (1993), and Kambourov and Manovskii (2009). This implies that human capital will be destroyed by industry and occupation switching that is induced by import competition. Workers displaced by such developments often experience permanent losses; some never return to the labor force while others are forced to take new jobs at lower wages. Farber (2005) examines displacement from manufacturing in general and from import-competing industries in particular and reports that about two-thirds of displaced workers find new full-time jobs—but at an average wage loss of 13 percent (17 percent if one accounts for forgone wage growth during the unemployment transition). This average disguises a range of experiences: 36 percent gained reemployment at or above previous earnings, whereas 25 percent suffered earnings losses of 30 percent or more.

Workers who endure mass layoffs appear to experience especially large wage losses. Davis and Von Wachter (2011) conclude that in present-value terms, men lose an average of 1.4 years of pre-displacement earnings if displaced in mass-layoff events that occur when the national unemployment rate is below 6 percent. They lose a staggering 2.8 years of pre-displacement earnings if displaced when the unemployment rate exceeds 8 percent. These results reflect discounting of earnings at a 5 percent annual rate over 20 years after displacement.

Section IV: Welfare and Cost Benefit Ratios

Arkolakis et al. (2008) develop a common estimator of the gains from trade that holds under a variety of trade models. Their basic estimator that measures the percentage change in real income necessary to compensate a representative consumer for going to autarky is given as $\delta^{1/\varepsilon} - 1$, where δ is the share of expenditure on domestic goods and ε is the elasticity of imports with respect to variable trade costs.

The one problem in calculating this value is that the import data do not distinguish between goods for final consumption and goods used as intermediate inputs in production. Arkolakis et al. (2010) present two additional variants of the basic gains from trade indicators that are more suitable for our analysis. In a world of tradable intermediate inputs, the estimator of the gains from trade becomes $\delta^{1/\beta\varepsilon} - 1$, where β is the share of non-tradable inputs (e.g., factors) in the production of goods. Arkolakis et al. (2010) argue that β is on average equal to one-half. A further extension includes tariff revenue, in which case the estimator becomes $\delta^{1/\beta\varepsilon}(1 + T) - 1$, where T is the share of tariff revenues in the initial equilibrium.

In Edwards and Lawrence (2013, pp. 149-152) we have used this version of the estimator to decompose the overall US gains from manufacturing trade into country components. The implicit assumption is that reductions in each country's share of US expenditure are fully offset by an increase in domestic production (and not by imports from other countries). We have obtained our estimates using the trade cost elasticity of –5. The overall gains from US trade in manufactures according to this measure range from 1.2 to 2.6 percent of real income, depending on the assumptions regarding elasticity of imports with respect to trade costs and whether or not intermediate inputs are accounted for. Over the period from 1998 to 2008, the gains from trade rose from 2.3 to 2.6 percent, but then fell to 2.2 percent during the recession as import values fell. There are some important variations at the country level that reflect the changing geographical composition of US imports. The gains from trade with emerging and developing countries rose steadily throughout the period and are larger than the gains from trade with advanced economies. In fact, the gains from trade in manufactured goods with advanced countries fell over the period.

The dominant source of these trends is China. Imports of manufactured goods from China raised real incomes by 0.2 percent in 1998, but by 2008 this had more than doubled to 0.6 percent or 25 percent of the overall gains from trade in manufactured goods. Given US national income in 2008 of $12.609 trillion, overall gains from manufactured goods trade would be $337.8 billion, or about $1,000 per person in the United States. The gains from Chinese imports would be $75.6 billion. Given the US population of 304.8 million, this works out to $249 per person. The gains from trade with emerging economies overall would be twice that.

Acemoglu et al. (2014) have obtained an estimate of an employment loss due to trade with China of around two million workers between 1999 and 2011. This works out to an average of 166 thousand per year. On average over this period measured in 2009 dollars, US compensation per full time equivalent employee was $62,000. Let us assume, following Davis and Wachter (2011) that the full displacement costs for these workers would amount to 1.4 times their annual compensation. This indicates costs per worker displaced of $86,800 in 2009 dollars per year. This implies that the average annual displacement costs over the decade were equal to 14.4 billion. However, this assumes that all "job losses" occurred through involuntary displacement and would represent an upper bound estimate of costs. It seems more appropriate to adopt a base case in which 30 percent of the adjustment takes place through voluntary attribution and suppression of new jobs. This reduces the annual adjustment costs to 10 billion per year. [5]

If we use the same methodology as described by Edwards and Lawrence (2013) assuming that benefits reflect the changes in the ratio of US imports from China to US National Income we obtain average benefits from Chinese imports of $ 61.61 billion per year (in 2009 dollars) between 1999 and 2011 (see table 3). This leads to estimates of a benefit-cost ratio of 6.2 (and the ratio would be 4.3 if no adjustment was made for voluntary attrition).

However, these are the benefits and costs that occur during the period of adjustment. In 2011, US benefits from China were equal to 85.33 billion. I assume that China will continue to export these products and that the benefits will grow roughly in line with US real incomes at an annual rate of 2.5 percent. In addition I use a discount rate of 5 percent. This gives me estimates

[5] We assume that costs of job loss and the ratio of Chinese imports to national income rise proportionately between 2000 and 2011 and therefore do not discount either the costs or benefits over that period. In later years however, as noted, we do discount the benefits.

of a cost-benefit ratio through 2022 of 14 times the initial costs through 2033 of 19 times these costs and through 2045 of 23. Thus, while there is a positive cost-benefit ratio during the adjustment period, thereafter gains from adjusting to trade build up over time, and over the long run the benefit-cost ratio becomes increasing favorable. To be sure, China could change its export mix, but as long as other countries replace these exports, the benefits of having adjusted will continue to accrue to the United States.

Table 3: United States Cost-Benefit Ratio of US-China Trade 1999-2011

Benefits (in 2009 dollars)	
2008 Benefits (from Edwards and Lawrence (2013)	75.6
Average Annual Benefit 2000-2011 using ratio of Chinese Imports to National Inco	61.61
Benefits 1999-2011	739.32
Aditional Discounted Benefits (billions) 2.5 % growth rate and 5% discount rate	
2012-2022	940.9
2023-2033	674.0
2034-2045	440.9
Costs	
Average Job Loss (Acemoglu et. al Estimates Adjusted For Voluntary Attrition)	116,200
Cost per worker (1.4 average annual compensation	86,800
Average Annual Cost (billions)	10.09
Total Cost (1999-2011	121.03
Benefit-Cost Ratio	
1999-2011	**6**
1999-2022	**14**
1999-2033	**19**
1999-2045	**23**

In a similar exercise, Lawrence 2014, I have used the estimates of Petri et al. to calculate the additional benefits from a US-China free trade agreement. In that case I adjusted the input-output numbers for both a demand and attrition and used my own estimated of non-manufacturing jobs lost. I concluded that after ten years such an agreement would provide a benefit-cost ratio 12 times greater than the costs of displacement of workers in final year. In sum, China and the United States are complementary in their trade patterns, and as long as this relationship continues and US imports from China increase as the US economy grows, the benefits to the United States of having undergone the painful adjustment to Chinese imports will grow over time.

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