The Pro-Competitive Effect of Chinese Imports: Amplification through the Input-Output Network

Miao Ouyang*

Job Market Paper

This version: Nov 8, 2016

Abstract

The share of Chinese manufacturing imports in U.S. consumption has increased eight-fold between 1993 and 2011, from 1 to over 8 percent. While the literature has documented the pro-competitive price effect of the rising Chinese import competition on U.S. industries, I provide new empirical evidence for a quantitatively larger, *indirect* effect: for the average manufacturing industry, the increase in import exposure of upstream suppliers reduces domestic producer prices by 0.82 percent per year, compared to a reduction of 0.27 percent due to the increase in direct import exposure. Together, the direct and indirect effects imply on average a lower price of more than 1 percent per year. By calibrating a general-equilibrium multi-industry model with input-output linkages, I further show that the net welfare gains from trade with China increase by 60 percent when the production network amplifies the pro-competitive effect. This mechanism also creates a substantially wider dispersion of industries that benefit and lose out from trade.

Keywords: Chinese import competition, producer price, input-output linkages, welfare

JEL Codes: F14; F62

*Department of Economics and International Business School, Brandeis University, MS 032, Waltham, MA 02453 (Email: mouyang@brandeis.edu). I am grateful for the insightful comments from Raphael Schoenle, Judith Dean, George Hall, Peter Petri, Daniel Tortorice, and other seminar participants at Brandeis University.

1 Introduction

China's rise has dramatically affected the U.S. and the global economy. Between 1993 and 2011, the share of world manufacturing exports originating from China increased from 3% to 16%, and the share of Chinese manufacturing imports in U.S. consumption of manufacturing products increased eight-fold from 1% to more than 8% (Figure 1).[1] Several studies show that intensified import competition from China has led to a significant loss of U.S. manufacturing jobs and lower wages during the last two decades. This negative employment impact has ignited a backlash against free trade and profoundly reshaped the current political debate over the consequence of globalization.

In contrast to the previous focus on the labor market, this paper studies the pro-competitive effect of Chinese imports on U.S. domestic producer prices, which plays an important role in evaluating the general-equilibrium gains versus losses from trade with China. While the literature has documented the pro-competitive price effect on directly competing domestic producers, I show a quantitatively larger, *indirect* effect amplified through the input-output linkages between industries: as import competition drives down the output prices of upstream supplying industries, downstream industries benefit from the lower cost of inputs and in turn tend to reduce their output prices. The input-output transmission mechanism thus results in a substantially wider distribution of industries that benefit and lose out from the increased Chinese import competition. In the aggregate, this mechanism significantly increases the net welfare gains from trade with China for the United States.

The main contribution of this paper is to quantify the magnitude of the price effect through both the direct and indirect channels and evaluate the welfare implications of the input-output transmission mechanism. My analysis proceeds in two steps. I first provide strong reduced-form evidence that exposure to Chinese import competition in upstream supplying industries reduces producer prices in the downstream, using the data of 386 North American Industry Classification System (NAICS) six-digit U.S. manufacturing industries from 1993-2011. The negative price effect of upstream import exposure is much larger in magnitude than that of direct exposure: for the average industry during this period, the increase in upstream import exposure reduces U.S. domestic producer price by 0.82% per year, compared to a reduction of 0.27% due to the increase in direct import exposure.

[1] Manufacturing imports account for almost all of the U.S. import growth from China (Figure 2).

Together, the direct and indirect effects imply on average a lower price of over 1% per year during this period. These results are robust to specifications that control for industry fixed effects, changes in wages and productivity, and pre-existing trends in industry prices. To address the potential endogeneity that both price changes and import growth are correlated with unobserved U.S. demand shocks, I build on the instrumental variable (IV) strategy of Autor et al. (2013), Autor et al. (2014), and Acemoglu et al. (2016) and use the growth of Chinese imports in eight other high-income countries during the same period to instrument for Chinese import exposure in the United States.

The reduced-form estimates establish the negative relationship between upstream exposure to Chinese import competition and producer prices. However, they do not represent the full general-equilibrium impact of Chinese competition on U.S. producer prices, as wages and employment both experienced significant adjustment to the increased import competition. These estimates also do not tell us the overall welfare implications of the amplified pro-competitive price effect.

In order to quantify the overall impact of increased Chinese import competition, in the second step, I calibrate an Armington (1969) general-equilibrium multi-industry model with input-output linkages (Arkolakis et al., 2012; Costinot and Rodriguez-Clare, 2014; Ossa, 2015) to match the predicted supply-driven growth of Chinese imports during the period of 1993-2007 for 600 U.S. manufacturing and non-manufacturing industries. In this model, an exogenous surge in the export supply of the foreign country causes substitution to imported final goods and intermediate inputs from the domestically produced varieties and therefore affects domestic wages, prices, employment, and production. The calibration enables me to conduct a comparative statics exercise to examine the equilibrium changes of these domestic variables in response to the supply-driven growth of imports from China. I find that the net welfare gains for the U.S. from the increased Chinese imports are 0.14% in terms of annual consumption during this period, and that the price reduction driven by import competition is key to generate these welfare gains. In equilibrium, the input-output transmission mechanism explains around 42% of the price reduction due to the China competitive "shock." To assess the importance of the transmission mechanism through input-output linkages, I also compare the model with a counterfactual economy in which there are no linkages between industries. Overall, the input-output transmission increases the U.S. net welfare gains by about 60% and creates a substantially wider dispersion of industries that benefit and lose out from trade with China.

This paper contributes to the literature in both empirical and theoretical aspects. First of all, I provide new empirical evidence that the pro-competitive price effect can substantially amplify though inter-industry input-output linkages and produce a larger indirect price effect than the direct competition effect. There is a growing branch of literature on the impact of the increased import competition from low-income countries such as China on the U.S. economy, but most studies in this literature have focused exclusively on the mechanism of direct competition. For example, direct exposure to rising import competition from China and other low-income countries has been found to cause a decline in U.S. manufacturing plants, employment, and wages (Bernard et al., 2006; Autor et al., 2013; Autor et al., 2014; Pierce and Schott, 2016; Acemoglu et al., 2016). A few studies that examine the price effect find that increased Chinese imports lower exchange rate pass-through to U.S. import prices (Bergin and Feenstra, 2007), shrink markups and increase marginal cost for the rest-of-world exporters to the U.S. (Mandel, 2013), and reduce consumer prices (Bai and Stumpner, 2016).

In this literature, two papers that investigate the effect of Chinese imports on U.S. manufacturing prices, which are most closely related to the current paper, also focus on the channel of direct competition. Auer and Fischer (2010) find that a 1% increase in import competition from nine low-income countries held down U.S. producer price inflation by 2.35% during 1997-2006. Amiti et al. (2016) find that the China trade shock following its 2001 WTO entry reduced the overall U.S. manufacturing price index by 7.3% between 2000 and 2006, mainly due to China lowering its own import tariffs on intermediate inputs and thus expanding its exports to the United States. In particular, they find that the total price decline in the U.S. is mostly caused by Chinese imports driving down prices of other competing producers.

The transmission mechanism through input-output linkages has been relatively new in the literature. Two recent empirical papers that account for this channel study the impact of Chinese imports on U.S. manufacturing employment. Pierce and Schott (2016) show that manufacturing plants whose downstream customers are more exposed to the U.S. granting of Permanent Normal Trade Relationships (PNTR) to China, which eliminated the potential tariff increases on Chinese imports, are more likely to reduce employment and exit. Acemoglu et al. (2016) find that inter-industry linkages magnify the employment effects of China trade shocks and double the negative employment impact of direct competition. Specifically, they find that trade exposure of downstream buyers significantly reduces employment in the upstream supplying industries as demand for inputs from the downstream decreases. Both papers emphasize the transmission of losses in quantity from import competition along the input-output linkages. In this paper, however, I show that these linkages can also magnify the pro-competitive price effect and create a beneficial and expansionary force for the affected downstream industries.

Related to the last point above, the second contribution of this paper is its demonstration that the input-output transmission is an important mechanism that magnifies the dispersion of welfare impact among U.S. domestic industries, while it increases the aggregate welfare gains from trade with China. The uneven distribution of gains and losses has especially important policy implications for how to reform or design the optimal trade assistance program in order to neutralize the short-run losses from trade. Although a number of recent studies (Caliendo and Parro, 2014; Costinot and Rodriguez-Clare, 2014; Ossa, 2015) have shown that input-output linkages across industries and countries can greatly increase welfare gains from trade, they focus on welfare at either the country or aggregate sectoral level. In this paper, I highlight the magnified dispersion of gains and losses at the disaggregated industry level. In spite of the magnified losses for some industries, I show that the input-output transmission mechanism amplifies the aggregate welfare gains from Chinese import competition, which is consistent with the trade literature. Moreover, the results in this paper show that a large number of industries that would have been predicted to lose from import competition by Acemoglu et al. (2016), simply due to loss of employment, actually expand their production when the amplified pro-competitive price effect is also accounted for.

In a similar vein, Caliendo et al. (2015) develop a dynamic and spatial trade model to quantify the labor market effects due to the rise in import competition from China during 2000-2007.[2] They find that the aggregate welfare increases by 0.6% for the U.S., despite the great loss of manufacturing jobs. Although these authors note that cheaper intermediate goods from China tend to expand employment in non-manufacturing sectors, they do not explicitly look at the effect of increased competition on prices and especially how the pro-competitive price effect transmits in the domestic production network. The level of data used in this paper also allows me to examine the distribution of gains and losses at an

[2]Two other papers that quantify the aggregate welfare impact of China's export growth are Hsieh and Ossa (2011) and di Giovanni et al. (2014).

extremely disaggregated level, compared to a total of only 22 aggregate sectors in Caliendo et al. (2015).

This paper is also closely related to two other strands of literature. The first strand is on the productivity gains and price effect from imported intermediate inputs (Amiti and Konings, 2007; Goldberg et al., 2010; Gopinath and Neiman, 2014; Caliendo and Parro, 2014; Blaum et al., 2016). For example, Blaum et al. (2016) show that imports of intermediate inputs allow firms to reduce their costs of production and thus benefit consumers through lower prices of domestically produced goods as in the case of French firms. The second strand of the literature is on how international input-output linkages propagate cost shocks (due to exchange rate movement) and generate inflation spillovers across countries (Auer and Aaron, 2014; Auer et al., 2016).

The remainder of this paper is organized as follows. The second section lays out the empirical specifications and describes the variable construction. Section 3 provides the data sources and summary statistics. In section 4, I discuss the empirical results and conduct several robustness checks. To quantify the impact of the increased Chinese import competition in general equilibrium, section 5 presents a theoretical general-equilibrium multi-industry model with input-output linkages and calibrates this model to the predicted supply-driven industry-level growth of Chinese imports. The last section concludes.

2 Empirical Approach

The main driving force in the remarkable growth of Chinese imports in the U.S. is China's expanding export capacity due to the economic reforms in the 1980s and 1990s, followed by China's accession to the World Trade Organization (WTO) in 2001. Import competition in labor-intensive sectors where China has comparative advantages has increased most significantly. The empirical estimation in this section aims to capture the impact of rapidly growing Chinese imports that are supply-driven on the prices of U.S. domestic producers, by accounting for both the direct and indirect channels. To do this, I define measures of direct, upstream, and downstream import exposure following Acemoglu et al. (2016)[3] and subsequently use them as the explanatory variables in the econometric specification.

[3] In Acemoglu et al. (2016), the terminology of upstream and downstream effects was reversed from an earlier version of this paper. I retain the initial definitions of upstream and downstream exposures (instead of "upstream and downstream effects") to reflect the sources of import competition.

2.1 Measures of Import Exposure

The change in direct exposure to Chinese import competition for a U.S. manufacturing industry i over period τ is defined as the change in its import penetration ratio relative to the initial year, 1993:

$$\Delta IP_{i,\tau} = \frac{\Delta IM^C_{i,\tau}}{IM_{i,1993} + Q_{i,1993} - EX_{i,1993}} \tag{1}$$

where $\Delta IM^C_{i,\tau}$ denotes the growth of imports from China in industry i over period τ, and the denominator is the initial absorption measured as total imports, $IM_{i,1993}$, plus total shipment, $Q_{i,1993}$, minus total exports, $EX_{i,1993}$ in this industry at the beginning of the period.[4]

For a given industry i, the change in trade exposure due to the competition in its upstream supplying industries ("upstream exposure") is defined as

$$\Delta IP^U_{i,\tau} = \sum_j \omega^U_{ij} \Delta IP_{j,\tau} \tag{2}$$

with the weights given by

$$w^U_{ij} = \frac{\mu_{ij}}{\sum_g \mu_{ig}} \tag{3}$$

where μ_{ij} is the value of industry j's output purchased by industry i, as indicated by the 1997 benchmark input-output table from the Bureau of Economic Analysis (BEA).[5] The denominator of the weight in equation (3) sums up the values of inputs across all sources (including manufacturing, non-manfacturing industries, and other production factors), indexed by g, from which industry i purchases and thus simply equals industry i's total sales.

[4]The use of initial absorption in 1993 ensures that the denominator itself is not endogenous with price changes. This definition is slightly different from the change in actual import penetration ratio, since the denominator is held constant; nevertheless, these two measures show the same pattern of movement over time for almost all industries. For robustness check, I confirm that they yield similar estimates of the price effects of increased import competition. These results are not reported in the paper but are available upon request.

[5]Note that I follow the literature and assume that the input-output structure is unchanged over period τ, since evidence has shown that the input-output coefficients change very little over time. It is possible, however, that the use of an input increases as its price drops. For the purpose of robustness, I use the 1997, 2002, 2007, and 2012 BEA benchmark input-output tables to construct the upstream and downstream exposures for the periods 1993-1997, 1998-2002, 2003-2007, and 2008-2011, respectively. The estimated results using these alternative measures are quite close to the baseline results in this paper. These results are not reported but are available upon request.

Therefore, the change in the upstream exposure of industry i is a weighted average of the change in direct import exposure faced by all of industry i's upstream suppliers.

Similarly, for a given industry i , the change in trade exposure due to the competition in its downstream buying industries ("downstream exposure") is defined as

$$\Delta IP^D_{i,\tau} = \sum_j \omega^D_{ji} \Delta IP_{j,\tau} \tag{4}$$

with the weights given by

$$w^D_{ji} = \frac{\mu_{ji}}{\sum_g \mu_{gi}} \tag{5}$$

where the denominator sums up the values of the purchases from industry i by all industries (including manufacturing, non-manufacturing industries, and final demand), indexed by g, which is again equal to industry i's total sales. The change in the downstream exposure of industry i is thus a weighted average of the change in the direct import exposure faced by all of industry i's downstream buyers.

Increased import competition in an industry might indirectly affect another industry with no direct buying-selling relationship through the input-output network. For example, industry A might affect its downstream industry B and thus affect B's downstream industry C, even though A and C are not directly linked. To account for this possibility that the impact of import competition might work along the full chain of the input-output relationship, I calculate the Leontief inverse of the matrix of upstream and downstream linkages to construct the full upstream and downstream exposure to Chinese import competition. Specifically, given the matrix of upstream linkages $\mathbf{\Omega}^U$, where $\mathbf{\Omega}^U(i,j) = \omega^U_{ij}$, I replace the weights for the first-order upstream exposure in equation (2) with the implied weights given by the (i,j) element of the Leontief inverse, $(1 - \mathbf{\Omega}^U)^{-1}$, to obtain the full upstream exposure to Chinese import competition. Similarly, given the matrix of downstream linkages $\mathbf{\Omega}^D$, where $\mathbf{\Omega}^D(i,j) = \omega^D_{ij}$, the full downstream exposure to Chinese import competition is obtained by replacing the weights for the first-order downstream exposure in equation (4) with the implied weights given by the (i,j) element of the Leontief inverse, $(1 - \mathbf{\Omega}^D)^{-1}$.

2.2 Econometric Specification

The baseline specification is of the following form:

$$\Delta \ln Price_{i,\tau} = \alpha_\tau + \beta \Delta IP_{i,\tau} + \gamma \Delta \ln X_{i,\tau} + \varepsilon_{i,\tau} \tag{6}$$

where $\Delta \ln Price_{i,\tau}$ is the annualized change in the logarithm of output price for industry i over period τ (as defined below), $\Delta IP_{i,\tau}$ denotes the annualized absolute change in direct exposure to imports from China over the same period, and $\Delta \ln X_{i,\tau}$ includes the percent change in industry-specific controls such as wages and productivity (TFP). α_τ is a period-specific constant and $\varepsilon_{i,\tau}$ is an error term. The coefficient β in this equation yields the estimate that one percentage point increase in direct exposure to Chinese imports reduces U.S. producer prices by β percent. Subsequently, I add the measure of upstream and downstream exposures to equation (6) to account for the effect of both direct and indirect import exposure on prices.

One concern about using $\Delta IP_{i,\tau}$ as a regressor in equation (6) is that price change may endogenously affect import exposure, as higher U.S. prices can induce more Chinese exports to the U.S. market. Therefore, an instrumental variable is needed to capture the supply-driven component in U.S. imports from China. I follow the IV strategy used by Autor et al. (2013), Autor et al. (2014), and Acemoglu et al. (2016) and instrument for the direct trade exposure in the U.S. given by equation (1) with the IV defined as below:

$$\Delta IPO_{i,\tau} = \frac{\Delta IM^{C,OTH}_{i,\tau}}{IM_{i,1993} + Q_{i,1993} - EX_{i,1993}} \tag{7}$$

where $\Delta IM^{C,OTH}_{i,\tau}$ is the growth of Chinese imports in industry i in eight other non-U.S. high-income countries (Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland), and the denominator is again the initial absorption of U.S. industry i.[6] The motivation for this instrument is that these high-income countries are similarly exposed to competition from Chinese imports as the U.S. during this period, as imports from China are mainly driven by Chinese supply shocks. Indeed, as shown by Figure 3, the change in U.S. direct exposure to Chinese import competition has a significant coefficient of correlation at 0.96 with the change in other high-income countries' exposure, which indicates that this

[6] Autor et al. (2014) and Acemoglu et al. (2016) use the three-year lag of industry absorption in the denominator of (7) to account for the possibility of worker/employment sorting across industries in anticipation of future trade with China. This is less of a concern for estimating the effect on prices. Nevertheless, as a robustness check, I use the initial absorption in 1990 when constructing the IVs, which yields estimates that are highly similar to the baseline. These additional results are not reported in the paper but are available upon request.

IV is relevant.

The validation of this instrument relies on the assumption that demand shocks are not correlated across high-income countries. If this assumption is violated and both U.S. prices and imports from China are positively correlated with unobserved U.S. demand shocks, the price effect of import exposure would be underestimated or even estimated with the wrong sign. The potential threats to this identification strategy include that U.S. productivity shocks may be driving growth in imports from China, or that growth in imports from China may reflect technology shocks common to high-income countries. See Autor et al. (2013) for a detailed discussion of these issues.

These possibilities, of course, cannot be ruled out completely, as noted by Autor et al. (2013). Therefore, estimates that rely on this IV strategy should be interpreted with these caveats in mind. Following this strategy, nevertheless, allows me to put the price effect of import competition in perspective with the employment effect identified by the literature. To reduce the concern for identification, Autor et al. (2013) and Autor et al. (2014) also provide a gravity-based strategy in which they use the inferred change in China's comparative advantage and market access via-à-vis the U.S. as an alternative identification method, which does not require IV. For robustness check, I adopt this alternative method and show that it produces similar estimates as the IV estimates, which suggests that correlated import demand shocks across high-income countries are not likely to bias the results. Details about how this procedure is conducted will be explained in Section 4.4.2 of the paper.

Since both the upstream exposure, $\Delta IP^U_{i,\tau}$, and the downstream exposure, $\Delta IP^D_{i,\tau}$, are functions of $\Delta IP_{i,\tau}$, they may as well be endogenous to changes in U.S. producer prices when included in equation (6). Therefore, I construct analogous IVs for $\Delta IP^U_{i,\tau}$ and $\Delta IP^D_{i,\tau}$ by simply replacing $\Delta IP_{j,\tau}$ in equation (2) and (4) with $\Delta IPO_{j,\tau}$ as given by (7):

$$\Delta IPO^U_{i,\tau} = \sum_j \omega^U_{ij} \Delta IPO_{j,\tau} \tag{8}$$

and

$$\Delta IPO^D_{i,\tau} = \sum_j \omega^D_{ij} \Delta IPO_{j,\tau} \tag{9}$$

The IVs for full (higher-order) upstream and downstream exposure measures are defined in the same way except for using the weights generated by the Leontief inverse of the matrix of upstream and downstream linkages.

I first fit equation (6) for 386 NAICS six-digit manufacturing industries for the long period of 1993-2007, which is prior to the onset of the global financial crisis, to estimate the cumulative price effect during this period. As a comparison, I also extend the sample period to 1997-2011. To further control for unobserved industry fixed effects, I estimate equation (6) for stacked first differences covering the two sub-periods of 1993-2000 and 2000-2007 (or 2000-2011), where I include a dummy for each sub-period in the regression.[7] All regressions include two-digit NAICS industry dummies, and standard errors are clustered at the three-digit NAICS industry level to allow for error correlations within aggregate industries.

3 Data

3.1 Trade Flows and Industry Variables

Data on U.S. imports and exports at the NAICS six-digit level for 1989-2011 are from the U.S. Census Bureau provided by Schott (2008)[8]. Data on imports and exports of other high-income countries are from the UN Comtrade Database[9], which provides bilateral trade data at the Harmonized Commodity Description and Coding System (HS) six-digit level. I apply the concordance provided by Pierce and Schott (2012) to concord these data to NAICS six-digit level. Whereas most HS six-digit codes can be mapped into a unique NAICS six-digit code, in some cases in which one HS six-digit corresponds to multiple NAICS six-digit codes, I use the weights generated from U.S. trade data to assign the trade value of the HS product to each concorded NAICS code.

U.S. producer prices for NAICS six-digit manufacturing industries are measured by the shipment deflator from the NBER-CES Manufacturing Industry Database (1958-2011) compiled by Bartelsman and Gray (1996). This database also provides data on industry wages, value of total shipment, and productivity (TFP)[10]. The overlap of the price data, trade data,

[7] The stacked first-differenced regression is similar to a three-period fixed-effects regression with slightly less restrictive assumptions on the error term (Autor et al., 2013).

[8] Downloadable on Peter K. Schott's International Trade Data Page: http://faculty.som.yale.edu/peter schott/sub_international.htm.

[9] http://comtrade.un.org/data

[10] Industry wage is calculated as the total wage bill divided by total employment; TFP refers to the 5-factor (non-production workers, production workers, energy, materials and capital) TFP index.

and variables of the domestic industries yields a balanced panel of 386 manufacturing industries[11] from 1993 to 2011. In addition to the manufacturing industries, I also obtain the GDP deflator for 79 non-manufacturing industries from the Bureau of Economic Analysis (BEA) GDP-by-Industry data for the period of 1997 to 2011.

For robustness check, I also use the Producer Price Index (PPI) constructed by the Bureau of Labor Statistics (BLS) as an alternative measure of U.S. domestic prices. Since PPI data is published on a monthly basis, I use the end-of-period observation of each year to calculate the year-to-year change in prices. One drawback of the PPI data is that it only yields a smaller balanced panel of 279 NAICS six-digit manufacturing industries during this period due to sampling changes over time.

3.2 Input-Output Table

I choose the BEA 1997 benchmark input-output table to measure the inter-industry linkages. Since 1997 is at the beginning of the sample period, these measured linkages are unlikely to be endogenous to the subsequent changes in import competition.

The BEA input-output (I/O) table consists of a "make" table and a "use" table. The "make" table shows the value of each commodity that each domestic industry produces, while the "use" table shows the use of each commodity by industry or final demand. One challenge with measuring linkages between industries is that some I/O industries may produce more than one commodity, and one single commodity may be produced by multiple I/O industries. I thus combine the "make" and "use" tables to map commodities into corresponding supplying industries and create an industry-to-industry network of commodity flows, following Acemoglu et al. (2016) and Pasten et al. (2016).

Let m_j^c denote the value of commodity c produced by industry j, and u_i^c the value of commodity c used by industry i. This procedure consists of three steps: First, I calculate the market share of commodity c accounted by each producing industry j, *i.e.* $share_j^c = m_j^c / \sum_j m_j^c$; Second, I multiply $share_j^c$ with the value of commodity c used by each industry

[11] A few industries are actually NAICS "roll-up" industries, which contains two or more six-digit industries. They include 31131X (311311-Sugarcane Mills, 311312-Cane Sugar Refining, and 311313-Beet Sugar Manufacturing), 31181X (311811-Retail Bakeries, 311812-Commercial Bakeries, and 311813-Frozen Cakes, Pies, and Other Pastries Manufacturing), 31511X (315111-Sheer Hosiery Mills and 315119-Other Hosiery and Sock Mills) and 33631X (336311-Carburetor, Piston, Piston Ring, and Valve Manufacturing and 336312-Gasoline Engine and Engine Parts Manufacturing). For these four roll-up industries, I make the assumption that the underlying industries within a roll-up industry have the same import penetration ratio.

i, *i.e.* $u^c_{ij} = share^c_j \times u^c_i$, which represents a flow of commodity c from industry j to i; Lastly, summing up the flows of all commodities from industry j to i, *i.e.* $u_{ij} = \sum_c u^c_{ij}$, yields the total value of inputs produced by industry j that are used by i.

The next challenge is that the BEA I/O industry classification is more aggregate than the NAICS six-digit level. To start, I use the concordance table between the 1997 NAICS codes and I/O industry codes provided by the BEA. When multiple NAICS six-digit industries are associated with the same I/O commodity-producing industry, I use the value of shipment to determine the output market share of each NAICS six-digit industry; when multiple NAICS six-digit industries are associated with the same I/O commodity-purchasing industry, I use materials costs to determine the input shares of each NAICS six-digit industry. Data on the value of shipment and material costs of NAICS six-digit industries in 1997 are obtained from the NBER-CES Manufacturing Industry Database.

After addressing these two issues, I obtain a matrix of industry-to-industry commodity flows for NAICS six-digit industries. The (i, j) cells of this matrix, denoted by μ_{ij}, are used to calculate the weights in constructing the first-order upstream and downstream import exposure in (3) and (5). The complexity of the inter-industry input-output network can be seen from Figure 4, which shows the linkages between 470 NAICS six-digit industries for all transactions above 1% of an industry's total purchase.

3.3 Summary Statistics

Table 1 provides the summary statistics of the main variables for the empirical estimation. Over the period from 1993 to 2011, the average change in direct exposure to Chinese imports is 0.91 percentage points per year, with a standard deviation of 1.53 percentage points. In comparison, the average changes in the first-order upstream and downstream exposure are 0.13 and 0.18 percentage points per year, respectively, which are much smaller in magnitude than that in direct exposure. As expected, the full (higher-order) indirect exposures have a larger magnitude than their first-order counterparts: the average change in full upstream and downstream exposures are 0.20 and 0.28 percentage points per year, respectively. Among the 386 NAICS industries, the annual changes in U.S. industry prices have a mean of 1.77% and a standard deviation of 2.26% during this period. The mean of growth in total factor productivity is 0.22% per year, while the mean of nominal wages growth is 3.03% per year.[12]

The last three columns of Table 1 report the means and standard deviations of the same variables for three sub-periods of 1993-2000, 2000-2007, and 2007-2011. Comparing across these three sub-periods, the means of direct, upstream, and downstream exposure to Chinese import competition are all largest during the period of 2000-2007, which is probably not surprising given that China joined the WTO in 2001.

4 Empirical Results

I begin this section by presenting the baseline estimates of the direct and indirect effects of intensified Chinese import competition on U.S. domestic prices. For robustness checks, I further controls for potential pre-existing trends in industry prices, and use alternative measures of import exposure and prices in the estimation. As a comparison to the baseline, the subsequent sub-sections discuss the price effect of Chinese import competition on U.S. non-manufacturing industries, and the effect of competition from other sources of U.S. imports.

4.1 Price Effect of Exposure to Chinese Imports

The baseline estimation shows that direct and upstream exposure to increased Chinese import competition both significantly reduce U.S. producer prices, while downstream exposure does not have a significant impact. Table 2 reports the estimates for the cumulative impact of direct and the first-order indirect exposure to Chinese import competition over the whole sample period. Columns (1)-(5) present the results for the period of 1993-2007, which is prior to the onset of the global financial crisis and the resulting trade collapse during 2008-2009, while columns (6)-(8) extend the period to 2011 for the purpose of comparison.

Column (1) shows the OLS estimate of equation (6) when only the change in direct import exposure is included. The estimated coefficient is negative but not significant at the 10% level. In contrast, in column (2), the coefficient on direct import exposure using the IV strategy becomes significantly negative with a larger magnitude than in column (1), which confirms that it is necessary to correct for the endogeneity. Column (3) adds

[12] Tables B5-B8 in the appendix provide the mean changes in prices and direct and indirect exposures for NAICS 3-digit industries.

additional controls of changes in wages and productivity, leading to a negative coefficient of -0.36, which means that a 1 percentage point increase in direct exposure to Chinese imports reduces U.S. producer price by 0.36%. To account for the effect of indirect import exposure, column (4) adds the variable of first-order upstream exposure to Chinese imports. The coefficient on the upstream exposure is significantly negative, confirming the hypothesis that rising import competition in the upstream supplying industries lowers the costs and thus the prices of the input-using industries, and the estimated coefficient on direct import exposure remains highly significant and of similar magnitude. In column (5), I further adds the first-order downstream exposure measure in the regression. Although the estimated coefficient is negative, it is not statistically significant at the 10% level.

The estimates in column (5) imply that a 1 percentage point rise in upstream exposure reduces U.S. producer prices by 6.68%, while a 1 percentage point rise in direct exposure reduces producer prices by 0.29%. The estimated coefficient on direct import exposure is in line with the estimate of -0.91 by Acemoglu et al. (2016) for 384 Standard Industrial Classification (SIC) four-digit industries over the two sub-periods of 1991-1999 and 1999-2009[13]. It is, however, smaller than the estimated coefficient of -2.53 by Auer and Fischer (2010) when they consider a group of nine low-wage countries for the period of 1997-2006.

To interpret the economic magnitude of these estimates, let us consider the mean or a one-standard-deviation movement in the change of exposure to Chinese import competition. For the average manufacturing industry, the annualized increase in direct and upstream exposure over the period of 1993-2007, which equals 0.91 and 0.13 percentage points, reduces the U.S. industry prices by 0.26% (= 0.91% $\times$ 0.289) and 0.87% (= 0.13% $\times$ 6.684), respectively. Alternatively, a rise of one standard deviation in direct and upstream exposure, which equals 1.53 and 0.12 percentage points, reduces the U.S. producer prices by 0.44% (= 1.53 $\times$ 0.289) and 0.80% (= 0.12% $\times$ 6.684) per year, respectively. As shown by these estimates, the price effect of indirect exposure to Chinese import competition through upstream supplying industries, is much larger than that of direct exposure.

The rest of Table 2 shows the same estimation as in columns (3)-(5) for the period of 1993-2011. The coefficients on both the direct and upstream exposure in column (8) remain negative and become even more statistically significant. These coefficients are a bit larger but are still similar in magnitude as those in column (5). A one-percentage-point

[13]When they exclude 28 computer-producing industries, however, the estimated coefficient becomes -0.14.

rise in upstream exposure is estimated to decrease U.S. producer prices by 6.64%, while a one-percentage-point rise in direct exposure decreases producer prices by 0.30%.[14]

Note that, in all columns of Table 2, the coefficient on wages growth is always significantly positive and the coefficient on TFP growth is always significantly negative, which is consistent with our expectation that higher wages tend to increase prices while technology advances put downward pressure on prices. To test for underidentification, this table reports the p-value associated with the Kleibergen-Paap rk LM statistic, which is robust to heteroskedasticity, autocorrelation, or clustering. For all the columns, we can reject the null hypothesis that the instrument variable(s) is(are) not correlated with the endogenous variable(s) at the 1% level. To test for weak identification, I also report the Kleibergen-Paap rk Wald statistic along with the Stock-Yogo critical value at the 10% level, which the former should exceed for weak identification not to be a concern.

Table 3 considers further the effect of full (higher-order) exposure to Chinese imports. Columns (1)-(2) report estimates of the cumulative effect during 1993-2007, while columns (3)-(4) extend the period to 1993-2011. In column (2), the estimated coefficients on direct and upstream exposure remain negative and highly significant, while the coefficient on downstream exposure is still insignificant and in fact decreases in magnitude compared to that of the first-order downstream exposure measure in column (5) of Table 2. The estimated coefficients in column (4) are very close to those in column (2) when a longer sample period is used, except that the coefficient on downstream exposure measure switches signs. Compared to columns (4)-(5) and (7)-(8) of Table 2, the coefficient on direct exposure becomes larger in magnitude when the full upstream and downstream exposure measures are used in the regression. The coefficient on upstream exposure becomes much smaller in magnitude in Table 3. It is worth mentioning though that the smaller coefficients do not imply smaller quantitative effects, given that the full upstream and downstream exposure measures are themselves larger in magnitude than the first-order exposure measures.

The cross-sectional estimation of the cumulative price effect in Tables 2-3 does not control for potential industry fixed effects. In Table 4, I estimate equation (6) for stacked first

[14]To address the concern about a possible sensitive breaking point for the cumulative estimation, I conduct a series of cumulative estimations by varying the period of τ. The estimated coefficients on the direct and upstream import exposure are reported in Figure B1 with their corresponding 95% confidence intervals, ranging from 1995 to 2011. The value for a given Year T represents the cumulative annualized effect from 1993 to year T. Due to the short span of time, the estimation for the first few years is noisy. Starting from year 2001, the estimated coefficients are always significantly negative and remain quite stable.

differences covering the two sub-periods of 1993-2000 and 2000-2007 (or 2000-2011), where I include a dummy for each sub-period. As shown in columns (3) and (6), the estimated coefficients on the direct and indirect exposure measure are smaller in magnitude compared to those in the full-period regressions in Table 2. In columns (1)-(3), the coefficients on the direct exposure remain significantly negative at the 5% level, and those on the upstream exposure all remain significantly negative at the 1% level. The coefficient on the downstream exposure measure is still insignificant, indicating no price effect of import exposure working from downstream buyers to upstream suppliers. In addition, the dummy of the second sub-period (either 2000-2007 or 2000-2011) is significantly positive, suggesting higher inflation in the later sub-period. Columns (4)-(6) repeat the stacked first differences covering the two sub-periods of 1993-2000 and 2000-2011, where the latter spans the period of crisis. The coefficients on both the direct and upstream exposure measure become more negative but are quite similar to those in columns (1)-(3), while the coefficient on downstream exposure switches signs. These results in Table 4 confirm the robustness of the negative price effect of direct and upstream import exposure.

Similarly, estimates of stacked first differences for the two sub-periods using the full (higher-order) exposure measures are reported in Table 5. The coefficients on direct and upstream exposures are again highly significant and negative. Compared to those in Table 3, these coefficient estimates are smaller in magnitude due to the controls of unobserved industry fixed effects. For the average manufacturing industry, the annualized increase in direct and full upstream exposure over the period of 1993-2007, which equals 0.91 and 0.20 percentage points, reduces U.S. industry prices by 0.26% (= 0.91% × 0.289) and 0.82% (= 0.20% × 4.117) per year, respectively. Alternatively, a one-standard-deviation rise in direct and full upstream exposure, which equals 1.53 and 0.14 percentage points, reduces U.S. producer prices by 0.44% (= 1.53 × 0.289) and 0.58% (= 0.14% × 4.117) per year, respectively.

4.2 Controlling for Pretrends

One might be concerned that the negative coefficients on the trade exposure measures may simply reflect a long-term decline in U.S. domestic prices, rather than trade exposures specific to this period. Although there is no clear upward or downward pattern of the aggregate PPI inflation during this period, as indicated by Figure 5, I nevertheless add the change in the log of industry price during the period of 1983-1993 as an additional control variable for pretrend. These results are reported in Table 6, which shows robustness to this additional control. For example, for the two sub-periods of 1993-2000 and 2000-2007, the estimated coefficients on direct and upstream exposure are -0.22 and -3.88, respectively, in column (2), which are close to those estimates of -0.23 and -4.77 in column (3) of Table 4. The coefficient on the pretrend variable in this table is significantly positive, although only at the 10% level, indicating that industries with larger price movement in the previous decade also tend to change price by more during our sample period.

4.3 Alternative Measures of Import Exposure

4.3.1 Net Imports

As U.S. imports from China grew substantially during the period under consideration, U.S. exports to China might have also increased a lot. In that case, the baseline measure of import exposure in equation (1) would not accurately reflect the competition pressure faced by U.S. domestic industries, and higher demand for U.S. exports also tends to push up U.S. producer prices. Although the composition of U.S. imports from China and U.S. exports to China is vastly different, to exclude this concern, I measure import exposure by replacing growth in imports with growth in net imports (imports minus exports) from China in equation (1).

Following Autor et al. (2013) and Autor et al. (2014), I use Chinese import exposure in the eight other high-income countries, as constructed in equation (7), and a measure of growth in exports from these high-income countries to China, constructed in the same way as equation (7) by only replacing the numerator with exports, to instrument for the U.S. exposure to net imports from China. The upstream and downstream exposures and their corresponding IVs are constructed in the same way as the baseline measures. Using these variables and IVs, I estimate the cumulative effect of direct and indirect exposures to Chinese net imports during 1993-2007. These results are reported in columns (1) and (2) of Table 7. In column (2), the coefficient of the direct exposure is -0.302, and for the upstream exposure it is -7.763, which are a bit larger in magnitude but very close to the coefficients in column (5) of Table 2. In this regression, since the number of IVs exceeds the number of endogenous variables, I can also test if the instruments are valid. The Hansen J statistic, which tests the null hypothesis that all instruments are valid, can not be rejected even at the 10% level.

4.3.2 Gravity Residual

I also use the alternative method of identification that exploits the gravity model as in Autor et al. (2013) and Autor et al. (2014). The purpose of this method is to obtain the inferred change in China's comparative advantage and market access via-à-vis the U.S., and use it to construct the U.S. exposure to Chinese imports without having to use IV. This approach confirms my finding that both direct and upstream exposure to Chinese import competition significantly reduce U.S. domestic prices.

I run the following regression using exports from China and the U.S. at the NAICS six-digit level to the eight other high-income countries during the period of 1993-2007:

$$\ln(X_{C,ikt}) - \ln(X_{US,ikt}) = \alpha_i + \alpha_k + [\ln(\tau_{C,ikt}) - \ln(\tau_{US,ikt})] + \epsilon_{ikt} \tag{10}$$

where $X_{C,ikt}$ represents Chinese exports in industry i to country k in year t, $X_{US,ikt}$ represents U.S. exports in industry i to country k in the same year, and $\tau_{C,ikt}(\tau_{US,ikt})$ represents the iceberg trade cost between China (the U.S.) and country k in industry i in year t. The industry fixed effect α_i absorbs the mean difference in the export capacities of China and the U.S., while the importer fixed effect captures the time invariant differences in trade costs between China and the U.S. to a third country k. The residual ϵ_{ikt} thus captures the growth of exports due to China's differential comparative advantage relative to the United States for country k in year t.

I estimate equation (10) using bilateral trade flows of China and the U.S. from the UN Comtrade Database. The differential iceberg cost are measured by bilateral tariffs and transport cost. Bilateral tariffs at the HS six-digit level are obtained from the World Integrated Trade Solution (WITS) database, and I choose the weighted average MFN rates. Transport cost are measured by the ratio of Free-on-Board (fob) to Cost, Insurance, and Freight (cif) value of imports calculated using aggregate data from the IMF Direction of Trade Statistics (DOT). I then compute the residuals from regression (10) and calculate the mean of residuals across all export destinations for each industry i in year t, which is denoted by $\bar{\epsilon}_{i,t}$.

As an alternative to the direct exposure measure in equation (1), I use the following measure of import exposure:

$$\Delta \tilde{IP}_{i,\tau} = \frac{\Delta\bar{\epsilon}_{i,1993-\tau} * IM^C_{i,1993}}{IM_{i,1993} + Q_{i,1993} - EX_{i,1993}} \tag{11}$$

where $\Delta\bar{\epsilon}_{i,1993-\tau}$ is the change in $\bar{\epsilon}_{i,t}$ during period τ, and $IM^C_{i,1993}$ denotes the initial value of imports from China in industry i in 1993. $\Delta\bar{\epsilon}_{i,1993-\tau}$ multiplied by $IM^C_{i,1993}$ thus represents the change in U.S. imports from China predicted by China's exporting capacities, which is due to its comparative advantages and lower trade costs. As before, $IM_{i,1993} + Q_{i,1993} - EX_{i,1993}$ denotes the initial U.S. domestic absorption in industry i.

I construct the analogous measures for upstream and downstream exposures by replacing the variable $\Delta IP_{i,\tau}$ in (2) and (4) with $\Delta \tilde{IP}_{i,\tau}$. We can then use these measures in OLS estimates without instrumental variables. These estimates are reported in columns (3) and (4) of Table 7. The estimated coefficients of direct and upstream exposure are both significantly negative. The coefficient on the direct exposure is similar in magnitude to the baseline estimate, though it is significant only at the 10% level. The coefficient on the upstream exposure variable becomes much larger due to the unit of the gravity residuals, nevertheless, these results confirm that both direct and upstream exposure to Chinese import competition have a negative effect on the prices of U.S. domestic industries.

4.4 Alternative Measure of Prices

An alternative source of U.S. industry prices is the PPI data constructed by the BLS. Unfortunately, this dataset only allows me to track 297 NAICS six-digit manufacturing industries during the sample period of 1993-2011, which is substantially smaller than the sample from the NBER-CES database. Nevertheless, I repeat the baseline regressions using these data to cross check with the results using the industry shipment deflators. The cumulative and stacked first-differenced estimates for the first-order and higher-order import exposures are reported in Tables B1-B4. The estimated results are quite similar to those using shipment deflators as the measure of prices and indicate a large negative impact of upstream exposure on producer prices.

4.5 Non-Manufacturing Industries

Import competition in manufacturing industries can potentially produce a spillover effect on the prices of non-manufacturing industries, since non-manufacturing industries require manufacturing inputs and also supply inputs to manufacturing industries. In contrast to the finding of Acemoglu et al. (2016) that import competition in manufacturing industries produces a large employment effect on non-manufacturing sectors, I do not find a significant price effect on the non-manufacturing industries due to the increased import competition from China.

To test whether increased import competition in either upstream or downstream manufacturing industries affects the output prices of the linked non-manufacturing industries, I use the price deflators for 79 non-manufacturing industries from 1997 to 2011 provided by the BEA GDP-by-Industry data. Table 8 reports the IV estimates for stacked first differences covering the two sub-periods of 1997-2002 and 2002-2007 (or 2000-2011), using the first-order upstream and downstream exposure measures. Across columns (1)-(4), the coefficient on neither the upstream nor downstream exposure is statistically significant at the 10% level when only the 79 non-manufacturing industries are used in the regression. Note that the change in direct exposure is not included in these regressions, as non-manufacturing industries are assumed to have zero direct exposure to Chinese import competition, and these regressions do not include industry controls such as wages and productivity, since these data for non-manufacturing industries are not available. Columns (5)-(6) in this table pool all the manufacturing and non-manufacturing industries together (465 NAICS industries in total). The coefficients on the direct exposure and upstream exposure are both negative and significant, but smaller in magnitude than the estimates for manufacturing industries only in Table 4. The coefficient on downstream exposure remains insignificant at the 10% level.

Table 9 repeats the same exercise in Table 8 but using the full (higher-order) upstream and downstream exposure measures. Again, we do not see a significant coefficient on the full upstream exposure variable in columns (1)-(4) when only the 79 non-manufacturing industries are included in the sample. In column (5), when I pool all the manufacturing and non-manufacturing industries and estimate the stacked first differences covering 1997-2002 and 2002-2007, the coefficient on the upstream exposure measure becomes insignificant at the 10% level. This coefficient is only significant at 10% level in the stacked first-differenced estimate covering 1997-2002 and 2002-2011 in column (6).

These results in Tables 8 and 9 suggest that the exposure to Chinese import competition in U.S. manufacturing industries do not seem to affect the prices of upstream or downstream non-manufacturing industries through their input-output linkages.

4.6 Comparing with Other Import Sources

One might be concerned that the baseline measures of exposure to Chinese import competition overstate the role of Chinese imports, as China might be just replacing other countries' market share in the United States. If that is indeed the case, we should see that the negative price effect of import exposure is not unique to China. To provide such a comparison across different sources of U.S. imports, I estimate the price effect of increased import competition from a few other groups of countries. These results are reported in Table 10, which indicates no significant price effect of upstream import competition from the other source countries.

First of all, I use import growth from all 62 low-income countries (LICs), including China, as defined by the World Bank in 1996[15] to measure the change in import competition exposures in equations (1), (2), and (4). I construct the corresponding IVs in the same manner as the baseline and estimate equation (6) for the stacked first differences covering the two sub-periods of 1993-2000 and 2000-2007. As shown in column (1) and (2) of Table 10, the coefficients on the direct and upstream exposure measure are significantly negative while slightly smaller in magnitude compared to those in columns (1)-(2) in Table 4. Given that China accounts for more than 70% of the total U.S. imports from these LICs, it is probably not surprising to see that the effect of imports from China is largest. Columns (3) and (4) repeat the same regression of (1) and (2) but only considering import competition from all LICs excluding China. Once China is excluded, only the coefficient on direct exposure measure is statistically significant. Note that, although the coefficient has a larger magnitude than the estimate using only Chinese imports, this does not imply a large economic impact, as the exposure to imports from the other LICs is itself much smaller in magnitude than the exposure to imports from China. In column (4), the coefficient on upstream exposure becomes large and positive, although it is not significant. As suggested by the weak identification test, this is presumably due to the failure of the IV strategy in this case, since exports from these countries to the U.S. might be highly influenced by U.S. demand shocks.

The second alternative source of U.S. imports I examine is Mexico and the CAFTA, which is an expansion of NAFTA to five Central American nations (Guatemala, El Salvador, Honduras, Costa Rica, and Nicaragua), and the Dominican Republic. I repeat the same exercise as above by using U.S. imports from Mexico and the CAFTA to measure the change in import competition exposures in equations (1), (2), and (4). The estimated results are

[15] A list of these low-income countries is provided in Table 11.

reported in columns (5) and (6) of Table 10. Neither the coefficient on the direct nor the upstream exposure is statistically significant at the 10% level. In fact, as argued by Autor et al. (2014), Mexico had minimal industrial productivity growth during this period, therefore making the U.S. demand shocks a relatively important driver for growth in U.S. imports from Mexico. As expected, the IV strategy of using shipments to other high-income countries performs poorly in this case. The Kleibergen-Paap rk Wald statistic reported at the bottom of the table confirms that the IV(s) used in the regressions is(are) very weak for the cases of Mexico and the CAFTA.

Lastly, in columns (7) and (8), I estimate the price effect of exposure to imports from all other countries (excluding all LICs, Mexico, and the CAFTA), which mainly consists of developed countries. The coefficients on the direct and upstream exposure are positive and statistically significant. Again, this is probably because the IV strategy is not appropriate for the case of developed countries.

These results confirm that exposure to Chinese imports has a profoundly negative effect on U.S. producer prices, not only directly but also through the transmission from upstream industries to the downstream, while U.S. exposure to other sources of imports does not seem to have the same impact.

5 Mechanism

The estimation presented in the preceding section establishes the strong effect of increased Chinese import competition in the upstream supplying industries on downstream producer prices. These results suggest that some U.S. industries might benefit from cheaper intermediate inputs due to import competition from China and expand as a result, although some industries would obviously experience production losses. To further quantify the overall impact of increased Chinese imports in general equilibrium, I calibrate an Armington (1969) model with inter-industry input-output linkages (Arkolakis et al., 2012; Caliendo and Parro, 2014; Costinot and Rodriguez-Clare, 2014; Ossa, 2015) to match the predicted supply-driven growth of Chinese imports from 1993-2007 at the NAICS six-digit level from the data. This exercise shows the changes of U.S. prices, employment, and production at an extremely disaggregated industry level in response to the China trade shock, holding other factors unchanged. To assess the importance of the input-output transmission mechanism, I then compare the model with a counterfactual economy in which there are no input-output linkages between industries.

5.1 Theoretical Model

Consider a world economy with N countries, indexed by n or k, and S industries, indexed by i or j. Each country is populated by a representative agent who aims to maximize

$$C_n = \prod_{i=1}^{S} (C_{n,i}^F)^{\alpha_{n,i}} \tag{12}$$

where $C_{n,i}^F$ is total final consumption of the industry-specific composite good i in country n, and $\alpha_{n,i}$ is the expenditure share of composite good i satisfying $\sum_{i=1}^S \alpha_{n,i} = 1$. The associated aggregate consumer price index is

$$P_n = \prod_{i=1}^{S} P_{n,i}^{\alpha_{n,i}} \tag{13}$$

where $P_{n,i}$ is the price of the composite good i in country n.

The production function of industry i in country n is given by:

$$Y_{n,i} \quad = \quad A_{n,i} L_{n,i}{}^{\omega_{n,i}^L} \prod_{i=1}^{S} Z_{n,ij}^{\omega_{n,ij}} \tag{14}$$

$A_{n,i}$ is the exogenous industry-specific technology, $L_{n,i}$ is the use of labor, and $Z_{n,ij}$ denotes the use of each composite good j as i's intermediate input. $\omega_{n,i}^L$ is the factor share of labor in production, and $\omega_{n,ij}$ is the factor share of each intermediate input $Z_{n,ij}$, which satisfies $\omega_{n,i}^L + \sum_{j=1}^S \omega_{n,ij} = 1$ under the assumption of constant return to scale. This implies a unit cost function for profit-maximizing firms as given by

$$MC_{n,i} = A_{n,i}^{-1} (\frac{W_n}{\omega_{n,i}^L})^{\omega_{n,i}^L} \prod_{j=1}^{S} (\frac{P_{n,j}}{\omega_{n,ij}})^{\omega_{n,ij}} \tag{15}$$

where W_n represents wages in country n.

The total demand for composite good i in country n, $C_{n,i}$, is thus the sum of the amount used as final consumption and as intermediate input by producers:

$$C_{n,i} = C^F_{n,i} + \sum_{j=1}^{S} Z_{n,ji} \tag{16}$$

The composite good $C_{n,i}$ is in turn a CES aggregate of all traded varieties from each country k, denoted by $C_{nk,i}$:

$$C_{n,i} = (\sum_{k=1}^{N} C_{nk,i}^{\frac{\sigma_i-1}{\sigma_i}})^{\frac{\sigma_i}{\sigma_i-1}} \tag{17}$$

where $\sigma_i > 1$ is the elasticity of substitution between varieties from different countries within industry i. Country n's demand for good i from country k is given by $C_{nk,i} = p_{nk,i}^{-\sigma_i} P_{n,i}^{\sigma_i} C_{n,i}$, where $p_{nk,i}$ is the price of the industry i variety imported from country k in country n. The value of imports of good i from country k to n thus has a gravity structure:

$$X_{nk,i} = p_{nk,i}^{1-\sigma_i} P_{n,i}^{\sigma_i-1} (P_{n,i} C_{n,i}) \tag{18}$$

with the price index of composite good i given by

$$P_{n,i} = (\sum_{k=1}^{N} p_{nk,i}^{1-\sigma_i})^{\frac{1}{1-\sigma_i}} \tag{19}$$

Shipping a unit of good i from country k to country n requires iceberg cost $\tau_{nk,i} > 1$ (whereas $\tau_{nn,i} = 1$), therefore $p_{nk,i} = \tau_{nk,i} p_{kk,i}$. In particular, $\tau_{nk,i} \to \infty \, (k \neq n)$ for goods produced by non-tradable industries, so they are only consumed in the producing country. The output of industry i in country n is used either by domestic consumers and producers or exported, it thus satisfies

$$p_{nn,i} Y_{n,i} = \sum_{k=1}^{N} X_{kn,i} \tag{20}$$

The model can be solved by consumers maximizing utility, firms maximizing profits, and clearing of all goods and factor markets, given the budget constraint

$$P_n C_n = W_n L_n + B_n \tag{21}$$

where B_n is country n's aggregate current-account deficit and treated as exogenous, and $L_n \equiv \sum_{i=1}^{S} L_{n,i}$ is the fixed amount of aggregate labor supply in country n. The equilibrium conditions under perfect competition are collected in Appendix A.

5.2 Comparative Statics

Since the focus of this paper is the impact of Chinese imports on the U.S. economy, I confine myself to a two-country version of this model, which has the advantage of being able to examine the impact on extremely disaggregated industries.[16] To quantify the impact of changing from the initial low levels of Chinese imports $\{X_{nk,i}\}$, to high levels of Chinese imports $\{X'_{nk,i}\}$, I log-differentiate all equilibrium conditions and solve the model in relative changes (see Appendix A). All of the variables are thus expressed in percent change from the initial equilibrium with Chinese imports $\{X_{nk,i}\}$ relative to the new equilibrium with Chinese imports $\{X'_{nk,i}\}$, namely variable $\hat{x} = \ln(x'/x)$. By calibrating the equilibrium conditions expressed in relative changes, the model is exactly matched to the data in the initial year chosen, which allows me to use the observed trade flows to examine the impact of the predicted supply-driven growth of Chinese imports either due to productivity growth in China (changes in $\{A_{k,i}\}$) or declining trade barriers (changes in $\{\tau_{nk,i}\}$) or both, by holding other factors (such as U.S. technology) unchanged.

The method of solving the equilibrium in relative changes follows Dekle et al. (2008) and Caliendo and Parro (2014). As noted by Caliendo and Parro (2014), this method requires little data to calibrate the model and avoids having to estimate parameters that are usually difficult to identify in the data, such as productivities. Given the observed China-driven growth of U.S. imports and exports in the data, I can solve for the system of linearized equations to obtain the percent changes in U.S. wages, prices, employment, production and consumption and evaluate the overall welfare impact of increased Chinese imports.

Note that, in perfect competition equilibrium, firms set prices equal to the unit cost. Define $\lambda_{nn,i} \equiv X_{nn,i}/P_{n,i}C_{n,i}$ as the expenditure share on domestically produced products of industry i in country n. Combining equations (15) and (18) and expressing variables in percent change yields

$$\hat{P}_{n,i} = -\hat{A}_{n,i} + \frac{1}{\sigma_i - 1}\hat{\lambda}_{nn,i} + \omega^L_{n,i}\hat{W}_n + \sum_{j=1}^{S} \omega_{n,ij}\hat{P}_{n,j} \tag{22}$$

Solving for $\hat{P}_{n,i}$ in equation (22) gives

[16] Of course, the use of two-country framework will affect the calibration results. For future work, it would be interesting to extend this exercise to a multi-country case.

$$\hat{P}_{n,i} = \hat{W}_n + \sum_{j=1}^{S} \delta_{n,ij}(-\hat{A}_{n,j} + \frac{1}{\sigma_j - 1}\hat{\lambda}_{nn,j}) \tag{23}$$

where $\delta_{n,ij}$ is the (i, j) element of the Leontief inverse of the input-output matrix, $(\boldsymbol{I}_{S\times S} - \boldsymbol{\Omega}_n)^{-1}$ with $\boldsymbol{\Omega}_n(i, j) = \omega_{n,ij}$.

Therefore, holding productivities constant (i.e. $\hat{A}_{n,i} = 0$), the domestic producer price can be written as

$$\begin{aligned} \hat{p}_{nn,i} &= \hat{W}_n + \sum_{j=1}^{S}\sum_{s=1}^{S} \omega_{n,ij}\delta_{n,js}\frac{1}{\sigma_s - 1}\hat{\lambda}_{nn,s} \\ &\approx \hat{W}_n + \sum_{j=1}^{S} \omega_{n,ij}\frac{1}{\sigma_j - 1}\hat{\lambda}_{nn,j} \end{aligned} \tag{24}$$

where the second line in equation (24) holds as long as the factor shares in the input-output matrix are small. As clearly shown by this equation, when import competition reduces the expenditure share on domestically produced products of any upstream industry j, i.e. $\hat{\lambda}_{nn,j} < 0$, the output price of domestic industry i will decline as its cost of inputs declines. In perfect competition, the magnitude of this indirect price effect depends on the elasticity of substitution within the upstream industry j, and the share of i's intermediate input from industry j, which measures the importance of input j for the production of industry i. Conditional on change in wages, the price effect of import competition only propagates from upstream to downstream as $\omega_{n,ij}$ corresponds to the transmission from input-producing industries to input-using industries. Direct and downstream exposure to import competition only affects prices through changes in wages. In fact, this equation is in line with the construction of the upstream exposure measure in equation (2) as well as the baseline specification (6) in the empirical section.

5.3 Calibration

I then calibrate a 600-industry (including manufacturing and non-manufacturing industries) version of the linearized model. The first step of the calibration is to identify the supply-driven component of the growth in Chinese imports. I employ the IV strategy used in the empirical section to compute the predicted growth of Chinese imports that is exogenous for the United States, as in Caliendo et al. (2015). Specifically, I regress Chinese import growth in the U.S. on Chinese import growth in eight other high-income countries at the NAICS six-digit industry level during 1993-2007 and use the fitted values of this regression as the China supply shocks. To obtain a proxy for the changes of U.S. exports to China due to the changes in China's demand (again exogenous for the U.S.), similarly, I compute the predicted China-driven growth of U.S. exports to China by regressing the growth of U.S. exports to China on the export growth of eight other high-income countries to China at the NAICS six-digit industry level. I then annualize the predicted growth of U.S. imports from China and U.S. exports to China and feed these data into the system of linearized equations. Note that the growth of imports and exports is set to zero for non-manufacturing industries in the calibration.

Next I choose the standard parameters based on the literature and calculate the initial shares needed for the calibration from the data. Elasticities of substitution within industries, σ_i, are taken from Broda and Weinstein (2006). I map their estimated elasticities of substitution at the HS ten-digit level to NAICS six-digit and take the median for each NAICS six-digit industry. The initial distribution of employment across industries, $s^L_{n,i} = L_{n,i}/L_n$, is calculated using the SIC industry-level employment data from the 1993 County Business Patterns (CBP) and concorded to the 1997 NAICS six-digit level. The initial share of current-account deficit in total income, $B_n/(P_nC_n)$, is set as 2%, as reflected by the BEA national account data in 1993. I use the input-output network derived from the BEA 1997 benchmark input-output table (see Section 3.2) to calculate the initial share of consumption across industries, $\alpha_{n,i}$, the factor share of labor and intermediate inputs in production, $\omega^L_{n,i}$ and $\omega_{n,ij}$, and the distribution of output across industries and final demand, denoted by $s^{zy}_{n,ji} = Z_{n,ji}/C_{n,i}$ and $s^{fy}_{n,i} = C^F_{n,i}/C_{n,i}$, respetively. Finally, the initial expenditure share of domestically produced products in each industry, $\lambda_{nn,i}$, is one minus the China import penetration ratio calculated using industry-level imports, exports, and shipment data, and the initial export share of industry output, $\mu_{kn,i}$, is calculated using industry-level exports and shipment data.

With these chosen parameters and initial shares, I conduct the baseline calibration of the model. To assess the importance of the input-output mechanism, I further compare the model with a counterfactual economy in which there are no linkages between industries. Specifically, in this conterfactual, only labor is used in production, so $\omega^L_{n,i} = 1$ and $\omega_{n,ij} = 0$

for any industry i. This additional experiment allows me to compare the equilibrium impact on wages, prices, employment, production, and overall welfare in the two different cases.

5.4 Equilibrium Impact

The key finding from the model calibration is that in general equilibrium, intensified import competition from China increases U.S. net welfare, with some industries declining while the others expanding. Compared to the conterfactual economy with no input-output linkages, prices decline by more and real aggregate consumption increases by more in the baseline case, along with a wider dispersion of declining and expanding industries.

The equilibrium impact on U.S. domestic variables are reported in Table 12. Recall that the changes in variables are annualized during 1993-2007. The upper part of this table shows the changes in aggregate variables in the baseline model with inter-industry input-output linkages versus the counterfactual case. In the baseline, aggregate price is 2.99% lower due to the exogenous growth of Chinese imports, and wages are 2.91% lower; in contrast, aggregate price and wages are only 1.77% and 1.71% lower in the counterfactual. The welfare gains from increased Chinese imports, measured in real aggregate consumption, are 0.140% and 0.089% per year in these two cases, which implies around 60% larger welfare gains in the case with input-output linkages than in the counterfactual:

$$\frac{\hat{C}_{\text{I/O linkages}}}{\hat{C}_{\text{no I/O linkages}}} = \frac{0.140\%}{0.089\%} = 1.57$$

Although wages decline by more in the baseline model, the larger decline in prices amplified through the input-output linkages leads to a bigger rise in real wages and thus higher welfare gains in equilibrium, which underscores the importance of this transmission mechanism.

The lower part of Table 12 reports the changes in industry variables. For the full sample, average declines in both domestic producer and consumption prices, employment, and production are larger in the baseline than in the counterfactual. Domestic producer prices are on average 2.91% lower due to Chinese imports in the baseline, compared to 1.71% in the counterfactual case. Note that domestic producer prices move closely with wages because I assume a unique wage level in the economy. Prices of industry consumption, which includes domestic and imported varieties, are on average 3.15% and 1.91% lower in these two respective cases. Employment declines on average by 0.30% in the baseline, compared to a decline of 0.25% in the counterfactual. Production moves closely with employment: Chinese import competition reduces production by 0.27% on average in the baseline and 0.25% in the counterfactual, with considerably large standard deviations of 1.40% and 1.31%, respectively. This comparison clearly shows that employment and production of domestic industries can decline by more with the amplification mechanism through input-output linkages, which is consistent with the results in Acemoglu et al. (2016).

I also report the mean and standard deviation of changes in each variable by excluding the outlier industries with the 5% lowest and 5% highest changes. As shown in the second and fourth columns of the lower part of Table 12, the mean of changes in consumption and producer prices are similar to that for the full sample, while the mean of employment and production changes become much smaller. In particular, production declines only by 0.08% on average in the baseline and 0.04% in the counterfactual. The third and sixth column focus on the 474 manufacturing industries out of the 600 industries. Consumption prices, employment, and production decline more on average for the sample of manufacturing industries, which is consistent with the fact that manufacturing industries are most affected by the increased Chinese import competition, and the standard deviations of the changes in these domestic variables are also larger for the sample of manufacturing industries.

In order to examine more closely the distribution of industries that benefit and lose out from the increased import competition, I show the histogram of changes in consumption prices, employment, and production in Figures 6-8 for all industries excluding the outliers with the 5% lowest and 5% highest changes[17]. Panel A of each figure presents the results from the baseline model, while panel B presents the results for the counterfactual case. Figure 6 shows the distribution of changes in consumption prices due to the growth in Chinese imports. In panel A, amplification through input-output linkages creates a larger negative effect on average consumption prices, mainly due to the large decline in prices of domestic product, and more large price changes compared to panel B.

To assess the importance of the input-output transmission mechanism in explaining the price changes in general equilibrium, recall that changes in domestic producer prices can be written in matrix form as:

$$\hat{\boldsymbol{p}}_{nn} \quad = \quad \boldsymbol{\Omega}_n^L \hat{\boldsymbol{W}}_n + \boldsymbol{\Omega}_n [\boldsymbol{\Gamma}_n \hat{\boldsymbol{p}}_{nn} + (\boldsymbol{I} - \boldsymbol{\Gamma}_n) \hat{\boldsymbol{p}}_{nk}] \tag{25}$$

[17] I do not show the histogram for changes in domestic producer prices, as these are close to the equilibrium change in wages.

where $\hat{\boldsymbol{p}}_{nn}$, $\hat{\boldsymbol{W}}_n$ and $\hat{\boldsymbol{p}}_{nk}$ are vectors of domestic producer prices, wages, and import prices for all S industries. $\boldsymbol{\Omega}_n^L$ is a $S \times S$ diagonal matrix with the industry-specific labor factor share on the diagonal, i.e., $\boldsymbol{\Omega}_n^L(i,i) = \omega_{n,i}^L$, $\boldsymbol{\Gamma}_n$ is a $S \times S$ diagonal matrix with the industry-specific expenditure share on domestic goods on the diagonal, i.e. $\boldsymbol{\Gamma}_n(i,i) = \gamma_{nn,i}$, and $\boldsymbol{\Omega}_n$ is the input-output matrix with the (i,j) element being $\omega_{n,ij}$.

Rearranging equation (25) yields

$$\hat{\boldsymbol{p}}_{nn} = \underbrace{(\boldsymbol{I} - \boldsymbol{\Omega}_n \boldsymbol{\Gamma}_n)^{-1}}_{\text{I/O amplification}} [\underbrace{\boldsymbol{\Omega}_n^L \hat{\boldsymbol{W}}_n}_{\text{wages}} + \underbrace{\boldsymbol{\Omega}_n(\boldsymbol{I} - \boldsymbol{\Gamma}_n)\hat{\boldsymbol{p}}_{nk}}_{\text{imported inputs}}] \tag{26}$$

Using the equilibrium changes in wages and prices of imported goods from the baseline calibration, one can back out the proportion of domestic price changes that is explained directly by changes in wages, which is equal to 50% on average, and the proportion that is explained by changes in prices of imported intermediate inputs, which is merely 8.35% due to the small factor share of imported intermediate inputs. The rest of the changes in domestic producer prices, which is about 41.7%, is explained by the general-equilibrium amplification through input-output linkages. These results highlight the importance of the input-output mechanism in amplifying the pro-competitive effect of Chinese imports and welfare gains for the U.S. economy.

Figures 7 and 8 show the distribution of changes in the domestic employment and production. By comparing panel A with panel B in each figure, one can see that the input-output linkages between industries not only lead to larger losses of employment and production in more domestic industries (fatter left tail), which aligns with Acemoglu et al. (2016), but also larger expansion for more domestic industries (fatter right tail) due to the access to cheaper inputs. The price adjustment mechanism through input-output linkages is the key in creating an expansionary force for some industries and generating the latter result. In particular, as shown by Figure 9, a large number of industries that would have been predicted to decline, simply due to loss of employment as in Acemoglu et al. (2016)[18], actually expand as a result of increased import competition when price adjustment is incorporated in the model (Panel A, Figure 8).

[18]Assuming that prices and consumption levels do not adjust when imports increase.

5.5 Robustness

For robustness checks, I conduct two additional exercises. In the first exercise, I set a uniform elasticity of substitution for all industries equal to 4.2, which is the mean of the estimates by Broda and Weinstein (2006). These results are reported in Table 13. Wages decline by the same amount as in the case with industry-specific elasticity of substitution, and the declines in both consumer and producer prices, employment, and production are only slightly smaller than in the case with industry-specific elasticity of substitution. However, there is much less dispersion of changes in consumer prices among industries, which suggests that heterogeneity in elasticity of substitution is important (Ossa, 2015). With a uniform elasticity of substitution, the net welfare gains in the baseline model with input-output linkages are about 67% higher than in the counterfactual.

In the second exercise, I allow for substitution of consumption between industries; namely, I replace the aggregate consumption in equation (12) with

$$C_n = (\sum_{i=1}^{S} C_{n,i}^{F\,\frac{\theta-1}{\theta}})^{\frac{\theta}{\theta-1}} \tag{27}$$

where θ is the elasticity of substitution between industries. I set $\theta = 2$ following the standard literature and calibrate the model with this CES consumption aggregate. The results are reported in Table 14. Both aggregate and industry-level price changes are larger in magnitude in this case, and wages also decline by more. The declines in employment and production, however, are smaller than in the baseline. Net welfare gains, measured in real consumption, are about 37.5% higher in the case with input-output linkages than in the counterfactual, which is smaller compared to the baseline calibration.

6 Conclusion

This paper studies the pro-competitive price effect of rapidly growing imports from China amplified through the inter-industry input-output network. Indirect exposure to Chinese import competition through upstream suppliers can produce a substantially larger effect on U.S. domestic producer prices than direct exposure to competition. I provide empirical evidence that increased upstream exposure during the period of 1993-2007 reduces U.S. producer prices on average by 0.82% per year, while direct exposure only reduces prices by 0.27%. These results suggest that some industries might benefit from increased Chinese import competition through lower cost of inputs and expand as a result, while some industries are adversely affected by such competition.

By calibrating a general-equilibrium multi-industry model with input-output linkages to the predicted supply-driven growth of Chinese imports, I show that there are net welfare gains for the U.S. from increased Chinese import competition and that the reduction of prices in response to competition plays an important role in generating these gains. In particular, net welfare gains are 60% larger with the amplification mechanism through input-output linkages, compared to the counterfactual case in which these linkages are shut down. Therefore, ignoring the input-output network effect is likely to lead to underestimation of the welfare gains from trade with China. The fact that the input-output linkages create a wider dispersion of industries that gain and lose from trade is particularly useful when thinking about possible reform in redistribution programs, such as the Trade Adjustment Assistance (TAA), to neutralize the short-run losses from intensified import competition.

References

Acemoglu, D., D. Autor, D. Dorn, G. Hanson, and B. Price (2016). Import Competition and the Great US Employment Sag of the 2000s. *Journal of Labor Economics 34*(S1), S141 – S198.

Amiti, M., M. Dai, R. C. Feenstra, and J. Romalis (2016). How Did China's WTO Entry Benefit U.S. Consumers?

Amiti, M. and J. Konings (2007, December). Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia. *American Economic Review 97*(5), 1611–1638.

Arkolakis, C., A. Costinot, and A. Rodriguez-Clare (2012). New Trade Models, Same Old Gains? *American Economic Review 102*(1), 94–130.

Armington, P. S. (1969). A Theory of Demand for Products Distinguished by Place of Production. *Staff Papers (International Monetary Fund) 16*(1), 159–178.

Auer, R. and A. M. Fischer (2010). The Effect of Low-wage Import Competition on U.S. Inflationary Pressure. *Journal of Monetary Economics 57*(4), 491 – 503.

Auer, R. A. and Aaron (2014). Trade Linkages and the Globalisation of Inflation in Asia and the Pacific. *Journal of International Money and Finance 49, Part A*, 129 – 151.

Auer, R. A., A. A. Levchenko, and P. Saure (2016). International Inflation Spillovers Through Input Linkages.

Autor, D. H., D. Dorn, and G. H. Hanson (2013). The China Syndrome: Local Labor Market Effects of Import Competition in the United States. *American Economic Review 103*(6), 2121–68.

Autor, D. H., D. Dorn, and G. H. Hanson (2016). The China Shock: Learning from Labor Market Adjustment to Large Changes in Trade. Working Paper 21906, National Bureau of Economic Research.

Autor, D. H., D. Dorn, G. H. Hanson, and J. Song (2014). Trade Adjustment: Worker Level Evidence. *The Quarterly Journal of Economics 129*(4), 1799–1860.

Bai, L. and S. Stumpner (2016). Estimating the Price Effects of Globalization: The Case of U.S. Imports from China.

Bartelsman, E. J. and W. Gray (1996). The NBER Manufacturing Productivity Database. Working Paper 205, National Bureau of Economic Research.

Baum, C. F., M. E. Schaffer, and S. Stillman (2007). Enhanced routines for instrumental variables/generalized method of moments estimation and testing. *Stata Journal 7*(4), 465–506(42).

Bergin, P. R. and R. C. Feenstra (2007). Pass-through of Exchange Rates and Competition Between Floaters and Fixers. Working Paper 13620, National Bureau of Economic Research.

Bernard, A. B., J. B. Jensen, and P. K. Schott (2006). Survival of the Best Fit: Exposure to Low-wage Countries and the (uneven) Growth of U.S. Manufacturing Plants. *Journal of International Economics 68*(1), 219 – 237.

Blaum, J., C. Lelarge, and M. Peters (2016). The Gains from Input Trade with Heterogenous Importers.

Bloom, N., M. Draca, and J. Van Reenen (2015). Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity. *The Review of Economic Studies 83*(1), 87–117.

Broda, C. and D. E. Weinstein (2006). Globalization and the Gains From Variety. *The Quarterly Journal of Economics 121*(2), 541–585.

Bugamelli, M., S. Fabiani, and E. Sette (2010). The Pro-Competitive Effect of Imports from China: an Analysis of Firm-Level Price Data. Temi di discussione (Economic working papers) 737, Bank of Italy, Economic Research and International Relations Area.

Caliendo, L., M. Dvorkin, and F. Parro (2015). The Impact of Trade on Labor Market Dynamics. Working Paper 21149, National Bureau of Economic Research.

Caliendo, L. and F. Parro (2014). Estimates of the Trade and Welfare Effects of NAFTA. *The Review of Economic Studies 82*(1), 1–44.

Costinot, A. and A. Rodriguez-Clare (2014). Chapter 4 - Trade Theory with Numbers: Quantifying the Consequences of Globalization. In E. H. Gita Gopinath and K. Rogoff (Eds.), *Handbook of International Economics*, Volume 4 of *Handbook of International Economics*, pp. 197 – 261. Elsevier.

Dekle, R., J. Eaton, and S. Kortum (2008). Global Rebalancing with Gravity: Measuring the Burden of Adjustment. *IMF Staff Papers 55*(3), 511–540.

di Giovanni, J., A. A. Levchenko, and J. Zhang (2014). The Global Welfare Impact of China: Trade Integration and Technological Change. *American Economic Journal: Macroeconomics 6*(3), 153–83.

Goldberg, P. K., A. K. Khandelwal, N. Pavcnik, and P. Topalova (2010). Imported Intermediate Inputs and Domestic Product Growth: Evidence from India. *The Quarterly Journal of Economics 125*(4), 1727–1767.

Gopinath, G. and B. Neiman (2014). Trade Adjustment and Productivity in Large Crises. *American Economic Review 104*(3), 793–831.

Hsieh, C.-T. and R. Ossa (2011). A global view of productivity growth in china. NBER Working Papers 16778, National Bureau of Economic Research, Inc.

Johnson, R. C. (2014). Trade in Intermediate Inputs and Business Cycle Comovement. *American Economic Journal: Macroeconomics 6*(4), 39–83.

Kamin, S. B., M. Marazzi, and J. W. Schindler (2006). The Impact of Chinese Exports on Global Import Prices. *Review of International Economics 14*(2), 179–201.

Mandel, B. (2013). Chinese Exports and U.S. Import Prices. Staff Reports 591, Federal Reserve Bank of New York.

Ossa, R. (2015). Why Trade Matters After All. *Journal of International Economics 97*(2), 266 – 277.

Pasten, E., R. Schoenle, and M. Weber (2016). The Propagation of Monetary Policy Shocks in a Heterogenous Economy.

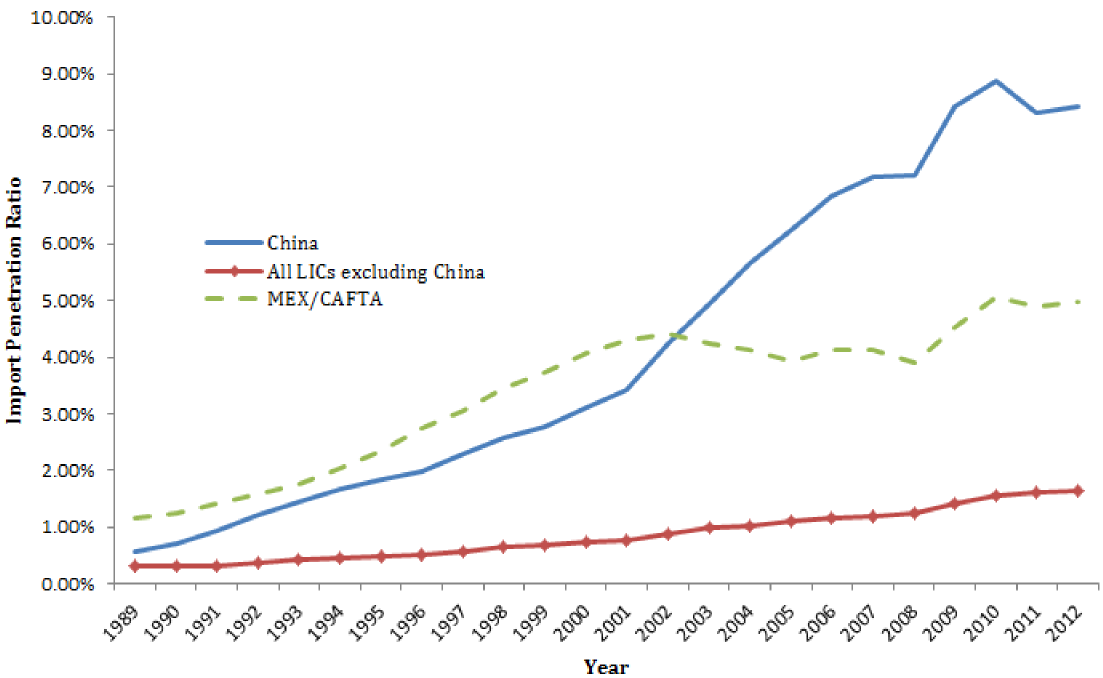
Pierce, J. R. and P. K. Schott (2012). A concordance between ten-digit U.S. Harmonized System codes and SIC/NAICS product classes and industries. Finance and Economics Discussion Series 2012-15, Board of Governors of the Federal Reserve System (U.S.).

Pierce, J. R. and P. K. Schott (2016). The Surpringly Swift Decline of U.S. Manufacturing Employment. *American Economic Review 106*(7), 1632–62.

Schott, P. K. (2008). The Relative Sophistication of Chinese Exports. *Economic Policy 23*, 5–49.

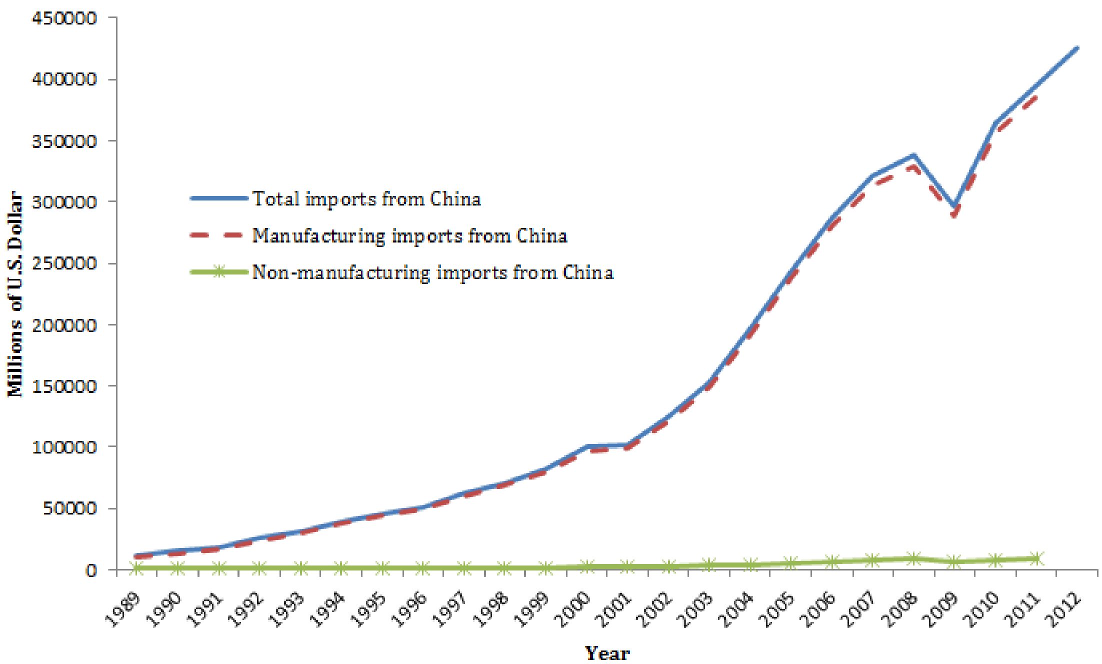
Shen, L. and P. Silva (2015). Value Added Exports and U.S. Local Labor Markets: Does China Really Matter?

Figure 1: Import Penetration in U.S. Manufacturing (1989-2012)



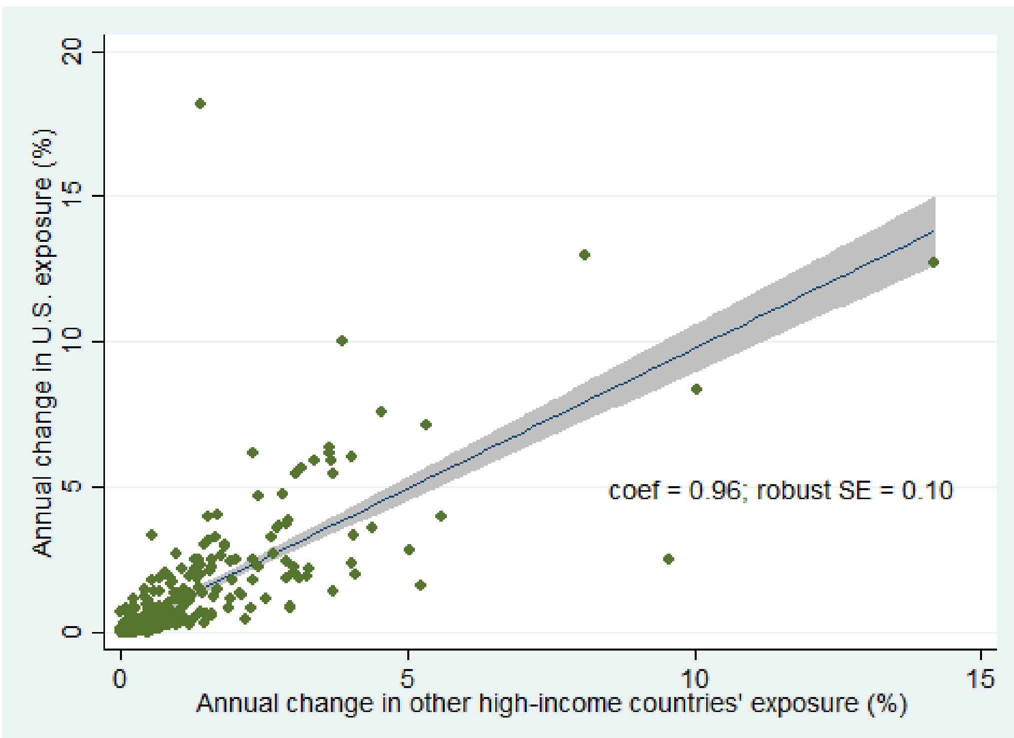
Notes: The aggregate import penetration ratio is calculated using bilateral trade data provided by the Census Bureau and U.S. manufacturing output data provided by the Bureau of Economic Analysis (BEA). The LICs refer to the 62 low-income countries as defined by the World Bank in 1996 (see Table 11), and MEX/CAFTA refer to Mexico and the CAFTA, which is an expansion of NAFTA to five Central American nations (Guatemala, El Salvador, Honduras, Costa Rica, and Nicaragua) and the Dominican Republic.

Figure 2: U.S. Imports of Manufacturing and Non-Manufacturing Goods from China (1989-2012)



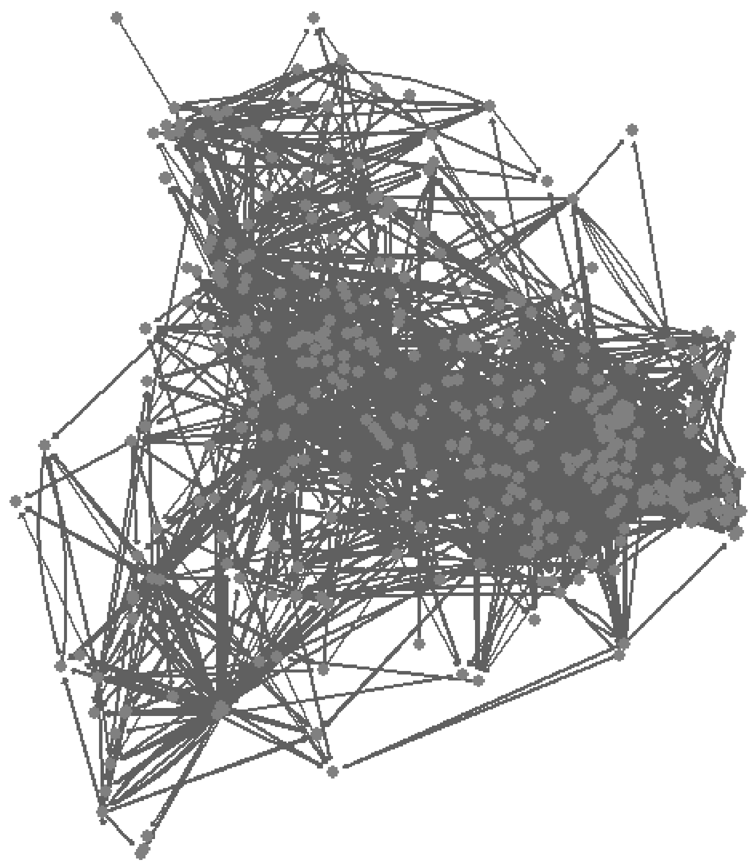
Data Source: U.S. Census Bureau

Figure 3: Correlation between the Instrumented Variable and the Instrument (1993-2007)



Notes: This figure plots the change in U.S. exposure to imports from China against the change in Chinese import exposure in the other high-income countries (HICs) for 386 NAICS six-digit manufacturing industries during 1993-2007. Each point represents one industry.

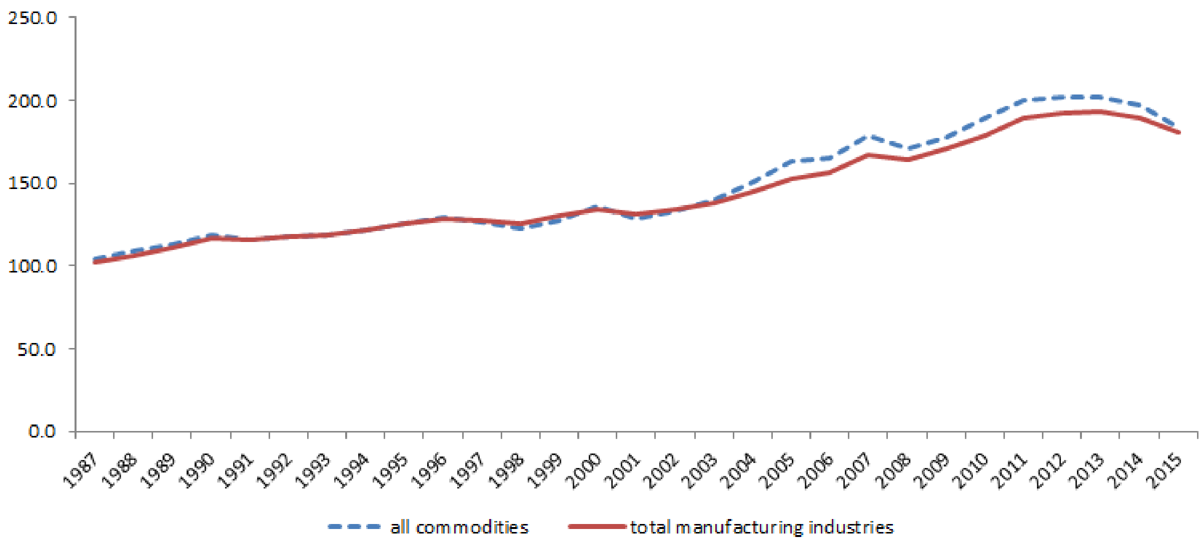
Figure 4: Inter-Industry Input-Output Network (1997)



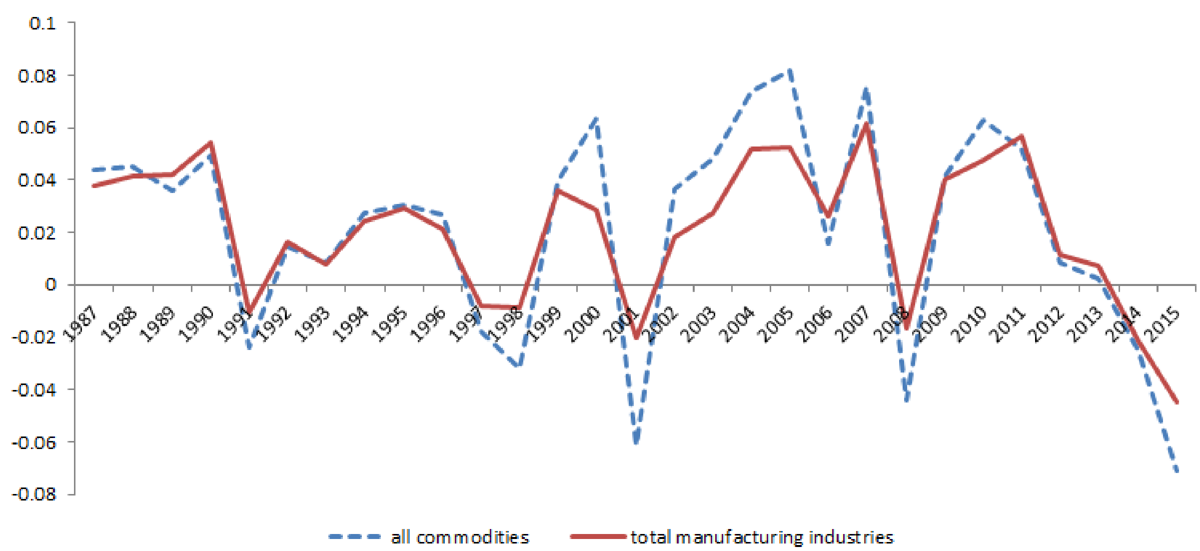
Notes: This graph illustrates the input-output relationship of 470 NAICS six-digit manufacturing industry. Each node represents one industry and the arrows point from the input-producing industries to the input-using industries. All the input-output transactions over 1% of total sales of industries are represented by arrows in this graph.

Figure 5: U.S. Producer Price Index and Inflation (1987-2015)

Panel A: PPI (level, 1984 = 100)

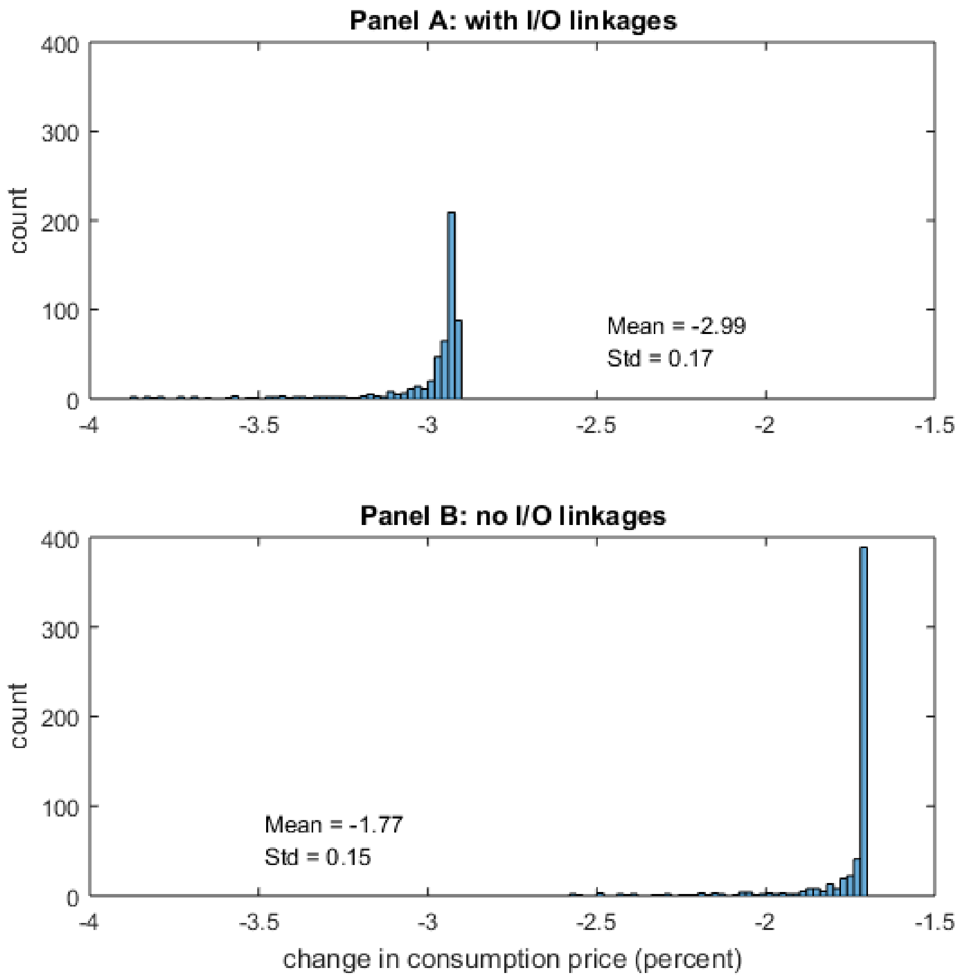


Panel B: PPI (inflation)



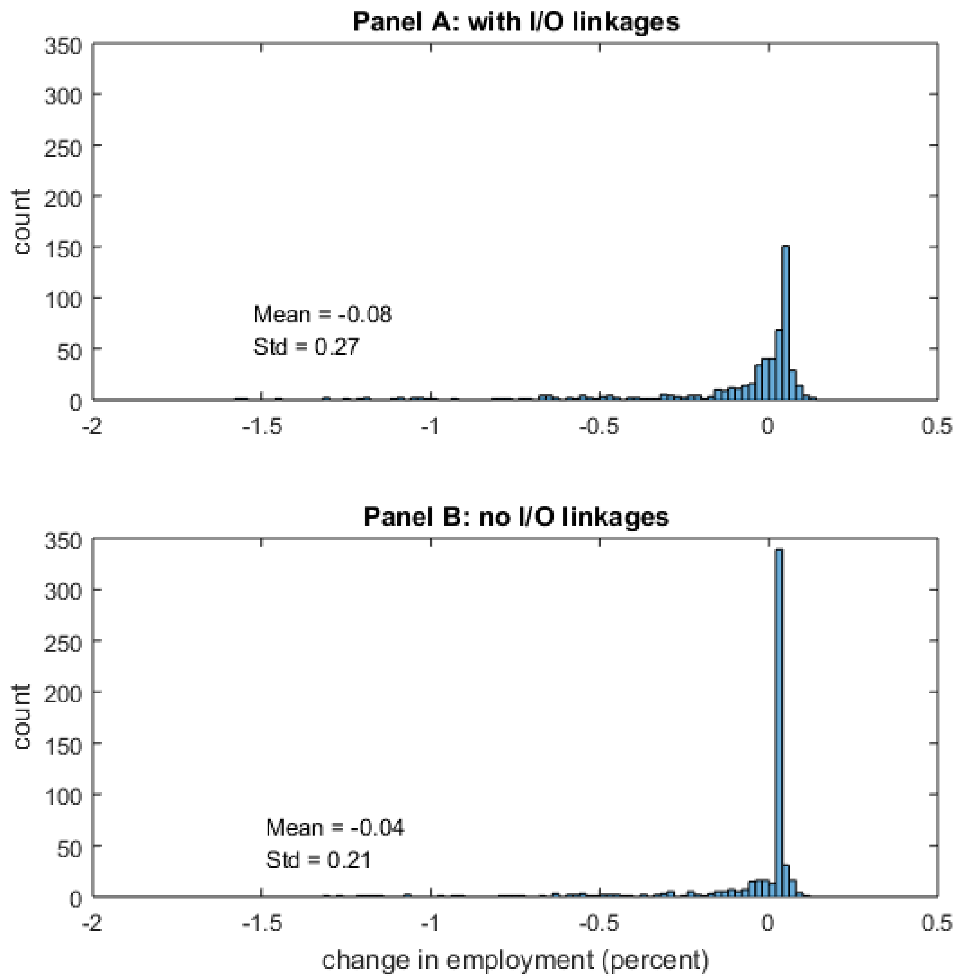
Data Source: U.S. Bureau of Labor Statistics

Figure 6: Changes in Industry Consumption Prices (Baseline)



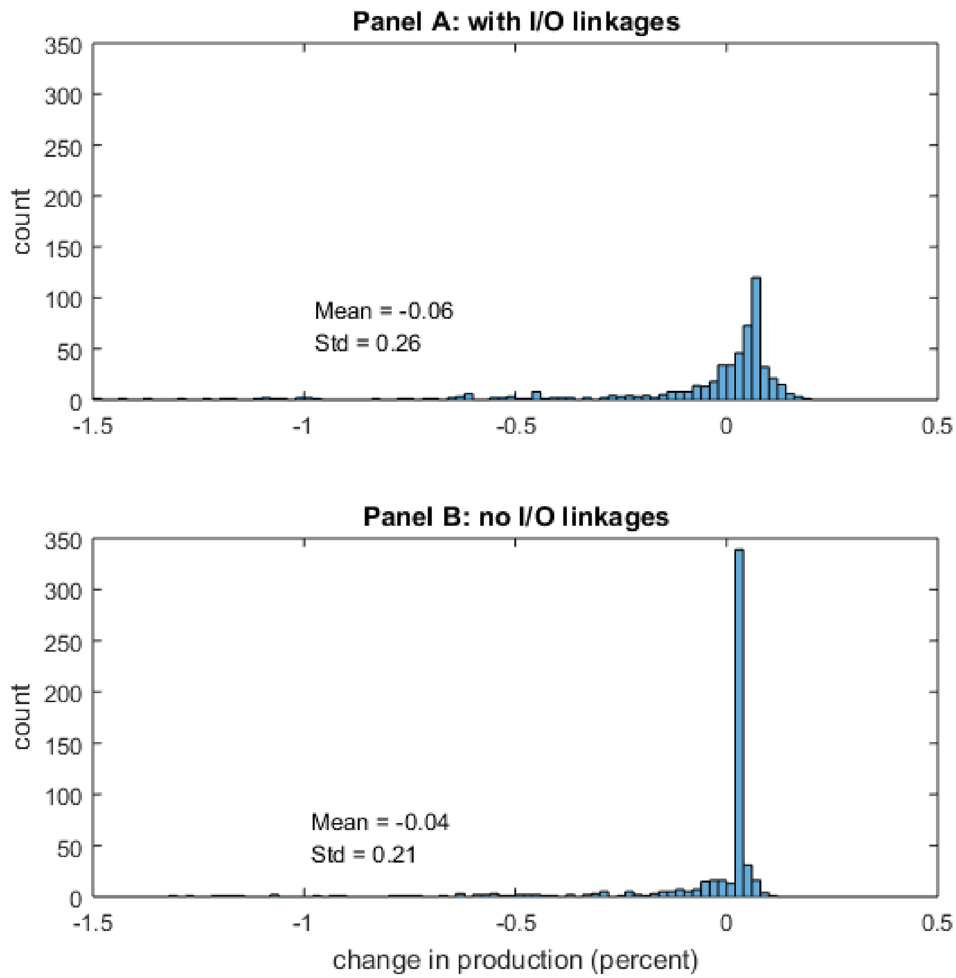
Notes: These figures plot the distribution of the changes in consumption prices for 600 U.S. industries in response to the predicted supply-driven growth of Chinese imports at the NAICS six-digit level from 1993-2007, based on the baseline calibration results. The predicted supply-driven growth of Chinese imports is the fitted values obtained by regressing Chinese import growth in the U.S. on Chinese import growth in eight other high-income countries for all NAICS six-digit industries. Industries with the 5% lowest and 5% highest changes in consumption prices are excluded. Means and standard deviations are reported in percentage change.

Figure 7: Changes in Domestic Industry Employment (Baseline)



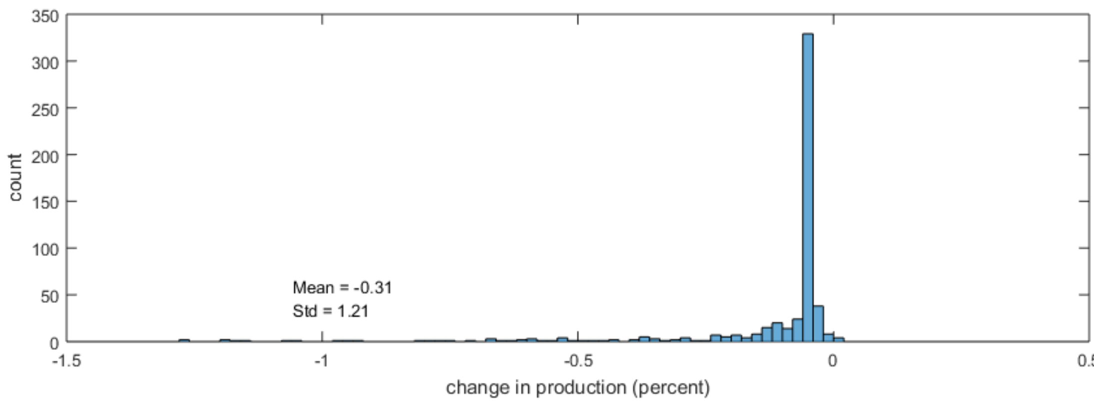
Notes: These figures plot the distribution of the changes in employment for 600 U.S. industries in response to the predicted supply-driven growth of Chinese imports at the NAICS six-digit level from 1993-2007, based on the baseline calibration results. The predicted supply-driven growth of Chinese imports is the fitted values obtained by regressing Chinese import growth in the U.S. on Chinese import growth in eight other high-income countries for all NAICS six-digit industries. Industries with the 5% lowest and 5% highest changes in employment are excluded. Means and standard deviations are reported in percentage change.

Figure 8: Changes in Domestic Production (Baseline)



Notes: These figures plot the distribution of the changes in production for 600 U.S. industries in response to the predicted supply-driven growth in Chinese imports at the NAICS six-digit level from 1993-2007, based on the baseline calibration results. The predicted supply-driven growth of Chinese imports is the fitted values obtained by regressing Chinese import growth in the U.S. on Chinese import growth in eight other high-income countries for all NAICS six-digit industries. Industries with the 5% lowest and 5% highest changes in production are excluded. Means and standard deviations are reported in percentage change.

Figure 9: Changes in Domestic Production (with No Price Adjustment)



Notes: This figure plots the distribution of the changes in production for 600 U.S. industries in response to the predicted supply-driven growth in Chinese imports at the NAICS six-digit level from 1993-2007, when the price adjustment mechanism is shut down. The predicted supply-driven growth of Chinese imports is the fitted values obtained by regressing Chinese import growth in the U.S. on Chinese import growth in eight other high-income countries for all NAICS six-digit industries. Industries with the 5% lowest and 5% highest changes in production are excluded. Means and standard deviations are reported in percentage change.

Table 1: Summary Statistics

	1993-2011				1993-2000	2000-2007	2007-2011
	Mean/SD	Median	Min	Max	Mean/SD	Mean/SD	Mean/SD
Direct exposure:							
Δdirect exposure to Chinese imports	0.91	0.31	-0.32	9.96	0.49	1.49	0.62
	(1.53)				(1.14)	(3.11)	(3.32)
IV for Δdirect exposure to Chinese imports	0.97	0.40	-0.04	13.15	0.31	1.45	1.27
	(1.57)				(0.78)	(2.36)	(2.90)
First-order indirect exposure:							
Δupstream exposure to Chinese imports	0.13	0.10	0.00	0.99	0.06	0.20	0.14
	(0.12)				(0.06)	(0.18)	(0.19)
Δdownstream exposure to Chinese imports	0.18	0.07	-0.00	1.52	0.08	0.33	0.09
	(0.27)				(0.14)	(0.72)	(0.94)
IV for Δupstream exposure to Chinese imports	0.16	0.14	0.00	0.88	0.04	0.24	0.23
	(0.11)				(0.03)	(0.17)	(0.19)
IV for Δdownstream exposure to Chinese imports	0.18	0.07	0.00	1.88	0.04	0.26	0.26
	(0.26)				(0.09)	(0.39)	(0.40)
Full (higher-order) indirect exposure:							
Δupstream exposure to Chinese imports	0.20	0.17	-0.02	1.23	0.09	0.31	0.21
	(0.14)				(0.06)	(0.21)	(0.22)
Δdownstream exposure to Chinese imports	0.28	0.11	0.00	1.69	0.12	0.51	0.18
	(0.37)				(0.17)	(0.85)	(0.99)
IV for Δupstream exposure to Chinese imports	0.25	0.23	0.03	1.11	0.06	0.37	0.38
	(0.14)				(0.04)	(0.21)	(0.23)
IV for Δdownstream exposure to Chinese imports	0.28	0.14	0.00	2.17	0.07	0.42	0.41
	(0.37)				(0.12)	(0.55)	(0.55)
Δlog of shipment price	1.77	2.01	-23.86	6.90	1.12	2.08	2.41
	(2.26)				(2.78)	(2.77)	(2.96)
Δlog of wages	3.03	3.05	0.65	5.70	3.06	3.06	2.90
	(0.68)				(1.00)	(1.49)	(1.76)
Δtotal factor productivity (TFP)	0.22	0.18	-7.76	20.27	0.15	0.33	0.17
	(1.91)				(2.85)	(3.02)	(3.56)

Notes: $N = 386$ NAICS six-digit manufacturing industries. The numbers are reported in percentage per year during each sample period.

Table 2: Effect of Import Exposures on Prices of U.S. Manufacturing Industries: Cumulative Estimates (First-Order)

	1993-2007					1993-2011		
	(1) OLS	(2) IV	(3) IV	(4) IV	(5) IV	(6) IV	(7) IV	(8) IV
Dependent var.:Δ ln(Price)								
Δ direct exposure	-0.177	-0.297**	-0.355**	-0.286**	-0.289**	-0.408**	-0.302***	-0.302***
	(0.106)	(0.138)	(0.159)	(0.118)	(0.119)	(0.163)	(0.113)	(0.113)
Δ upstream exposure				-6.978***	-6.684***		-6.681***	-6.639***
				(1.843)	(1.767)		(1.563)	(1.475)
Δ downstream exposure					-0.468			-0.055
					(0.598)			(0.394)
Δ ln(wages)			0.313*	0.375***	0.384***	0.363**	0.471***	0.471***
			(0.185)	(0.141)	(0.137)	(0.177)	(0.130)	(0.130)
Δ TFP			-0.719***	-0.680***	-0.677***	-0.732***	-0.711***	-0.710***
			(0.241)	(0.213)	(0.210)	(0.232)	(0.211)	(0.207)
Kleibergen-Paap rk LM statistic (P-val)	.	0.003	0.003	0.004	0.003	0.001	0.002	0.002
Kleibergen-Paap rk Wald statistic	.	74.976	76.522	38.512	22.292	43.680	21.006	13.847
Stock-Yogo critical value (10%)	.	16.380	16.380	7.030	.	16.380	7.030	.

Notes: N = 386 NAICS six-digit manufacturing industries. The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers), as identified by the Bureau of Economic Analysis (BEA) 1997 benchmark input-output table. In columns (2)-(8), the direct and first-order upstream and downstream import exposures are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification, and the Kleibergen-Paap rk Wald statistic tests for weak identification. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Effect of Import Exposures on Prices of U.S. Manufacturing Industries: Cumulative Estimates (Higher-Order)

	1993-2007		1993-2011	
	(1)	(2)	(3)	(4)
Dependent var.:Δ ln(Price)				
Δ direct exposure	-0.329**	-0.329**	-0.348***	-0.349***
	(0.132)	(0.133)	(0.125)	(0.126)
Δ upstream exposure	-4.983***	-4.943***	-4.773***	-4.935***
	(1.615)	(1.540)	(1.428)	(1.330)
Δ downstream exposure		-0.067		0.225
		(0.614)		(0.376)
Δ ln(wages)	0.350**	0.351**	0.430***	0.430***
	(0.153)	(0.150)	(0.132)	(0.131)
Δ TFP	-0.684***	-0.683***	-0.711***	-0.717***
	(0.217)	(0.214)	(0.213)	(0.210)
Kleibergen-Paap rk LM statistic (P-val)	0.003	0.002	0.001	0.001
Kleibergen-Paap rk Wald statistic	39.180	35.463	21.488	14.114
Stock-Yogo critical value (10%)	7.030	.	7.030	.

Notes: $N = 386$ NAICS six-digit manufacturing industries. The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers). The weights for the higher-order exposure measures are from the Leontief inverse of the upstream and downstream linkages identified by the Bureau of Economic Analysis (BEA) 1997 input-output matrix. In all columns, the direct and higher-order upstream and downstream import exposure are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification, and the Kleibergen-Paap rk Wald statistic tests for weak identification. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Effect of Import Exposures on Prices of U.S. Manufacturing Industries: Stacked Differences (First-Order)

	1993-2000 & 2000-2007			1993-2000 & 2000-2011		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent var.:Δ ln(Price)						
Δ direct exposure	-0.288**	-0.232**	-0.233**	-0.356**	-0.256***	-0.257***
	(0.127)	(0.091)	(0.091)	(0.139)	(0.091)	(0.091)
Δ upstream exposure		-4.911***	-4.768***		-5.548***	-5.661***
		(1.233)	(1.121)		(1.258)	(1.141)
Δ downstream exposure			-0.218			0.140
			(0.683)			(0.461)
Δ ln(wages)	0.265***	0.278***	0.279***	0.277***	0.318***	0.318***
	(0.048)	(0.049)	(0.051)	(0.069)	(0.077)	(0.077)
Δ TFP	-0.493**	-0.480**	-0.481**	-0.582***	-0.577***	-0.578***
	(0.228)	(0.212)	(0.214)	(0.215)	(0.211)	(0.209)
I{1993-2000}	0.002	0.001	0.001	0.005	0.004	0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
I{2000-2007}	0.015**	0.021***	0.021***			
	(0.006)	(0.005)	(0.005)			
I{2000-2011}				0.019***	0.023***	0.023***
				(0.006)	(0.005)	(0.005)
Kleibergen-Paap rk LM statistic (P-val)	0.003	0.003	0.001	0.001	0.001	0.001
Kleibergen-Paap rk Wald statistic	140.435	68.437	56.535	63.535	31.815	20.939
Stock-Yogo critical value (10%)	16.380	7.030	.	16.380	7.030	.

Notes: $N = 2 \times 386$ NAICS six-digit manufacturing industries. The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers), as identified by the Bureau of Economic Analysis (BEA) 1997 benchmark input-output table. In all columns, the direct and first-order upstream and downstream import exposure are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification, and the Kleibergen-Paap rk Wald statistic tests for weak identification. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Effect of Import Exposures on Prices of U.S. Manufacturing Industries: Stacked Differences (Higher-Order)

	1993-2000 & 2000-2007		1993-2000 & 2000-2011	
	(1)	(2)	(3)	(4)
Dependent var.:Δ ln(Price)				
Δ direct exposure	-0.265***	-0.264**	-0.299***	-0.299***
	(0.103)	(0.104)	(0.101)	(0.102)
Δ upstream exposure	-3.282***	-3.380***	-3.864***	-4.117***
	(1.200)	(1.094)	(1.213)	(1.101)
Δ downstream exposure		0.156		0.325
		(0.681)		(0.407)
Δ ln(wages)	0.269***	0.269***	0.301***	0.300***
	(0.049)	(0.049)	(0.074)	(0.073)
Δ TFP	-0.481**	-0.481**	-0.576***	-0.579***
	(0.214)	(0.215)	(0.211)	(0.209)
I{1993-2000}	0.002	0.002	0.005	0.005
	(0.004)	(0.004)	(0.004)	(0.004)
I{2000-2007}	0.022***	0.022***		
	(0.006)	(0.007)		
I{2000-2011}			0.026***	0.025***
			(0.006)	(0.006)
Kleibergen-Paap rk LM statistic (P-val)	0.003	0.002	0.001	0.001
Kleibergen-Paap rk Wald statistic	70.196	53.667	32.232	21.098
Stock-Yogo critical value (10%)	7.030	.	7.030	.

Notes: $N = 2 \times 386$ NAICS six-digit manufacturing industries. The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers). The weights for the higher-order exposure measures are from the Leontief inverse of the upstream and downstream linkages identified by the Bureau of Economic Analysis (BEA) 1997 input-output matrix. In all columns, the direct and higher-order upstream and downstream import exposure are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification, and the Kleibergen-Paap rk Wald statistic tests for weak identification.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Effect of Import Exposures on Prices of U.S. Manufacturing Industries: Controlling for Pretrends (First-Order)

	1993-2000 & 2000-2007		1993-2000 & 2000-2011	
	(1)	(2)	(3)	(4)
Dependent var.:Δ ln(Price)				
Δ direct exposure	-0.258**	-0.217***	-0.322***	-0.245***
	(0.105)	(0.082)	(0.117)	(0.085)
Δ upstream exposure		-3.875***		-4.803***
		(1.175)		(1.150)
Δ downstream exposure		-0.053		0.270
		(0.630)		(0.466)
Δ ln(wages)	0.251***	0.264***	0.231***	0.272***
	(0.050)	(0.050)	(0.065)	(0.061)
Δ TFP	-0.403***	-0.404***	-0.481***	-0.495***
	(0.153)	(0.154)	(0.141)	(0.151)
I{1993-2000}	-0.007	-0.006	-0.002	-0.002
	(0.007)	(0.006)	(0.006)	(0.006)
I{2000-2007}	0.006	0.012		
	(0.009)	(0.008)		
I{2000-2011}			0.012	0.016**
			(0.008)	(0.008)
Δ ln(Price){1983-1993}	0.445*	0.390*	0.405*	0.340*
	(0.247)	(0.218)	(0.221)	(0.188)
Kleibergen-Paap rk LM statistic (P-val)	0.003	0.001	0.001	0.001
Kleibergen-Paap rk Wald statistic	142.891	58.224	64.335	20.914
Stock-Yogo critical value (10%)	16.380	.	16.380	.

Notes: $N = 2 \times 386$ NAICS six-digit manufacturing industries. The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers), as identified by the Bureau of Economic Analysis (BEA) 1997 benchmark input-output table. In columns (2)-(8), the direct and first-order upstream and downstream import exposures are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification, and the Kleibergen-Paap rk Wald statistic tests for weak identification.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Effect of Import Exposures on Prices of U.S. Manufacturing Industries: Alternative Measures of Import Exposure

	Net imports		Gravity residuals	
	(1)	(2)	(3)	(4)
Dependent var.:Δ ln(Price)				
Δ direct exposure	-0.353**	-0.302**	-0.526*	-0.352*
	(0.157)	(0.121)	(0.270)	(0.182)
Δ upstream exposure		-7.763***		-30.606***
		(2.378)		(11.364)
Δ downstream exposure		-0.856		-0.629
		(0.605)		(1.524)
Δ ln(wages)	0.473***	0.632***	0.454**	0.657***
	(0.152)	(0.109)	(0.179)	(0.099)
Δ TFP	-0.730***	-0.698***	-0.731***	-0.756***
	(0.236)	(0.200)	(0.248)	(0.210)
Kleibergen-Paap rk LM statistic (P-val)	0.011	0.039	.	.
Kleibergen-Paap rk Wald statistic	36.300	32.669	.	.
Stock-Yogo critical value (10%)	19.930	.	.	.
Hansen J statistic (P-val)	0.946	0.142		

Notes: $N = 2 \times 386$ NAICS six-digit manufacturing industries. The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period, measured by U.S. net imports (imports minus exports) from China in columns (1)-(2) and the inferred supply-driven Chinese imports from the gravity residuals in columns (3)-(4), respetively. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers), as identified by the Bureau of Economic Analysis (BEA) 1997 benchmark input-output table. In columns (1)-(2), the direct and first-order upstream and downstream import exposures are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports, and a measure of their exports to China. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification, and the Kleibergen-Paap rk Wald statistic tests for weak identification. The Hansen J statistic tests for overidentification of all instruments. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Effect of Import Exposure on Prices of Non-Manufacturing Industries (First-Order)

	Non-manufacturing				Pooling w/ manufacturing	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent var.:Δ ln(Price)						
Δ direct exposure					-0.124***	-0.102**
					(0.046)	(0.040)
Δ upstream exposure	3.826	2.801	4.712	4.151	-3.856*	-4.693***
	(4.613)	(3.968)	(5.058)	(4.570)	(2.097)	(1.640)
Δ downstream exposure		4.617		2.431	0.266	0.185
		(4.913)		(3.439)	(0.877)	(0.702)
I{1997-2002}	0.007	0.008*	0.011**	0.012***	0.004	0.007**
	(0.006)	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)
I{2002-2007}	0.023***	0.021***			0.037***	
	(0.004)	(0.005)			(0.005)	
I{2002-2011}			0.021***	0.020***		0.035***
			(0.004)	(0.004)		(0.004)
Kleibergen-Paap rk LM statistic (P-val)	0.022	0.009	0.036	0.016	0.001	0.001
Kleibergen-Paap rk Wald statistic	92.625	41.250	320.598	17.156	35.114	23.963
Stock-Yogo critical value (10%)	16.380	7.030	16.380	7.030	.	.

Notes: $N = 2 \times 79$ non-manufacturing industries in column (1)-(4); and $N = 2 \times 465$ manufacturing and non-manufacturing industries in column (5)-(8). The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers), as identified by the Bureau of Economic Analysis (BEA) 1997 benchmark input-output table. In all columns, the direct and first-order upstream and downstream import exposures are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification, and the Kleibergen-Paap rk Wald statistic tests for weak identification. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Effect of Import Exposure on Prices of Non-Manufacturing Industries (Higher-Order)

	Non-manufacturing				Pooling w/ manufacturing	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent var.:Δ ln(Price)						
Δ direct exposure					-0.149***	-0.135***
					(0.053)	(0.037)
Δ upstream exposure	5.129	2.876	5.532	4.206	-2.631	-3.358*
	(4.508)	(3.700)	(4.623)	(3.923)	(2.009)	(1.724)
Δ downstream exposure		4.063*		2.856	0.672	0.406
		(2.345)		(1.906)	(0.808)	(0.541)
I{1997-2002}	0.004	0.006	0.009	0.010*	0.005	0.007***
	(0.007)	(0.006)	(0.007)	(0.006)	(0.003)	(0.003)
I{2002-2007}	0.017**	0.012			0.036***	
	(0.007)	(0.009)			(0.008)	
I{2002-2011}			0.016***	0.013**		0.036***
			(0.005)	(0.006)		(0.005)
Kleibergen-Paap rk LM statistic (P-val)	0.011	0.006	0.017	0.005	0.001	0.001
Kleibergen-Paap rk Wald statistic	130.274	60.792	605.340	94.414	61.878	23.791
Stock-Yogo critical value (10%)	16.380	7.030	16.380	7.030	.	.

Notes: $N = 2 \times 79$ non-manufacturing industries in column (1)-(4); and $N = 2 \times 465$ manufacturing and non-manufacturing industries in column (5)-(8). The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers). The weights for the higher-order exposure measures are from the Leontief inverse of the upstream and downstream linkages identified by the Bureau of Economic Analysis (BEA) 1997 input-output matrix. In all columns, the direct and higher-order upstream and downstream import exposure are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification, and the Kleibergen-Paap rk Wald statistic tests for weak identification. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Comparing the Price Effect of Import Exposures to Different Sources (1993-2007)

	All LICs		All LICs excluding China		Mexico/CAFTA		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent var.:Δ ln(Price)								
Δ direct exposure	-0.257**	-0.211***	-1.167**	-2.001**	0.304	0.443	0.171***	0.088*
	(0.110)	(0.079)	(0.537)	(0.778)	(0.804)	(0.800)	(0.064)	(0.051)
Δ upstream exposure		-4.053***		49.548		-6.266		1.916***
		(1.437)		(44.609)		(4.635)		(0.448)
Δ ln(wages)	0.277***	0.287***	0.300***	0.323***	0.211***	0.188***	0.196***	0.196***
	(0.048)	(0.051)	(0.088)	(0.089)	(0.066)	(0.069)	(0.056)	(0.060)
Δ TFP	-0.494**	-0.487**	-0.495**	-0.452*	-0.507**	-0.517**	-0.513**	-0.503**
	(0.228)	(0.214)	(0.236)	(0.252)	(0.219)	(0.224)	(0.237)	(0.238)
I{1993-2000}	0.002	0.002	0.003	-0.003	0.001	0.005	0.001	-0.003
	(0.004)	(0.003)	(0.003)	(0.009)	(0.006)	(0.005)	(0.005)	(0.006)
I{2000-2007}	0.015***	0.021***	0.014***	0.003	0.011	0.014**	0.012*	0.013*
	(0.006)	(0.005)	(0.005)	(0.014)	(0.007)	(0.007)	(0.007)	(0.007)
Kleibergen-Paap rk LM statistic (P-val)	0.002	0.002	0.053	0.005	0.020	0.022	0.045	0.041
Kleibergen-Paap rk Wald statistic	280.786	137.885	26.968	1.241	3.997	2.204	14.539	9.163
Stock-Yogo critical value (10%)	16.380	7.030	16.380	7.030	16.380	7.030	16.380	7.030

Notes: $N = 2 \times 386$ NAICS six-digit manufacturing industries. The direct import exposure for a given industry is equal to the annulized change of import penetration ratio from the corresponding source over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers), as identified by the Bureau of Economic Analysis (BEA) 1997 benchmark input-output table. In all columns, the direct and first-order upstream and downstream import exposures are instrumented using variables constructed from the changes in eight other high-income countries' exposure to imports from the source under consideration. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification, and the Kleibergen-Paap rk Wald statistic tests for weak identification. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 11: Low-income countries in 1996

Afghanistan	Congo, Dem. Rep.	Lao PDR	Rwanda
Angola	Congo, Rep.	Lesotho	São Tomé and Principe
Armenia	Côte d'Ivoire	Liberia	Senegal
Azerbaijan	Equatorial Guinea	Madagascar	Sierra Leone
Bangladesh	Eritrea	Malawi	Somalia
Benin	Ethiopia	Mali	Sri Lanka
Bhutan	Gambia, The	Mauritania	Tajikistan
Bosnia and Herzegovina	Ghana	Moldova	Tanzania
Burkina Faso	Guinea	Mongolia	Togo
Burundi	Guinea-Bissau	Mozambique	Uganda
Cambodia	Guyana	Myanmar	Vietnam
Cameroon	Haiti	Nepal	Yemen, Rep.
Central African Republic	Honduras	Nicaragua	Zambia
Chad	India	Niger	Zimbabwe
China	Kenya	Nigeria	
Comoros	Kyrgyz Republic	Pakistan	

Source: The World Bank

Table 12: Annualized Percent Changes in Domestic Variables (Baseline)

	I/O linkages			no I/O linkages		
Aggregate variables:						
Aggregate price (P_n)		-2.99			-1.77	
Wages (W_n)		-2.91			-1.71	
Aggregate consumption (C_n)		0.14			0.09	
	full sample	excluding outliers	manufacturing only	full sample	excluding outliers	manufacturing only
Industry variables:						
Consumption price ($P_{n,i}$)	-3.15	-2.99	-3.21	-1.91	-1.77	-1.97
	(0.95)	(0.17)	(1.06)	(0.89)	(0.15)	(0.99)
Producer price ($p_{nn,i}$)	-2.94	-2.93	-2.94	-1.71	-1.77	-1.71
	(0.03)	(0.02)	(0.03)	(0.00)	(0.15)	(0.00)
Employment ($L_{n,i}$)	-0.30	-0.08	-0.39	-0.25	-0.04	-0.32
	(1.41)	(0.27)	(1.57)	(1.31)	(0.21)	(1.47)
Production ($Y_{n,i}$)	-0.27	-0.06	-0.35	-0.25	-0.04	-0.32
	(1.40)	(0.26)	(1.57)	(1.31)	(0.21)	(1.47)

Notes: This table reports the changes in domestic variables in response to the predicted supply-driven growth of Chinese imports at the NAICS six-digit level from 1993-2007, based on the baseline calibration results of a 600-industry version of the model. The predicted supply-driven growth of Chinese imports is the fitted values obtained by regressing Chinese import growth in the U.S. on Chinese import growth in eight other high-income countries for all NAICS six-digit industries. The second and fourth columns in the lower part of this table exclude industries with the 5% lowest and 5% highest changes in the corresponding variables. Standard errors are in the parentheses.

Table 13: Annualized Percent Changes in Domestic Variables (Elasticity of Substitution = 4.2)

	I/O linkages	no I/O linkages
Aggregate variables:		
Aggregate price (P_n)	-2.94	-1.74
Wages (W_n)	-2.91	-1.71
Aggregate consumption (C_n)	0.10	0.06
Industry variables:		
Consumption price ($P_{n,i}$)	-3.02	-1.81
	(0.44)	(0.41)
Producer price ($p_{nn,i}$)	-2.92	-1.71
	(0.01)	(0.00)
Employment ($L_{n,i}$)	-0.30	-0.25
	(1.41)	(1.31)
Production ($Y_{n,i}$)	-0.29	-0.25
	(1.41)	(1.31)

Notes: This table reports the changes in domestic variables in response to the predicted supply-driven growth of Chinese imports at the NAICS six-digit level from 1993-2007, based on the calibration results of a 600-industry version of the model with a uniform elasticity of substitution within industries equal to 4.2. The predicted supply-driven growth of Chinese imports is the fitted values obtained by regressing Chinese import growth in the U.S. on Chinese import growth in eight other high-income countries for all NAICS six-digit industries. The second and fourth columns in the lower part of this table exclude industries with the 5% lowest and 5% highest changes in the corresponding variables. Standard errors are in the parentheses.

Table 14: Annualized Percent Changes in Domestic Variables (CES Aggregate Consumption)

	I/O linkages	no I/O linkages
Aggregate variables:		
Aggregate price (P_n)	-3.49	-2.43
Wages (W_n)	-3.45	-2.40
Aggregate consumption (C_n)	0.11	0.08
Industry variables:		
Consumption price ($P_{n,i}$)	-3.56	-2.50
	(0.39)	(0.36)
Producer price ($p_{nn,i}$)	-3.46	-2.40
	(0.01)	(0.00)
Employment ($L_{n,i}$)	-0.20	-0.15
	(0.95)	(0.81)
Production ($Y_{n,i}$)	-0.19	-0.15
	(0.95)	(0.81)

Notes: This table reports the changes in domestic variables in response to the predicted supply-driven growth of Chinese imports at the NAICS six-digit level from 1993-2007, based on the baseline calibration results of a 600-industry version of the model with a CES consumption aggregate. The predicted supply-driven growth of Chinese imports is the fitted values obtained by regressing Chinese import growth in the U.S. on Chinese import growth in eight other high-income countries for all NAICS six-digit industries. The second and fourth columns in the lower part of this table exclude industries with the 5% lowest and 5% highest changes in the corresponding variables. Standard errors are in the parentheses.

Appendix A.

Given $\{L_n,\ B_n,\ A_{n,i},\ X_{nk,i},\ X_{kn,i}\}$, the system of equations with 12 unknowns (W_n,P_n, C_n,$C_{n,i}$, $C^F_{n,i}$, $Z_{n,ij}$, $Y_{n,i}$, $L_{n,i}$, $C_{nn,i}$, $P_{n,i}$, $p_{nk,i}$, $p_{nn,i}$) consists of

1. First-order conditions:

$$W_n L_{n,i} = \omega^L_{n,i} p_{nn,i} Y_{n,i} \tag{A1}$$

$$P_{n,j} Z_{n,ij} = \omega_{n,ij} p_{nn,i} Y_{n,i} \tag{A2}$$

$$X_{nk,i} = p^{1-\sigma_i}_{nk,i} P^{\sigma_i}_{n,i} C_{n,i} \tag{A3}$$

$$C_{nn,i} = p^{-\sigma_i}_{nn,i} P^{\sigma_i}_{n,i} C_{n,i} \tag{A4}$$

2.The budget constraint and goods and labor market clearing conditions:

$$\begin{aligned} P_{n.i} C^F_{n,i} &= \alpha_{n,i}(W_n L_n + B_n) && \text{(A5)} \\ C_{n,i} &= C^F_{n,i} + \sum_{j=1}^{S} Z_{n,ji} && \text{(A6)} \\ p_{nn,i} Y_{n,i} &= p_{nn,i} C_{nn,i} + \sum_{k=1,k\neq n}^{N} X_{kn,i} && \text{(A7)} \\ L_n &= \sum_{i=1}^{S} L_{n,i} && \text{(A8)} \end{aligned}$$

3. Production functions and price aggregators:

$$Y_{n,i} = A_{n,i} L^{\omega^L_{n,i}}_{n,i} \prod_{j=1}^{S} Z^{\omega_{n,ij}}_{n,ij} \tag{A9}$$

$$P_{n,i} = (\sum_{k=1}^{N} p^{1-\sigma_i}_{nk,i})^{\frac{1}{1-\sigma_i}} \tag{A10}$$

$$C_n = \prod_{i=1}^{S} (C_{n,i}^F)^{\alpha_{n,i}} \tag{A11}$$

$$P_n = \prod_{i=1}^{S} P_{n,i}^{\alpha_{n,i}} \tag{A12}$$

Log-differentiating the system of equations (A1)-(A12) yields (where $\hat{x} = d\ln x$)

$$\hat{W}_n + \hat{L}_{n,i} = \hat{p}_{nn,i} + \hat{Y}_{n,i} \tag{A13}$$

$$\hat{P}_{n,j} + \hat{Z}_{n,ij} = \hat{p}_{nn,i} + \hat{Y}_{n,i} \tag{A14}$$

$$\hat{X}_{nk,i} = \sigma_i \hat{P}_{n,i} + (1-\sigma_i)\hat{p}_{nk,i} + \hat{C}_{n,i} \tag{A15}$$

$$\hat{C}_{nn,i} = \sigma_i(\hat{P}_{n,i} - \hat{p}_{nn,i}) + \hat{C}_{n,i} \tag{A16}$$

$$\hat{P}_{n,i} + \hat{C}_{n,i}^F = s_n^W(\hat{W}_n + \hat{L}_n) + (1-s_n^W)\hat{B}_n \tag{A17}$$

$$\hat{C}_{n,i} = s_{n,i}^{fy}\hat{C}_{n,i}^F + \sum_{j=1}^{S} s_{n,ji}^{zy}\hat{Z}_{n,ji} \tag{A18}$$

$$\hat{p}_{nn,i} + \hat{Y}_{n,i} = (1 - \sum_{k=1,k\neq n}^{N} \mu_{kn,i})(\hat{p}_{nn,i} + \hat{C}_{nn,i}) + \sum_{k=1,k\neq n}^{N} \mu_{kn,i}\hat{X}_{kn,i} \tag{A19}$$

$$\hat{L}_n = \sum_{i=1}^{S} s_{n,i}^L \hat{L}_{n,i} \tag{A20}$$

$$\hat{Y}_{n,i} = \hat{A}_{n,i} + \omega_{n,i}^L \hat{L}_{n,i} + \sum_{j=1}^{S} \omega_{n,ij}\hat{Z}_{n,ij} \tag{A21}$$

$$\hat{P}_{n,i} = \sum_{k=1}^{N} \lambda_{nk,i}\hat{p}_{nk,i} \tag{A22}$$

$$\hat{C}_n = \sum_{i=1}^{S} \alpha_{n,i} \hat{C}^F_{n,i} \tag{A23}$$

$$\hat{P}_n = \sum_{i=1}^{S} \alpha_{n,i} \hat{P}_{n,i} \tag{A24}$$

where

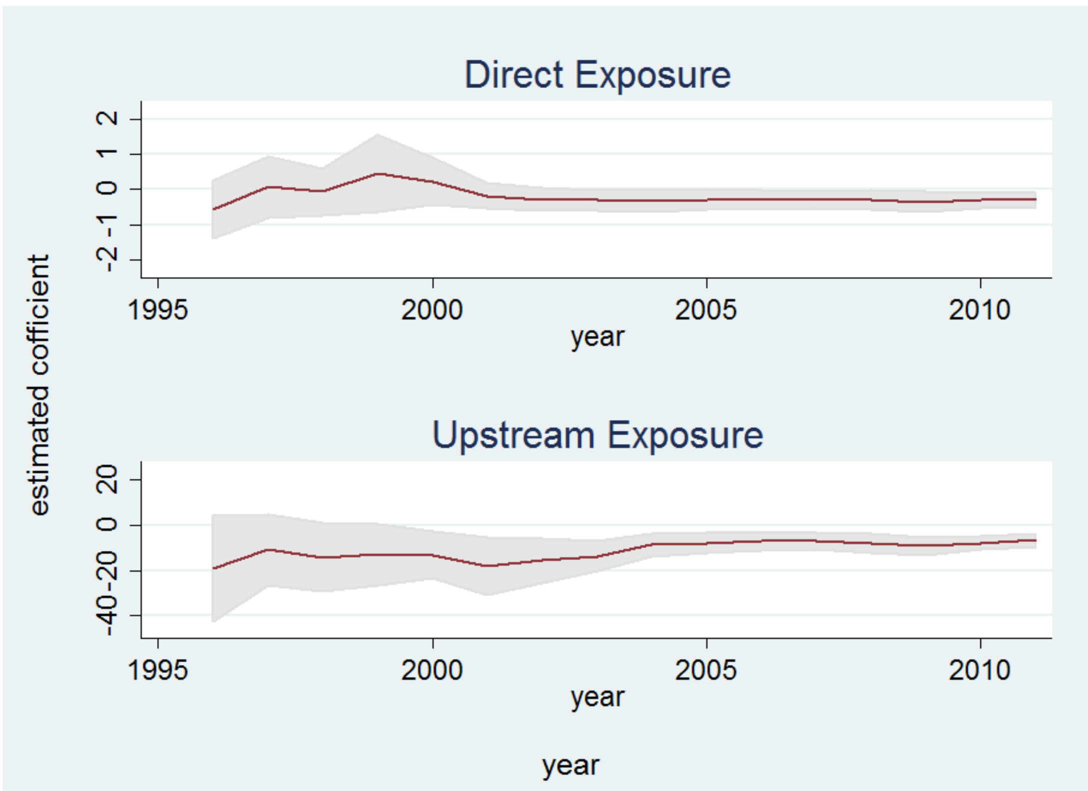
$$s^W_n = \frac{W_n L_n}{W_n L_n + B_n},\ s^{fy}_{n,i} = \frac{C^F_{n,i}}{C_{n,i}},\ s^{zy}_{n,ji} = \frac{Z_{n,ji}}{C_{n,i}}$$

$$\mu_{kn,i} = \frac{X_{kn,i}}{Y_{n,i}},\ \gamma_{nk,i} = \frac{p_{nk,i} C_{nk,i}}{P_{n,i} C_{n,i}},\ s^L_{n,i} = \frac{L_{n,i}}{L_n},\ \alpha_{n,i} = \frac{P_{n,i} C_{n,i}}{P_n C_n}$$

Appendix B.

This appendix contains additional figures and tables.

Figure B1: Estimated Cumulative Effect of Direct and Upstream Exposure to Chinese Imports



Notes: This figure plots the estimated cofficients on the direct and upstream exposure to Chinese imports in a series of cumulative long-period regressions. The value for a given Year T represents the cumulative annualized price effect from 1993 to year T. The shaded area represents the 95% confidence interval.

Table B1: Effect of Import Exposures on Prices of U.S. Manufacturing Industries (BLS PPI Data): Cumulative Estimates (First-Order)

	1993-2007			1993-2011		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent var.:Δ ln(Price)						
Δ direct exposure	-0.435***	-0.371***	-0.379***	-0.448***	-0.365***	-0.364***
	(0.124)	(0.087)	(0.090)	(0.119)	(0.090)	(0.091)
Δ upstream exposure		-6.577***	-6.236***		-5.590***	-5.408***
		(1.426)	(1.363)		(1.170)	(1.110)
Δ downstream exposure			-0.676*			-0.272
			(0.400)			(0.288)
Δ ln(wages)	0.389**	0.466***	0.497***	0.371	0.456**	0.458**
	(0.194)	(0.160)	(0.169)	(0.239)	(0.185)	(0.187)
Δ TFP	-0.392***	-0.347***	-0.341***	-0.403***	-0.381***	-0.376***
	(0.109)	(0.085)	(0.082)	(0.126)	(0.107)	(0.103)
Kleibergen-Paap rk LM statistic (P-val)	0.008	0.008	0.006	0.004	0.004	0.005
Kleibergen-Paap rk Wald statistic	73.230	38.333	18.111	131.332	66.240	44.402
Stock-Yogo critical value (10%)	16.380	7.030	.	16.380	7.030	.

Notes: $N = 279$ NAICS six-digit manufacturing industries. The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers), as identified by the Bureau of Economic Analysis (BEA) 1997 benchmark input-output table. In all columns, the direct and first-order upstream and downstream import exposures are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification, and the Kleibergen-Paap rk Wald statistic tests for weak identification. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B2: Effect of Import Exposures on Prices of U.S. Manufacturing Industries (BLS PPI Data): Cumulative Estimates (Higher-Order)

	1993-2007		1993-2011	
	(1)	(2)	(3)	(4)
Dependent var.:Δ ln(Price)				
Δ direct exposure	-0.417***	-0.422***	-0.401***	-0.401***
	(0.100)	(0.101)	(0.097)	(0.097)
Δ upstream exposure	-4.960***	-4.757***	-4.238***	-4.212***
	(1.323)	(1.265)	(1.026)	(0.944)
Δ downstream exposure		-0.407		-0.043
		(0.385)		(0.283)
Δ ln(wages)	0.445***	0.463***	0.428**	0.428**
	(0.166)	(0.171)	(0.190)	(0.190)
Δ TFP	-0.350***	-0.345***	-0.380***	-0.379***
	(0.088)	(0.085)	(0.109)	(0.106)
Kleibergen-Paap rk LM statistic (P-val)	0.007	0.002	0.004	0.004
Kleibergen-Paap rk Wald statistic	37.649	55.962	64.786	43.627
Stock-Yogo critical value (10%)	7.030	.	7.030	.

Notes: $N = 279$ NAICS six-digit manufacturing industries. The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers). The weights for the higher-order exposure measures are from the Leontief inverse of the upstream and downstream linkages identified by the Bureau of Economic Analysis (BEA) 1997 input-output matrix. In all columns, the direct and higher-order upstream and downstream import exposure are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification,, and the Kleibergen-Paap rk Wald statistic tests for weak identification. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B3: Effect of Import Exposures on Prices of U.S. Manufacturing Industries (BLS PPI Data): Stacked Differences (First-Order)

	1993-2000 & 2000-2007			1993-2000 & 2000-2011		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent var.:Δ ln(Price)						
Δ direct exposure	-0.397***	-0.330***	-0.336***	-0.420***	-0.328***	-0.326***
	(0.108)	(0.076)	(0.075)	(0.107)	(0.077)	(0.079)
Δ upstream exposure		-4.968***	-4.545***		-5.014***	-4.750***
		(1.041)	(0.870)		(1.083)	(0.984)
Δ downstream exposure			-0.754			-0.367
			(0.550)			(0.461)
Δ ln(wages)	0.292***	0.306***	0.307***	0.285***	0.307***	0.308***
	(0.070)	(0.069)	(0.073)	(0.098)	(0.094)	(0.095)
Δ TFP	-0.272***	-0.251***	-0.255***	-0.303***	-0.298***	-0.295***
	(0.101)	(0.086)	(0.087)	(0.091)	(0.086)	(0.083)
I{1993-2000}	0.004	0.003	0.003	0.006	0.005	0.005
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
I{2000-2007}	0.020***	0.025***	0.027***			
	(0.004)	(0.004)	(0.003)			
I{2000-2011}				0.023***	0.027***	0.027***
				(0.005)	(0.004)	(0.004)
Kleibergen-Paap rk LM statistic (P-val)	0.009	0.009	0.006	0.004	0.004	0.004
Kleibergen-Paap rk Wald statistic	133.369	65.568	21.601	112.415	63.891	42.092
Stock-Yogo critical value (10%)	16.380	7.030	.	16.380	7.030	.

Notes: $N = 2 \times 279$ NAICS six-digit manufacturing industries. The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers), as identified by the Bureau of Economic Analysis (BEA) 1997 benchmark input-output table. In all columns, the direct and first-order upstream and downstream import exposures are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification, and the Kleibergen-Paap rk Wald statistic tests for weak identification. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B4: Effect of Import Exposures on Prices of U.S. Manufacturing Industries (BLS PPI Data): Stacked Differences (Higher-Order)

	1993-2000 & 2000-2007		1993-2000 & 2000-2011	
	(1)	(2)	(3)	(4)
Dependent var.:Δ ln(Price)				
Δ direct exposure	-0.368***	-0.372***	-0.364***	-0.363***
	(0.085)	(0.084)	(0.084)	(0.084)
Δ upstream exposure	-3.526***	-3.266***	-3.681***	-3.581***
	(1.023)	(0.852)	(0.936)	(0.787)
Δ downstream exposure		-0.476		-0.151
		(0.495)		(0.410)
Δ ln(wages)	0.299***	0.299***	0.297***	0.297***
	(0.069)	(0.073)	(0.095)	(0.096)
Δ TFP	-0.253***	-0.255***	-0.297***	-0.296***
	(0.087)	(0.088)	(0.086)	(0.083)
I{1993-2000}	0.004	0.004	0.007*	0.007*
	(0.003)	(0.003)	(0.003)	(0.003)
I{2000-2007}	0.028***	0.029***		
	(0.004)	(0.004)		
I{2000-2011}			0.029***	0.029***
			(0.005)	(0.005)
Kleibergen-Paap rk LM statistic (P-val)	0.009	0.005	0.004	0.004
Kleibergen-Paap rk Wald statistic	66.417	69.252	62.013	40.953
Stock-Yogo critical value (10%)	7.030	.	7.030	.

Notes: $N = 2 \times 279$ NAICS six-digit manufacturing industries. The direct import exposure for a given industry is equal to the annulized change of China import penetration ratio over the relevant period. Upstream (downstream) import exposure for a given industry is a weighted average of the direct import exposure experienced by its upstream suppliers (downstream buyers). The weights for the higher-order exposure measures are from the Leontief inverse of the upstream and downstream linkages identified by the Bureau of Economic Analysis (BEA) 1997 input-output matrix. In all columns, the direct and higher-order upstream and downstream import exposure are instrumented using variables constructed from the changes in eight other high-income countries' exposure to Chinese imports. All specifications include dummies for 3 two-digit sectors. Standard errors in parentheses are clustered on three-digit industry. The Kleibergen-Paap rk LM statistic tests for underidentification,, and the Kleibergen-Paap rk Wald statistic tests for weak identification.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B5: Annual Changes in Direct Exposure to Chinese Imports (1993-2007)

NAICS Code	NAICS Industry Name	Change in Direct Import Exposure (%)
316	Leather and Allied Product	4.296
337	Furniture and Related Product	2.598
334	Computer and Electronic Product	2.509
339	Miscellaneous	2.379
315	Apparel	1.817
314	Textile Product Mills	1.700
335	Electrical Equipment, Appliance, and Component	1.588
332	Fabricated Metal Product	0.749
333	Machinery	0.701
323	Printing and Related Support Activities	0.694
327	Nonmetallic Mineral Product	0.612
326	Plastics and Rubber Products	0.593
331	Primary Metal	0.430
321	Wood Product	0.293
313	Textile Mills	0.165
322	Paper	0.141
325	Chemical	0.135
336	Transportation Equipment	0.130
311	Food	0.052
324	Petroleum and Coal Products	0.013
312	Beverage and Tobacco Product	0.003

Table B6: Annual Changes in Upstream Exposure to Chinese Imports (1993-2007)

NAICS Code	NAICS Industry Name	Change in Upstream Import Exposure (%)
334	Computer and Electronic Product	0.356
314	Textile Product Mills	0.191
336	Transportation Equipment	0.190
333	Machinery	0.168
335	Electrical Equipment, Appliance, and Component	0.159
337	Furniture and Related Product	0.148
332	Fabricated Metal Product	0.143
315	Apparel	0.140
339	Miscellaneous	0.134
321	Wood Product	0.124
331	Primary Metal	0.110
326	Plastics and Rubber Products	0.089
316	Leather and Allied Product	0.079
323	Printing and Related Support Activities	0.077
325	Chemical	0.071
327	Nonmetallic Mineral Product	0.069
313	Textile Mills	0.067
322	Paper	0.056
324	Petroleum and Coal Products	0.043
312	Beverage and Tobacco Product	0.032
311	Food	0.025

Table B7: Annual Changes in Downstream Exposure to Chinese Imports (1993-2007)

NAICS Code	NAICS Industry Name	Change in Downstream Import Exposure (%)
314	Textile Product Mills	0.970
313	Textile Mills	0.817
334	Computer and Electronic Product	0.501
331	Primary Metal	0.494
326	Plastics and Rubber Products	0.354
316	Leather and Allied Product	0.236
337	Furniture and Related Product	0.224
332	Fabricated Metal Product	0.216
322	Paper	0.201
335	Electrical Equipment, Appliance, and Component	0.195
325	Chemical	0.191
321	Wood Product	0.142
327	Nonmetallic Mineral Product	0.140
323	Printing and Related Support Activities	0.105
339	Miscellaneous	0.104
315	Apparel	0.095
333	Machinery	0.087
336	Transportation Equipment	0.029
324	Petroleum and Coal Products	0.028
311	Food	0.012
312	Beverage and Tobacco Product	0.000

Table B8: Annual Changes in Prices (1993-2007)

NAICS Code	NAICS Industry Name	Change in Prices (%)
334	Computer and Electronic Product	0.901
315	Apparel	1.055
313	Textile Mills	1.060
321	Wood Product	1.101
314	Textile Product Mills	1.112
316	Leather and Allied Product	1.121
336	Transportation Equipment	1.144
323	Printing and Related Support Activities	1.147
335	Electrical Equipment, Appliance, and Component	1.149
339	Miscellaneous	1.159
311	Food	1.173
333	Machinery	1.184
337	Furniture and Related Product	1.188
327	Nonmetallic Mineral Product	1.209
326	Plastics and Rubber Products	1.233
322	Paper	1.247
332	Fabricated Metal Product	1.293
312	Beverage and Tobacco Product	1.339
325	Chemical	1.346
331	Primary Metal	1.554
324	Petroleum and Coal Products	1.939