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The Effect of Trade with Low-Income Countries on U.S. Industry*

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Abstract

When labor-abundant nations grow, their exports increase more in labor-intensive sectors than in capital-intensive sectors. We utilize this sectoral difference in how exports are affected by growth to identify the causal effect of trade with low-income countries (LICs) on U.S. industry. Our framework relates differences in sectoral inflation rates to differences in comparative advantage-induced import growth rates and abstracts from aggregate fluctuations and sector specific trends. In a panel covering 325 manufacturing industries from 1997 to 2006, we find that LIC exports are associated with strong downward pressure on U.S. producer prices and a large effect on productivity. When LIC exporters capture 1% U.S. market share, producer prices decrease by 3.1%, which is nearly fully accounted by a 2.4% increase in productivity and a 0.4% decrease in markups. We also document that while LICs on average find it easier to penetrate sectors with elastic demand, the price and productivity response to import competition is much stronger in industries with inelastic demand. Overall, between 1997 and 2006, the effect of LIC trade on manufacturing PPI inflation was around two percentage points per year, far too large to be neglected in macroeconomic analysis.

JEL codes: F14, F15, F16

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China and other poor, yet rapidly growing, nations now account for over a third of global trade and they have a virtual monopoly in specific sectors such as toys and textiles. What is the effect of trade with these low-income countries (LICs) on inflation, productivity, and industry structure in developed economies?

The standard approach taken in the literature to identify the causal effect of trade relies on natural experiments, such as one-time tariff reductions. While event studies such as Trefler (2004) have greatly enhanced our understanding of trade's one-time impact, the narrow event window of these experiments limits their ability to capture cumulative effects of a phenomenon such as "globalization." Moreover, the regime change experiment, due to the paucity of natural events, is not a viable strategy to examine the block impact of trade with the newly developing world.[1]

The contribution of this paper is to develop an instrumentation strategy that measures the true effect of the gradual increase in trade with the nine major LICs on U.S. industry productivity and prices. Our approach relies on the most basic force of trade, comparative advantage. The classical theory of trade predicts that countries should specialize in industries that intensively use relatively abundant factors. We document that this relationship also holds at the margin: if a country's output capacity grows, exports increase most in sectors that are intensive in factors the country is abundant in.

We first show that labor intensity can explain changes in trade flows between the United States and individual LICs, while it fails to explain marginal trade flows between the United States and other developed economies. In contrast, skill intensity can explain marginal trade flows between developed economies, but has no power in explaining bilateral LIC-U.S. trade. From these counterfactuals, we conclude that changes in trade flows are well explained by differences in factor endowments. We next construct a measure of the comparative advantage-induced imports from LICs.

Second, we develop an empirical framework that abstracts from sector-specific trends and aggregate fluctuations. Due to this difference-in-difference approach, the identifying restriction

[1] We are not aware of one-time events that induced a sizeable increase in LIC imports. For example, China's accession to the WTO in 2001 reduced average tariffs by less than two percentage points. Although the accession of Mexico to NAFTA had a sizeable effect on Mexico (see Hanson 2003), it did not affect the United States to an extent measurable in nationwide data.

necessary to establish the causal effect of trade only requires that U.S. relative demand shocks are not systematically biased toward labor-intensive goods. The latter assumption is reasonable ex ante and can also be tested by investigating whether imports from developed nations are systematically biased towards labor-intensive goods, which is not the case.

We find that LIC trade has had a profound impact on U.S. relative producer prices and productivity.[2] The two-stage least squares estimates reveal a profound negative relationship between changes in LIC import share and changes in U.S. producer prices. We find that when our nine LICs capture 1% market share in a sector, U.S. producer prices decrease between 2% and 3%. This result stands in stark contrast to the OLS regressions predicting an insignificant and often positive correlation between these two variables.

We next decompose the price-dampening effect into the contribution of productivity growth, markup reductions, and cost changes. Surprisingly, we find that the dominant channel in which LICs have affected U.S. industry is by inducing sectoral productivity growth, as predicted by Melitz (2003) and in particular by Bernard et al. (2007). The latter authors predict that trade-induced productivity growth is especially large if trade is motivated by comparative advantage, in addition to the Ricardian motive. In our estimations, a one percentage point increase in the U.S. market share of LIC imports is associated with a productivity increase of about two percentage points. We also find that decreasing markups can explain the remainder of the three percentage-point drop in prices, but this result is not statistically significant.

Further corroborating the evidence in favor of the "new" new theories of trade, we also document that the response of prices and productivity to import competition is systematically related to the elasticity of demand. While the response of import flows to growth in LICs is much more pronounced in sectors with elastic demand, the response of prices and productivity to a given increase of import competition is systematically higher in sectors with inelastic demand. We also find the differences between sectors with different elasticities of demand are larger in the long run than in the short run.

Surprisingly, we do not find any evidence of a negative effect of LICs on the wages of unskilled

[2] We do not analyze the direct effect of changes in LIC imports on U.S. import prices because import prices are not available on a bilateral basis and aggregate import price data are available only for a small number of sectors.

workers. While OLS regressions do suggest that increasing exposure to low-wage countries does depress the wages of production workers, this is never the case in any of the IV specifications of this study.

Second, we also estimate the importance of intermediate goods, relying on the measure of input intensity developed by Schott (2004). When we split the sample into sectors that do contain and those that do not contain inputs, we find the following. While the first-stage estimation for sectors that do *not* contain any inputs is well identified, we cannot predict marginal trade flows in sectors containing input goods. That is, our instrumentation strategy does not predict the intermediate good content of trade and therefore, it does not capture the "cost channel" effect of inputs from China and similar countries, but rather the pro-competitive effect of low-wage country imports.

The conclusion of this paper is that globalization has had a profound impact on U.S. relative prices and productivity, much larger than is commonly assumed. Our results, however, should be interpreted with care when making statements about the aggregate effect of LICs on U.S. inflation, productivity, and wages. We estimate the effect on relative prices, and due to the difference-in-difference type of identification, our methodology abstracts from factors such as the increase in global raw material prices that growth in LICs has brought about.

Given these limitations, a rough estimate is that from 1997 to 2006, the U.S. PPI inflation rate in the manufacturing sector was reduced due to the trade with LICs by about two percentage points (each year), while productivity growth was increased by one to two percentage points in the sectors examined in this paper. China accounts for over one half of the total effect.

The paper is organized as follows. Section 1 discusses the relationship of our approach to the existing literature. Section 2 describes our data. Section 3 documents that imports from LICs can be explained by comparative advantage. Section 4 lays down the empirical framework and discusses the identifying assumption. Section 5 presents empirical results of the LIC impact for the following U.S. sectoral variables: producer prices, productivity, markups, and wages. Section 6 decomposes the effect on prices into changes in productivity, markups, and costs. Section 7 analyses the impact of demand elasticity and compares long- and short-term responses. Section 8 concludes.

1 Relationship to the Literature

The developing economies examined in this study are China, Brazil, Indonesia, India, Malaysia, Mexico, the Philippines, Thailand, and Vietnam. As documented in Figure 1, these nine countries accounted for imports worth more than 5.5% of U.S. GDP in 2006, or roughly one-third of total U.S. imports. Even more impressive is the growth rate of trade with this group of countries: in 1997, they accounted for imports worth a mere 2.5% of U.S. GDP.

Notwithstanding the large magnitude of trade volume, many empirical studies find that imports from LICs only had a small aggregate effect on the U.S. industry structure, price levels, and inflation.[3] Studies based on micro data that are closest to our investigation are Bernard et al. (2006), Broda and Weinstein (2007), Broda and Romalis (2008), Feyzioglu and Willard (2008), Glatzer et al. (2006), Kamin et al. (2006), the IMF's World Economic Outlook (2006), and Wheeler (2008). Other studies focusing on inflation - including Ball (2006), Borio and Filardo, (2007), Ihrig et al. (2007), Pain et al. (2006), Razin (2004), and Tootell (1998) - use conventional specifications of the Phillips curve to determine the role of foreign output gaps or import prices on domestic inflation.

We argue that the existing literature fails to establish the true effect of trade since trade flows are endogenous to local demand conditions. For example, when a sector in the United States experiences a positive demand shock, prices increase, thereby inducing an increase of imports from LICs. The negative influence of LIC imports on prices is compounded with the positive effect that U.S. demand has on LIC import flows. Similarly, the estimated effect of LIC imports on U.S. productivity is biased toward zero in an OLS regression. This bias arises because positive sectoral productivity shocks in the United States tend to increase domestic production and therefore reduce imports.

Our instrumentation approach is motivated by the Heckscher-Ohlin theory, which predicts that countries specialize in industries that intensively use relatively abundant factors. The Rybczynski theorem extends this prediction in a dynamic context. The modern extensions of the Heckscher-

[3]Numerous central bank governors and policy makers have recognized that the links between globalization and inflation go beyond influencing relative price differences in the short term. Mishkin (2007), Carney (2008), Trichet (2008), Rogoff (2006), and others highlight the role of productivity, markups, and price flexibility.

Ohlin theory by Trefler (1993; 1995), Davis and Weinstein (2001), Romalis (2004), Bernard et al. (2007), and Chor (2007) account for factor-augmenting technology, transportation costs, and the Ricardian motive for trade. Dynamically, these theories predict that when the economy grows, exports increase relatively more in sectors with comparative advantage. In what follows below, we thus instrument for marginal trade flows with flows induced by comparative advantage.

Bernard et al. (2006), who proxy industry exposure to low-wage countries by the sectoral import share originating from countries with less than 5% of U.S. GDP per capita, provide a study that is most similar in spirit to our instrumentation strategy, While we think that their measure of import share originating from LICs is well suited to establish the effect of trade on within-industry productivity dynamics (i.e., differences across single plants in a given industry), we do not think that their instrument can capture industry-wide effects since aggregate trade flows are endogenous to U.S. supply and demand shocks. In this study, we therefore instrument for trade flows themselves rather than using the level of LIC imports as a causal driver of U.S. industry.

An alternative methodology developed by Frankel and Romer (1999) constructs measures of geographic proximity to foreign markets to establish the causal effect of trade on income. Due to the fact that geographic proximity does neither vary across sectors nor across time, it cannot be used to establish the effect of increasing and industry-varying exposure to LICs that this study is concerned with.

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2 Data Description

We use annual trade data from the United States International Trade Commission (USITC), covering the 1997-2006 period. The classification of the import data is six-digit North American

Industry Classification System (NAICS) and the selected trade type is the General Customs value.[4] U.S. data on wages, producer prices, and productivity (four to six-digits) are from the Bureau of Labor Statistics (BLS).[5] Information to construct sectoral markups were taken from the Annual Survey of Manufactures, see the Appendix for the respective definition of variables. The overlap of industry information from the Annual Survey of Manufacturers and the price data from the BLS yields 325 different sectors (NAICS codes 311111 to 339999).

Sectoral information used to construct sectoral markups was taken from the Annual Survey of Manufacturers; see the Appendix for the respective definition of variables. The overlap of industry information from the Annual Survey of Manufacturers and the price data from the BLS yields 325 different sectors (NAICS codes 311111 to 339999).

The measure of import penetration is constructed in the following way. We divide the value of imports from the country in question (or from the nine LICs together) by the value of U.S. domestic shipments plus world imports. To make sure that our results are not driven by the endogenous response of U.S. sales to U.S. demand, the value of domestic shipments plus world imports is averaged over the 10 years in our sample.[6] Our measure of import penetration takes the value of 0.01 in a sector where imports from the country in question amount to 1% of average U.S. sales in the respective sector.

We evaluate absolute changes in import penetration; i.e., import penetration at time t minus import penetration at $t-1$. This strategy is expedient since the response of U.S. prices should be related to the increase of imports normalized by U.S. demand rather than related to the percentage increase of imports. Further, evaluating absolute growth rather than the relative (percentage) growth of imports does not force us to drop any zero-trade observations.

To measure an industry's labor intensity, we use information from the Annual Survey of Manufacturers. Labor share is defined as the 1997 to 2006 average of the U.S. labor expenditure share for each of the 325 sectors. The labor expenditure share equals expenditures for labor

[4] The General Customs value is appraised by the U.S. Customs Service and is the price paid or payable for merchandise when sold for exportation, excluding U.S. import duties, freight, insurance, and other changes incurred.

[5] The BLS publishes only four-digit data on its website. Additional data were obtained through private correspondence.

[6] Due to this averaging, LIC import share could exceed 100% towards the end of the sampling period. This is never the case in any of the 325 industries.

divided by the total expenditure for labor and capital. Because we exclude expenditures for inputs, energy, and transportation, the average labor share is rather high at 85%. Only taking into account labor and capital expenditures, however, leads to a clear measure of labor versus capital intensity and we thus follow this definition.

The sample criterion for the nine LICs in this study is the following. We define a nation to be "low income" if it's non-PPP adjusted GDP per capita in 2005 is less than 20% of U.S. income per capita. There are 133 LICs for which we have both trade and GDP (per capita) information (source: World Bank Development Indicators), but most of these countries account for only a very small fraction of U.S. imports. Furthermore, most countries do not publish reliable information about their manufacturing output. We thus drop all countries that account for less than 0.4% of U.S. imports in 2005. There are 17 remaining economies that have less than 20% of U.S. GDP per capita and account for more than 0.4% of U.S. world imports. We next exclude all countries where raw materials account for more than 30% of U.S. imports. We next exclude all countries where raw materials account for more than 30% of U.S. imports.[7] The latter criterion excludes Angola, Algeria, Chile, Colombia, Iraq, Nigeria, the Russian Federation, and Venezuela.

In total, we end up with nine countries that account for 87% of U.S. non-raw material imports from LICs. They are China, Brazil, India, Indonesia, Malaysia, Mexico, the Philippines, Thailand, and Vietnam. In 2005, these nine countries accounted for 37% of non-raw material U.S. imports and for 32% of all U.S. imports.

How would altering the criterion affect our sample? Changing the cut-off of a "low income" country to 10% of U.S. GDP per capita excludes Brazil, Mexico, and Malaysia. Altering the level at which a country is dropped from our data set because it exports mostly raw materials has no big effect on the composition of our sample. We would include Chile if the cut off is higher than 35%, and the next country to be included is Colombia if the cut off is above 59%. Furthermore, Mexico has the highest raw material import share of the included countries at 16%. Last, if we also include countries with less than 0.4% of total U.S. imports, this adds a large number of countries, yet only very little trade volume. For example, lowering the cut-off to 0.3% would

[7] Raw material imports are defined as the sum of imports in sectors (Harmonized System) 27 (mineral fuels), 7106, 7108, 7110, 74, 7502, 7601, 7801, 7901, and 8001 (different unwrought metals)

add only Turkey, and lowering it to 0.2% would also add the Dominican Republic, Argentina, Honduras, Costa Rica, and Pakistan. These additional countries, in total, account for only 1.5% of U.S. imports and 3.8% of non-raw material imports from LICs.

3 LIC Trade and Factor Intensity

Labor-abundant nations tend to export labor-intensive goods. The upper scatter plot of Figure 2 relates the volume of U.S. imports from the nine LICs normalized by U.S. sales in 1997 to the sector's labor intensity. In 1997, imports were concentrated in labor-intensive industries. The lower scatter plot of Figure 2 documents that this relationship is even more pronounced in 2006. In terms of changes, the two scatter plots of Figure 2 also imply that the increase in LIC imports was concentrated in labor-intensive sectors.[8] Table 1 formalizes this observation.

In all estimations of Table 1, the dependent variable is the year-to-year change of the U.S. import share from selected country. For example, in Column (1), the dependent variable is the absolute change of imports from China divided by the size of the respective sector in the United States. The U.S. sector size is defined as the value of domestic shipments plus the values of imports from all countries.

In the random effects model of Column (1), the independent variables are the growth of industrial output in China, the sectoral labor expenditure share, and the interaction of the two ($g_{china}\overline{ls}_j$).

Column (1) documents that when industrial output in China grows, exports to the United States increase more in labor-intensive sectors compared to imports in capital-intensive sectors. The coefficient of $g_{lic}\overline{ls}_j$ is estimated at +0.665 and is highly significant, that is, when China's industrial capacity grows, exports to the United States increase when the sector is more labor-intensive. In contrast, the main effect of industrial growth is estimated to be negative at −0.445. This means that if the annual growth of Chinese industrial output is 1%, the value of U.S. imports in an industry using only capital ($\overline{ls}_j = 0$) decreases by 0.445 percentage points.

[8] It is often argued that China and other emerging economies grow by accumulating capital rather than labor. Figure 3 documents that this is not the case: the real stock of capital and the stock of labor adjusted for labor productivity grew at the same rates during the period with available data (1996 to 2004).

For the same 1% change in Chinese output, U.S. imports in an industry using only labor ($\overline{ls}_j = 1$) increase by $(0.665 - 0.445) * 0.01$ or 0.22 percentage points. The average labor intensity in the sample is 0.85, so that the average sector will capture an import share of 0.12 percentage points when China's aggregate manufacturing output grows by 1%.

In Column (2), we next add fixed effects to the estimation in order to filter out sectoral trends. Because the labor share is averaged over time and does not vary within a sector, it is dropped from the estimation. Next, in Column (3), we also add time dummies to the estimation. Because the growth of industrial production in China is an aggregate variable, this regressor is dropped from the estimation when time dummies are introduced.

Columns (4) to (6) repeat the specification of Column (3) for imports from Mexico, India, and Vietnam. In these specifications and in the rest of the paper, we include time dummies and fixed effects so that the labor share and the aggregate growth rate of these countries are dropped from the estimations. The coefficients for growth interacted with labor intensity are positive and significant. The coefficients are smaller reflecting the fact that these economies are smaller than the Chinese economy.

We next turn to two falsification exercises that are particularly important in the context of the identification restriction made in the next section. The fact that imports grew particularly quickly in labor-intensive sectors may also be a result of U.S. demand shocks biased towards labor-intensive goods. As a first falsification exercise, we next repeat the analysis for Canada and Japan in Columns (7) and (8). We find that labor share multiplied by manufacturing growth in the two countries is not significantly correlated with changes in import share.

As a further counterfactual, we instrument for Japanese trade with Japanese growth interacted with skill intensity. The measure of skill intensity is constructed by averaging the U.S. share of non-production workers of total employees averaged over 1997 to 2006. While this measure can predict changes of imports from Japan (see Column (9)), it fails to predict imports from China (see Column (10)).

Summarizing, Table 1 documents that there is a systematic relationship between the changes in U.S. imports, growth, and comparative advantage. When labor-abundant LICs grow, their exports increase much more in labor-intensive sectors than in capital-intensive sectors. When a skill abundant nation such as Japan grows, its exports increase in skill-intensive sectors, yet not in labor-intensive ones.

We next construct our instrument, the weighted growth rate of the nine LICs in our study interacted with skill intensity. The instrument is constructed in the following way. We first generate one weight for each LIC country i by averaging (imports from country i /(U.S. domestic shipments + total imports)) over the 325 sectors and over the 10 years. We then construct the weighted growth of manufacturing output in the nine LICs by summing over the growth rate multiplied by the country weight. Finally, we multiply the weighted growth rate by the 1997 to 2006 average U.S. labor expenditure share of sector j. Since the labor share varies over industries and the growth rate over time, the instrument varies across both time and sectors.

4 Empirical Framework

It is evident that trade is endogenous to global and local demand conditions. In this section, we lay out our strategy to instrument for trade flows with those induced by the growth of aggregate productive capacity in LICs interacted with labor intensity. The exhibition in this section is conducted for prices, but the analysis applies equally to productivity.

We begin with the true relationship between trade and prices. Denote U.S. prices at time t for sector j by $p_{us,j,t}$, and sectoral U.S. imports from LICs normalized by the U.S. sector size by $m_{lic,j,t}$. Denote the industry-specific trend of U.S. prices in sector j by $\alpha_{p,j}$, the common shock to U.S. prices at time t by $\epsilon_{p,t}$, and sector-specific price shocks by $\epsilon_{p,j,t}$. Finally, let Δ denote the change of a variable.

In the United States, the true relationship between price changes and the changes of import volume is given by

$$\Delta p_{us,j,t} = \alpha_{p,j} + \beta \Delta m_{lic,j,t} + \epsilon_{p,t} + \epsilon_{p,j,t}. \tag{1}$$

In Equation (1), the coefficient of interest is β, measuring the true impact of an increase in imports from LICs on sectoral prices. A prior shared by most researchers is that LIC imports lower U.S. prices, i.e., $\beta < 0$.

Imports, however, also respond to U.S. demand conditions. Apart from the unobserved export supply shocks in LICs (denoted by $\Delta s_{m,j,t}$), U.S. prices also influence how much foreign firms export. The relationship between the change in LIC imports, U.S. prices, and export supply shocks in LICs, $\Delta s_{m,j,t}$, is given by

$$\Delta m_{lic,j,t} = \alpha_{m,j} + \delta \Delta p_{us,j,t} + \theta \Delta s_{lic,j,t} + \epsilon_{m,t} + \epsilon_{m,j,t}, \tag{2}$$

where $\alpha_{m,j}$ is an industry-specific trend of LIC imports, $\epsilon_{m,t}$ is a common shock to exports to the United States, and $\epsilon_{m,j,t}$ is a sector-specific shock.

When prices in the United States rise, imports from LICs most likely increase. Therefore, an OLS estimation of β in Equation (1) is biased. When $\delta > 0$ and $\beta < 0$, the true effect of LIC imports is either underestimated or even estimated with the wrong sign. We thus instead focus on finding an exogenous driver of export supply shocks in LICs, $\Delta s_{m,j,t}$.

We next turn to the instrumentation strategy. Denoting the growth of LICs by g_{lic} and a sector's time-invariant labor intensity by· $\overline{ls}_j$, export supply shocks in LICs are determined by

$$\Delta s_{lic,j,t} = \alpha_{s,j} + \lambda_1 g_{lic,t} + \lambda_2 g_{lic,t} \overline{ls}_j + \epsilon_{s,t} + \epsilon_{s,j,t}, \tag{3}$$

where $\epsilon_{s,t}$ and $\epsilon_{s,j,t}$ are aggregate and sector-specific shocks.

Since aggregate growth in LICs may be correlated with aggregate demand in the United States, we do not use Equation (3) as an instrument for trade. Rather, we evaluate the difference of imports between two sectors j and k that differ in their time labor intensities $\overline{ls}_j$ and $\overline{ls}_k$, yielding

$$\Delta m_{lic,j,t} - \Delta m_{lic,i,t} = \alpha^*_{m,j,k} + \frac{\theta \lambda_2}{1 - \delta\beta} g_{lic,t} \left(ls_j - ls_i \right) + \epsilon^*_{m,j,k,t}. \tag{4}$$

The reduced-form relationship between labor intensity differentials and price differentials is derived by substituting Equation (4) into a similar difference-in-difference version of Equation (2). The reduced-from difference-in-difference specification relating LIC growth changes and skill intensity to relative changes in prices is

$$\Delta p_{us,j,t} - \Delta p_{us,k,t} = \alpha^*_{p,k,j} + \beta \frac{\theta \lambda_2}{1 - \delta \beta} \left(\overline{ls}_j - \overline{ls}_k \right) g_{lic,t} + \epsilon^*_{p,k,j,t}, \tag{5}$$

where

$$\begin{aligned} \epsilon^*_{p,k,j,t} &= \frac{1}{1-\delta\beta} \left((\epsilon_{p,j,t} - \epsilon_{p,k,t}) + \beta \epsilon^*_{m,j,k,t} \right), \\ \alpha^*_{pk,j} &= \frac{1}{1-\delta\beta} \left((\alpha_{p,j} - \alpha_{p,i}) + \beta \left(\alpha_{m,j} - \alpha_{m,k} \right) + \beta\theta \left(\alpha_{s,j} - \alpha_{s,i} \right) \right). \end{aligned}$$

By construction, the residuals of any regression are orthogonal to the dependent variables. Since we estimate the change in (i.e., the first-stage regression of Equation (4)), it is always true that $\epsilon^*_{m,j,k,t}$ is orthogonal to $g_{lic,t}$. Our methodology can therefore establish the true effect of LIC imports if the following condition holds.

Assumption 1. (Identification Restriction)

$$(\epsilon_{p,j,t} - \epsilon_{p,k,t}) \perp g_{lic,t}. \tag{6}$$

It is important to note that the orthogonality assumption (6) does not impose that aggregate growth in LICs is orthogonal to U.S. demand shocks (that are cancelled out due to the difference-in-difference formulation).

Rather, our orthogonality assumption (6) is an assumption about relative price shocks and therefore relative demand shocks in the United States. We assume that growth in LICs was not the result of sector-specific demand shocks that are concentrated in labor-intensive sectors.

We believe that this orthogonality assumption is reasonable. In addition, we have already tested the orthogonality assumption (6) in the previous section, where we demonstrated that marginal trade flows from Japan and Canada cannot be explained by labor intensity (but by skill intensity). Hence, it cannot be the case that demand in the United States was systematically biased towards labor-intensive goods.[9]

[9] Technically, our identification fails only if all of the following three conditions hold. First, there is a systematic shift in U.S. or global demand towards labor-intensive goods (for constant prices of these goods). Second, the demand shift induces imports from LICs. Third, aggregate growth in LICs is caused by the increase in U.S. import

Given the difference-in-difference specification with year dummies to filter out aggregate effects and fixed effects to filter out sector-specific trends, the variation that we utilize below is the following. In years that LICs grow more than average, imports grow more in labor-intensive sectors than in capital-intensive sectors. This different reaction of imports to growth is utilized to establish the effect of LIC trade.

5 Results in a Difference-in-Difference Setup

This section presents OLS and two-step least square estimates for the difference-in-difference form of Equation (4) relating price changes to changes in import shares. We first explain our strategy and document the large difference between OLS and IV estimates in Table 2. We next present the robustness analysis in Table 3.

As has been argued by Iranzo and Ma (2006), Hanson and Robertson (2008), and others, China may crowd out imports from other low-wage countries such as Mexico. In order to analyze the overall effect of LIC exposure on the United States, rather than the effect of China's imports on U.S. prices compounded by the crowding-out channel, we analyze the block impact of the nine countries together.

OLS and IV Estimates: U.S. Producer Prices

In all regressions of Table 2, the dependent variable in Panel B is the percentage change of the U.S. producer price index for each six-digit sector. We begin our discussion by first presenting OLS estimates of U.S. producer prices regressed on LIC import share. This is done in order to relate our findings to the existing literature and highlight the bias in OLS estimations. All estimations of Table 2 include fixed effects.

Column (1) simply regresses the annual change in LIC import share on the change of the logarithm of the U.S. producer price. The coefficient is estimated to be significantly positive, that is, these specifications suggest that imports from low-wage countries tend to increase U.S. prices. Aggregate U.S. and LIC shocks may be more endogenous than shocks at the sectoral level. We therefore introduce the growth of low-income manufacturing output in Column (2). The

demand.

coefficient remains positive, but is no longer significant. Since variables other than low-income manufacturing may affect U.S. prices, we next introduce year dummies in Column (3).

Column (3) establishes that even conditional on all aggregate information – which is filtered out by the year dummies – OLS estimations predict that LICs seem to have no effect on U.S. prices. While the estimated coefficient is estimated negative, it is far from significant, and economically very small: the estimation in Column (3) predicts that even if China and other LICs were to capture 100% of a U.S. market, prices would decrease by only 0.9%.

In contrast, the estimated effect of LIC imports is very large once we instrument for the trade flows with the comparative advantage induced component of trade. In Column (4), we do not introduce year dummies, but we again introduce the weighted LIC growth rate of manufacturing output. Consider the first-stage estimation in Panel A, Column (4). The main coefficient of the growth of manufacturing output in LICs is estimated at -0.675, while the interaction coefficient of manufacturing growth rate times labor share is estimated at 1.07. If LICs grow by one percentage point, the import share increases by 0.395% for a sector using only labor, while the import share of a sector using only capital decreases by 0.675%.

Consider next the second-stage estimation in Panel B, Column (4). If LICs grow, the import share increases in labor-intensive sectors. This comparative advantage induced component of trade leads to a large downward pressure on prices: the coefficient is estimated at -3.112%, that is, a 1% increase in importer market share reduces U.S. producer prices by more than three percentage points.

We next estimate the main specification including fixed effects and year dummies in Column (5). Again, because the manufacturing output growth is one aggregate number per year, it drops out once we introduce time dummies. In the specification of Column (5), all sector specific averages and aggregate shocks are filtered out. Again, we find that when imports from LICs increase by 1% of the U.S. sector size, prices decrease by around 3%.

Before turning to an explanation of why prices react so dramatically to foreign competition, we first present some robustness tests in Table 3.

Robustness Analysis

Table 3 presents several robustness tests. The structure of Table 3 is the following. Panel A presents the first-stage estimation with changes of the LIC import share as the dependent variable. Panel B presents the second-stage estimation relating instrumented trade flows to changes in prices. Panel C presents the OLS equivalent to Panel B.

We start by including the lagged level of LIC imports in the estimation. This specification controls for the fact that the level of LIC imports might affect prices, since existing imports could become cheaper over time. This is not the case (see Panel B, Column 1). Nevertheless, a high level of existing exports can further explain increases in imports (Panel A, Column 1).

Prices might react to changes in imports with a lag, and prices might themselves mean revert. We therefore include the lagged change in the import share in Column (2) and the lagged price change in Column (3). Indeed, each of these two controls reduces the estimated coefficient for the changes of imports somewhat, but the coefficient is still estimated above two and highly significant. In Column (4), we control for productivity growth.

Our sample is characterized by a small number of observations with very large price movements that might not be representative, since they are in raw material-intensive industries such as oil refineries, copper wire, and petrochemical manufacturing where LIC imports do not have an important impact on prices. We have thus excluded 35 NAICS-Year observations based on the criterion that the absolute change in the logarithm of the price exceeded 0.25. The excluded observations are listed in Appendix B. In Column (5), we include the 35 outliers to the estimation. The estimated coefficient nearly doubles and is again highly significant.

The Hecksher-Ohlin theory of trade and its modern extensions not only make predictions about trade flows, but also about net trade flows (i.e., imports minus exports). We therefore instrument for the change in net imports in Column (6). We find that net trade flows are well explained by our instrumentation strategy and also that comparative advantage-induced net trade has a profound effect on U.S. producer prices.

In Column (7), we analyze the special role of China. In Panel A, we instrument for the change of Chinese imports with the growth of manufacturing production in China interacted with U.S. labor intensity. The highly significant coefficient in Panel B suggests that Chinese exports have a slightly stronger effect on U.S. prices than imports from other LICs (compare Column 5 of Table 2 and Column 7 of Table 3).

Summarizing, Table 3 documents that our instrumentation strategy can predict changes in LIC imports for a wide variety of specifications and it also documents that the estimated effect of LIC trade on prices is statistically significant and economically large. In Panel C, we also document that the OLS bias is sizeable for all specifications. We next analyze the precise channels through which trade has affected prices.

6 Decomposing the Impact of Import Competition

A good's cost can be expressed as the product of per unit cost of all inputs used in the production of the good divided by the productivity with which these inputs are used. A good's price can be expressed as the per unit cost of the good multiplied by (one plus the markup). Hence, abstracting from aggregation issues, the percentage change of the sectoral average price can be decomposed into the contribution of cost of input changes ($\Delta c_{j,t}$), changes in productivity ($\Delta a_{j,t}$), and changes in one plus the markup ($\Delta\left(1+\pi_{j,t}\right)$) (always in %).

$$\Delta p_{j,t} = \Delta c_{j,t} - \Delta a_{j,t} + \Delta\left(1+\pi_{j,t}\right)$$

With this de-composition in mind, in this section, we set out to analyze why prices react so strongly to import competition.

U.S. Productivity

Table 4 repeats the basic specification of Column (5) in Table 2 and the robustness tests of Table 3, but with productivity as the dependent variable. Because the first stage is identical to that of Table 2, it is not reported. Panel A of Table 4 presents the two-stage least squares estimates, while Panel B presents the OLS results.

In Column (1), we present the baseline estimation including only fixed effects and year dummies, and the interaction of LIC growth and labor intensity. A one percentage point increase in imports is associated with a 2.375% increase in sectoral productivity. Hence, of the 3.1% total percent price change, over three-fourths are explained by productivity growth.

In the robustness tests presented in Table 4, the magnitude of productivity changes is comparable to the baseline result of Column 1. It is economically large, but significant only in five of the eight specifications. These robustness tests are identical to those of Table 3, except in Column 5, where we have added the lagged productivity change rather than the contemporaneous change as a control.

Panel A again underscores the bias of OLS regressions. Although the coefficients for the effect of imports on productivity have the right sign in seven out of eight cases, the magnitude of the coefficients is around 0.4%, or only one-sixth of the true effect.

Wages and Input Costs

While productivity explains a large part of the price-dampening effect of import competition, costs might also be affected by trade. In Table 5, we examine the effect of imports on wages and on the cost of input goods. We present the OLS estimations in Panel C, the instrumental variable estimations in Panel B, and the first-stage estimations in Panel A.

In Columns (1) to (3), the dependent variable is the change in the logarithm of the hourly wage of production workers in each sector. Column (1) presents the baseline estimation, Column (2) controls for U.S. productivity growth, and Column (3) controls for lagged changes of worker wages. While the OLS regressions in Panel C suggest that competition from LICs tends to decrease the hourly wages of production workers, this is not supported by the IV estimations.

Rather, the coefficient of changes of the import share is estimated to be positive, although not statistically significant. A potential explanation for the positive correlation is that productivity increases considerably when import competition increases, therefore benefiting production workers. This result, however, does not imply that low-skilled workers do not suffer from import competition: the absence of any industry-specific effect could also be the consequence of workers being mobile across industries. As a result, differences between sectors are non-responsive to import competition.

While sector-specific wages seem not to be affected, low-cost imports might nevertheless affect the cost of production since they reduce the costs of inputs. In Column (4), we analyze the effect of imports on the change in the cost of materials purchased. The dependent variable is the change in the logarithm of the cost of material divided by the value of shipments. Interestingly, although far from significant, the ratio of the costs of inputs does drop considerably (see Panel B) when imports from low-cost producers increase.

To further investigate the importance of input goods, we directly analyze whether the response of prices to imports is different in sectors that contain more or less intermediate goods, inputs, and parts. We construct a measure of input intensity following Schott (2004) and split the sample into sectors that do and do not contain inputs.

Column (5) only includes six-digit NAICS sectors which do not include 10-digit HS goods code containing the words "Parts," "Input," or related abbreviations in the sector description. The first stage is well identified, and the effect of imports on prices is estimated at -2.339, comparable to our baseline estimate.

In the estimations of Columns (6) to (8), the sample is restricted to the six-digit NAICS sectors that include at least one 10-digit HS sector with "Parts," "Input," or related abbreviations in the sector description and a non-zero trade flow. In the OLS regressions of Panel C, the response of prices in the sector with inputs and without (Column (5) and (6)) have similar coefficients, and the impact of imports is comparable to or greater for sectors that do not have imports.

However, when we turn to the instrumental variable estimations, a different issue arises. Our instrumentation strategy cannot explain trade flows in the sample containing input goods. Also, when we add additional instruments, the first and second lag of manufacturing growth in LICs interacted with labor intensity, in Column (7), or instrument for the change of net imports in Column (8), the first-stage estimation is not significant. Consequently, the second-stage estimation is weakly identified.

In sum, our instrumentation strategy does not predict the intermediate good content of trade and therefore does not capture the "cost channel" effect of inputs from China and similar countries, but rather the pro-competitive effect of low-wage country imports.

U.S. Markups

The first four columns of Table 6 present the relationship between changes in U.S. imports from nine LICs and changes in markups and profits of domestic U.S. firms. Panel C displays the OLS results and Panel B the two-stage least squares estimations. Markups are defined as one minus the ratio of variable costs divided by the value of shipments. Column (1) displays the basic regression for markups, Column (2) adds productivity growth in the U.S. as a control and Column (3) adds the lagged change in markups as a control. Column (4) presents the baseline regression for profits defined as one minus total costs over the value of shipments.

The OLS regressions in Panel C suggest that import competition is associated with increasing markups and profits. The sign of the instrumental variable coefficients are of the opposite sign, although they are again not significant.

However, it is noteworthy that the sign of the coefficients are within the right order of magnitude. Consider the baseline estimation including only year dummies and fixed effects. In the basic estimation of Column 5 of Table 2, a 1% increase in import competition is associated with a 3.1 percentage point drop in prices. This is nearly fully explained by a 2.4% increase in productivity and a 0.35% decrease in markups (see Column (1) of Tables 4 and 6).

7 Demand Elasticity and the Effect of LIC Trade

The results presented so far highlight the importance of the productivity reshuffling channel of Melitz (2003) as the main channel through which low-wage country imports affect U.S. industry. We next document that the response of trade volume, prices, and productivity to growth in low-wage countries varies across the dimension of the elasticity of substitution in a way highly consistent with the Melitz model.

We document that while the response of import volume to output growth in LICs is much more pronounced in sectors with elastic demand, the response of prices and productivity to a given increase in import volume is much larger in sectors with inelastic demand. While these differential responses are present in the short run, they are even more pronounced in the long run.

In Columns (5) to (8) of Table 6, we split the sample by the median elasticity of substitution. The elasticities we use are estimated by Broda and Weinstein (2006) following the methodology of Feenstra (1994). There are two striking findings. First, the response of import volume to growth in LICs is much stronger in sectors with elastic demand (see Panel A). This finding is intuitive given that we estimate the instantaneous response of import volume to growth in LIC output capacity. Foreign firms find it easier to penetrate markets with elastic demand.[10]

[10] Chaney (forthcoming) shows that sectors with inelastic demand offer higher profits and, therefore, the additional set of firms that start exporting is larger when the elasticity is low. This long run "distorted-gravity" effect is absent in our data.

Second, for a given change in import volume, the response of prices and productivity is larger in sectors with inelastic demand (see Panel B). Also this result is intuitive: a given level of import competition implies a much larger change in profits when the elasticity of substitution is low. Consequently, a much larger crowding out effect of unproductive firms occurs.[11]

We next analyze the time dimension of how imports, prices, and productivity react to growth in LICs and we again evaluate whether this reaction is different for sectors with different demand elasticities. We are interested in how imports react in the long run to the growth in LICs and we are interested in how prices react in the long run to imports.

First, in Column (1) to (5) of Table 7, we check whether imports react to lagged growth in LICs. We begin by adding the lagged manufacturing growth times the average labor share of the sector in Column (1), and we successively also add the second and third lags in Columns (2) and (3). Then in the next two columns, we keep the three lags, but we again split the sample by the median elasticity of demand, which equals 5.55. We find that overall, most of the response of imports to growth in LIC's is instantaneous and that also the major difference in how high and low elasticity sectors are affected by growth is instantaneous.

There is also evidence that imports react with a lag and that this is more pronounced in sectors with elastic demand. The single coefficients for the lags of LIC growth interacted with labor intensity are not significant. However, the joint test that the sum of the lagged coefficient equals zero cannot be rejected at the 5% level. In addition, a test that the long-run response of imports differs for sectors with elastic and inelastic demand cannot be rejected at the 5% level.

Second, in Columns (6) to (10) of Table 7, we investigate the long-run response of prices to growth in LICs. There are three ways in which prices might be affected dynamically. Prices might react in a staggered way to changes in imports. Moreover, Column (1) to (5) document that the response of trade flows to growth in LICs is somewhat staggered, itself. Last, prices might be autoregressive. We therefore present reduced-form estimations that directly relate our (lagged)

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[11] For example, when firms face demand from consumers with love of variety utility function $u = \left(\sum_{i\epsilon I} x_i^{\frac{\epsilon-1}{\epsilon}}\right)^{\frac{\epsilon}{\epsilon-1}}$, firm i's profits in equilibrium are equal to a share of $1/\epsilon$ of revenue minus the fixed costs of operating the business. When all domestic firms in the industry loose 1% of their revenue to foreign competitors, ceteris paribus, the absolute loss in profits is the largest in low-elasticity industries. Since the exit rate of unproductive firms depends on profitability, the response of industry to a 1% increase in foreign competition is more pronounced if the elasticity of demand is low.

instrument to price changes and we also control for lagged price changes.

In Column (6), we add the first lag of our instrument and the lagged price change. We add the second and third lag in Columns (7) and (8). The estimations reveal that prices display non-trivial mean reversion. While there is no effect of the first and second lag of LIC growth on U.S. prices, there is a significant effect of the third lag of the growth in LICs. In Columns (3) to (5), we documented that the price response is not the result of imports reacting with a lag to growth. Consequently, the staggered response of prices to our instrument must be the consequence of prices reacting with a lag to import competition.

We next split the sample by the median elasticity of substitution in Columns (9) and (10), with two interesting findings. First, the instantaneous response of prices to growth in LICs is about the same in sectors with high and low elasticity of substitution. Second, the response is markedly different after three years.

In the reduced-form estimation, prices react strongly to lagged manufacturing growth in inelastic sectors. This cannot be explained by the response of imports to lagged growth (see Column (4) and (5)), so it must be the long term response of prices to a given level of import competition that differs between sectors with different demand structures.

This differential response of prices in the long term can be rationalized in the context of the existing literature. A given level of import competition leads to much greater losses of profits in a sector with inelastic demand. Therefore, the long-term exit of unproductive firms and consequent productivity growth is much more pronounced in these sectors.[12]

8 Conclusion

This paper investigates how imports from LICs influence prices, productivity, and markups in the United States. The novel contribution is to instrument for trade flows that are endogenous to U.S. demand with marginal trade flows implied by comparative advantage.

Our instrument relies on the observation that when LICs grow, their exports increase much

[12] We have no understanding of why the differential effect occurs exactly after three years rather than smoothly through time. We have also evaluated longer horizons, but three years is the lag at which the response diverges across sectors with different elasticities.

more in labor-intensive sectors than in capital-intensive sectors. Thus, we instrument for trade flows using the interaction between growth of LIC manufacturing output and sectoral labor share.

Second, we develop an empirical framework that abstracts from sector-specific trends and aggregate fluctuations. Due to our difference-in-difference approach, the identifying restriction necessary to establish the causal effect of trade only requires that U.S. relative demand shocks are not systematically biased toward labor-intensive goods. The latter assumption seems reasonable ex ante and can also be tested by investigating whether imports from developed nations are systematically biased towards labor-intensive goods, which is not the case.

We then document that trade with LICs had a strong impact on prices and productivity. Our two-stage least square specification predicts that LIC exports are associated with strong downward pressure on prices and strong productivity growth. For example, when LIC exports capture 1% of U.S. market share, producer prices decrease by 3%, with about three-fourths of this change due to productivity growth.

Surprisingly, we do not find any evidence of a negative effect of LICs on the wages of unskilled workers. We also show that our results are not driven by cheap intermediate goods imports. We therefore argue that the effect of low-wage country imports works via the channel hypothesized by Melitz (2003).

The empirical findings based on our instrumentation strategy uncover much stronger effects of globalization than is commonly assumed and reverse, for example, the "China does not matter" verdict reached by Kamin et al. (2006).

Regarding the aggregate effect of LIC growth on U.S. industry, our results should be interpreted with care. We estimate the effect of imports on relative rather than absolute level. Due to the difference-in-difference type identification, our methodology abstracts from factors such as the increase in global raw material prices that growth in LICs has brought about.

Given these limitations, the aggregate effect we estimate is the following. From 1997 to 2006, LIC import share has risen by around one percentage point per year in the sectors that this study covers. Hence, we estimate that from 1997 to 2006, the U.S. PPI inflation rate in manufacturing was reduced due to the trade with LICs by more than two percentage points (each year), while productivity growth was increased by one to two percentage points. China accounts for more than half of the total effect.

While manufacturing prices only make up a fraction of PPI inflation and producer price inflation is passed through imperfectly to consumers, the aggregate effect of imports from the newly developing world surely cannot be neglected.

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Appendix A: Data Sources

Industrial production (For China, there is no reliable estimate of Manufacturing Production)

China: IMF International Financial Statistics

Manufacturing production:

Mexico: IMF International Financial Statistics

The Philippines: IMF International Financial Statistics

India: Datastream Malaysia: Datastream

Brazil: OECD Main Economic Indicators

Indonesia: OECD Main Economic Indicators

Canada: OECD Main Economic Indicators

Germany: OECD Main Economic Indicators

Japan: OECD Main Economic Indicators

Thailand: Bank of Thailand

Vietnam: General Statistics Office of Vietnam

Definition for Markups

Markup = (Value Added - Total Compensation Paid to Employers)/ Value of Shipments

where

Value Added = Value of Shipments - Cost of Materials, Fuels, Electricity

thus

Markup = (Value of Shipments - Variable Costs)/ Value of Shipments

where

Variable Costs = Cost of Materials, Supplies, Fuels, Electricity + Total Compensation Paid to Employers

Skill intensity = (number of employees - average number of production workers)/number of employees

Source: Annual Survey of Manufacturers

Value Added is compiled by the BLS and also adjusts for changes in inventories, and the income from merchandise operations.

Data Sources for Figures 1 to 4

Figure 1: United States International Trade Commission

Figure 2: Trade data are from the United States International Trade Commission. Labor share is from the U.S. Annual Survey of Manufacturers and is defined as total compensation of employees divided by total compensation of employees and total capital expenditures.

Figure 3: Real capital stock is from B. Bosworth used in Bosworth and Collins (2007). Effective labor supply: total number of persons employed in China (Asian Development Bank) times real manufacturing wage growth in China (nominal wage growth from Laborstat database ILO and GDP deflator from the World Bank Development Indicators).

Appendix B: List of Outliers

35 NAICS-Year observations where excluded because the absolute year-to-year price change exceeded 0.25 log points.

Table A - Observations with Absolute Change of Ln Price > 0.25

Year	Naics	Sector Names
2003	311212	Rice Milling
1999		
2002	311512	Creamery Butter Manufacturing
1998, 2003, 2004	311613	Rendering and Meat Byproduct Processing
1998	312221	Cigarette Manufacturing.
2003	321212	Softwood Veneer and Plywood Manufacturing
2003	321219	Reconstituted Wood Product Manufacturing
1998, 1999, 2001, 2002, 2004, 2005	324110	Petroleum Refineries
2004	325110	Petrochemical Manufacturing
2004	325181	Alkalies and Chlorine Manufacturing
2005	325182	Carbon Black Manufacturing
2004	325192	Cyclic Crude and Intermediate Manufacturing
2006	325193	Ethyl Alcohol Manufacturing
2004	325211	Plastics Material and Resin Manufacturing
		Nitrogenous Fertilizer Manufacturing
2000, 2001, 2003	325311	
		Plastics Pipe and Pipe Fitting Manufacturing
2005	326122	
2000	327420	Gypsum Product Manufacturing
2004	331111	Iron and Steel Mills
2004	331112	Electrometallurgical Ferroalloy Product Manufacturing
2004	331222	Steel Wire Drawing
2003, 2004, 2005	331411	Primary Smelting and Refining of Copper.
2006	331419	Primary Smelting and Refining of Nonferrous Metal
2005, 2006	331421	Copper Rolling, Drawing, and Extruding
2005	331422	Copper Wire (except Mechanical) Drawing
2006	331491	Nonferrous Metal Rolling, Drawing
		(except Copper Aluminum)
2006	331492	Secondary Smelting, Refining, and Alloying
		of Nonferrous Metal (except Copper Aluminum)
2004	332311	Prefabricated Metal Building and
		Component Manufacturing
2000	334414	Electronic Capacitor Manufacturing.

Table 1 - Growth of Manufacturing Output, Factor Intensity, and Imports (Panel Estimations)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
US Imports originating from	*China*	*China*	*China*	*Mexico*	*India*	*Vietnam*	*Canada*	*Japan*	*Japan*	*China*
Panel Estimation with	*RE, w/o year dummies*	*FE, w/o year dummies*	*FE, with year dummies*	*FE, with year dummies*	*FE, with year dummies*	*FE, with year dummies*	*FE, with year dummies*	*FE, with year dummies*	*FE, with year dummies*	*FE, with year dummies*
Sample	*325 6-Digit NAICS Manufacturing Industries from 97-06 (NAICS 3111111 to 3399999)*									
Dependent Variable	***Dependent variable is the y/y absolute change of (Country Imports / (US Industry Size+World Imports))***									
Labor Share	-0.051 [0.016]**									
Growth Industrial Production in China	-0.445 [0.093]**	-0.447 [0.093]**								
Growth Ind. Prod. China * Labor Share	0.665 [0.108]**	0.668 [0.108]**	0.667 [0.107]**							
Growth Manufact. Mexico * Labor Share				0.121 [0.044]**						
Growth Manufact. Mexico * Labor Share					0.062 [0.022]**					
Growth Manufact. Vietnam * Labor Share						0.052 [0.014]**				
Growth Manufact. Canada * Labor Share							0.021 [0.053]			
Growth Manufact. Japan * Labor Share								0.078 [0.052]		
Growth Manufact. Japan * Skill Intensity									0.210 [0.036]**	
Growth Ind. Prod. China * Skill Intensity										0.049 [0.076]
Fixed Effects	n	y	y	y	y	y	y	y	y	y
Year Dummies	n	n	y	y	y	y	y	y	y	y
Observations	2890	2890	2890	2890	2890	2890	2890	2890	2890	2890
Sectors	325	325	325	325	325	325	325	325	325	325
R-Squared (within)	0.082	0.087	0.106	0.031	0.023	0.027	0.024	0.046	0.057	0.092

Notes: Table 1 presents the relation between the growth of manufacturing output in several nations, factor intensity and growth of U.S. imports. The countries covered are China (Columns (1), (2), (3), and (10)), Mexico in Columns (4), India in Column (5), Vietnam in Column (6), Canada in Column (7), and Japan in Columns (8) and (9) The dependent variable is the year to year in the level of Import from the respective country divided by the U.S. industry size. U.S. Industry Size is defined as the 1997-2006 average value of U.S. shipments plus total imports in the respective industry. An industry is measured at the six-digit NAICS level (only manufacturing industries). All specifications except (1) and (2) include year dummies, and all specifications except (1) include fixed effects (FE) by industry; * significant at 5%; ** significant at 1%

Table 2 - LIC Imports and U.S. Prices: OLS and IV Results (Fixed Effects Panel Estimations)

	(1)	(2)	(3)	(4)	(5)
	w/o year dummies	*Incl. LIC Manfct. Growth*	*with Year Dummies*	*Incl. LIC Manfct. Growth*	*with Year Dummies*
Estimation:	***OLS***	***OLS***	***OLS***	***IV***	***IV***
Sample:	*Six-Digit NAICS Manufacturing Industries from 97-06 (311111- 3399999)*				
Panel B: OLS or 2nd Stage - Dep. Var. is the y/y Ln-change U.S. Producer Price					
Ch. Imports LIC	0.232	0.048	-0.009	-3.112	-3.097
(in % of U.S. Industry Size)	[0.047]**	[0.047]	[0.047]	[0.733]**	[0.710]**
Ch. % LIC Manfacturing		0.508		1.269	
Output		[0.038]**		[0.187]**	
Within R-Square	0.01	0.08	0.11		
Panel A: First Stage Estimation - Dep. Var. is the y/y change in (Imports LIC / U.S. industry Size)					
Labor Share * Ch. % LIC				1.07	1.073
Manfct. Output				[0.200]**	[0.197]**
Ch. % LIC Manfacturing				-0.675	
Output				[0.172]**	
Year dummies (both stages)	n	n	y	n	y
Observations	2667	2667	2667	2667	2667
Sectors	325	325	325	325	325
R-Square (first stage within)	-	-	-	0.10	0.12

Notes: Panel B of Table 2 displays the relation between changes of imports from nine LICs and U.S. Producer Prices. The dependent variable is the annual change in the logarithm of U.S. producer price at the six-digit NAICS level (only manufacturing industries). "Ch. Imports LIC" is defined as the y/y absolute change in (LIC Imports/US Industry Size). U.S. Industry Size is defined as the 1997-2006 average value of U.S. shipments plus world imports. In Columns (2) and (4), "Ch. % LIC Manfct." is the weighted growth rate of manufacturing output in the nine LICs. In the lower Panel A the first-stage relation is displayed and the instrument is the sectoral labor intensity times Ch. % LIC Manufacturing output. All estimations include fixed effects by sector; * significant at 5%; ** significant at 1%

Table 3 - LIC Imports and U.S. Prices (Fixed Effects Panel Estimations with Year Dummies)

	(1) *Lagged LIC imports*	(2) *Lagged Ch. LIC Imports*	(3) *Adding Lagged PPI Changes*	(4) *Adding Productivity*	(5) *Including Outliers*	(6) *Changes in **NET** Imports*	(7) *Chinese Imports*
Sample: 6 Digit NAICS Manufacturing Industries from 97-06 (311111- 3399999)							
Panel C: OLS estimates - Dependent Variable is the y/y Ln-change of the 6 Digit NAICS US Producer Price							
Ch. Imports LIC	0.006	0.036	0.034	-0.030	0.131		
(in % of U.S. Industry Size)	[0.047]	[0.051]	[0.051]	[0.050]	[0.064]*		
Ch. NET Imports LIC						-0.092	
(in % of U.S. Industry Size)						[0.042]*	
Ch. Imports China							-0.108
(in % of U.S. Industry Size)							[0.061]
Not Displayed: Estimations Include Controls of Panel B							
Panel B: IV Estimates - Dependent Variable is the y/y Ln-change of the 6 Digit NAICS US Producer Price							
Instrumented Ch. Imports LIC	-3.276	-2.234	-2.249	-3.463	-5.788		
(in % of U.S. Industry Size)	[0.832]**	[0.653]**	[0.633]**	[0.842]**	[1.269]**		
Instrumented Ch. NET Imports						-2.818	
LIC (in % of US Industry Size)						[0.643]**	
Instrumented Ch. Imports							-3.516
China (in % of U.S. Industry Size)							[0.701]**
Lag 1 of Imports LIC	0.061						
(in % of U.S. Industry Size)	[0.052]						
Lag 1 of Ch. Imports		0.122					
LIC (in % of U.S. Industry Size)		[0.083]					
Lag 1 of Sectoral Inflation (PPI)			-0.019				
			[0.025]				
U.S. Productivity Growth				0.037			
				[0.025]			
Panel A: First Stage Estimation - Dep. Var. is the y/y Change of							
	Imports LIC	**Imports LIC**	**Imports LIC**	**Imports LIC**	**Imports LIC**	**NET Imp. LIC**	**Imports China**
Labor Share * Ch.% LIC	0.962	1.059	1.104	1.03	1.007	1.18	
Manfacturing Output	[0.199]**	[0.213]**	[0.216]**	[0.212]**	[0.190]**	[0.222]**	
Labor Share * Ch. % Chinese							0.755
Manfacturing Output							[0.116]**
Lag 1 of Imports LIC	0.035						
(in % of US Industry Size)	[0.010]**						
Lag 1 of Ch. Imports LIC		0.066					
(in % of US Industry Size)		[0.021]**					
Lag 1 of Sectoral Inflation (PPI)			0.003				
			[0.008]				
U.S. Productivity Growth				0.015			
				[0.005]**			
Observations	2667	2381	2345	2279	2702	2667	2667
Sectors	325	325	325	325	325	325	325
R-Square (first stage within)	0.13	0.14	0.14	0.13	0.12	0.06	0.11

Notes: All estimations include fixed effects by sector and year dummies. Panels B and C of Table 3 presents the relation between changes in U.S. imports from nine LICs and U.S. producer prices. Panel C displays the OLS results and Panel B the two-stage least-squares estimations. The dependent variable is the annual change in the logarithm of U.S. producer prices at the six-digit NAICS level (manufacturing industries). "Ch. Imports LIC" is defined as the y/y absolute change in (LIC Imports/U.S. Industry Size). U.S. Industry Size is defined as the 1997-2006 average value of U.S. shipments plus world imports. Also "Imports LIC" in (1) is normalized by the U.S. industry size. Panel A presents the first-stage estimation. "Ch. % LIC Manufacturing Output" is the weighted average growth rate of manufacturing output in the nine LICs. The instrument employed is the labor intensity times Ch. % LIC (or Chinese in (7)) manufacturing output. "Productivity" in (4) is the four-, five-, or six-digit NAICS productivity growth from the BLS; * significant at 5%; ** significant at 1%

Table 4 - LIC Imports and U.S. Productivity (Fixed Effects Panel Estimations with Year Dummies)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Basic Specification	*Lagged LIC imports*	*Lagged Ch. LIC Imports*	*Adding Lagged PPI Changes*	*Adding Productivity*	*Including Outliers*	*Changes in NET Imports*	*Chinese Imports*
	Sample: 6 Digit NAICS Manufacturing Industries from 97-06 (311111- 3399999)							
Panel C: OLS estimates - Dependent Variable is the y/y US Productivity Growth (BLS)								
Ch. Imports LIC	0.323	0.329	0.424	0.412	0.331	0.362		
(in % of U.S. Industry Size)	[0.101]**	[0.101]**	[0.116]**	[0.118]**	[0.101]**	[0.099]**		
Ch. NET Imports LIC							-0.012	
(in % of U.S. Industry Size)							[0.089]	
Ch. Imports China								0.236
(in % of U.S. Industry Size)								[0.129]
Lag 1 of Imports LIC		-0.034						
(in % of U.S. Industry Size)		[0.060]						
Lag 1 of Ch. Imports LIC			-0.13					
(in % of U.S. Industry Size)			[0.117]					
Lag 1 of Sectoral				-0.109				
Inflation (PPI)				[0.041]**				
Lag 1 U.S. Productivity					-0.140			
Growth					[0.022]**			
Panel B: IV Estimates - Dependent Variable is the y/y US Productivity Growth (BLS)								
Instrumented Ch. Imports	2.375	2.759	2.043	1.743	2.180	2.051		
LIC (in % of U.S. Industry Size)	[1.022]*	[1.201]*	[1.122]	[1.052]	[0.960]*	[1.003]*		
Instrumented Ch. NET Impt.							2.243	
LIC (in % of US Industry Size)							[1.012]*	
Instrumented Ch. Imports								0.407
China (in % of U.S. Industry Size)								[0.986]
Lag 1 of Imports LIC		-0.183						
(in % of U.S. Industry Size)		[0.100]						
Lag 1 of Ch. Imports LIC			-0.243					
(in % of U.S. Industry Size)			[0.147]					
Lag 1 of Sectoral				-0.107				
Inflation (PPI)				[0.043]*				
Lag 1 U.S. Productivity					-0.140			
Growth					[0.024]**			
Observations	2317	2317	2031	1957	2279	2350	2317	2317
Sectors	325	325	325	325	325	325	325	325

Notes: Table 4 presents the relation between changes in U.S. imports from nine LICs and the four, five, or six digit NAICS annual productivity growth from the BLS. Panel B displays the OLS estimation results and Panel A the two-stage least squares results. "Ch. Imports LIC" is defined as the y/y absolute change in (LIC Imports/U.S. Industry Size). U.S. Industry Size is defined as the 1997-2006 average value of U.S. shipments plus world imports. Also "Imports LIC," "Imports China," and "Net imports LIC" are normalized by U.S. industry size. "Ch. % LIC Manufacturing Output" is the weighted average growth rate of manufacturing output in the nine LICs. The instrument employed is the labor intensity times Ch. % LIC (or Chinese in (8)) manufacturing output. All estimations include fixed effects by sector and year dummies. For First Stage see Panel A of Table 3 (except Column (5)); * significant at 5%; ** significant at 1%

Table 5 - LIC Imports, Wages, and Input Costs (Fixed Effects Panel Estimations with Year Dummies)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Production Worker Wage		*Cost of*	*Parts=1*		*Parts =0*	
	Basic	*Productivty*	*Lagged Wage*	*Inputs*		*Basic*	*3 Instruments*	*Net Imports*
	Sample: Six Digit NAICS Manufacturing Industries from 97-06 (311111- 3399999)							
	Dependent Variable (Panel B and C) is the Ln Change of:							
	Hourly Wage	Hourly Wage	Hourly Wage	Inputs/ Revenue	Producer Price	Producer Price	Producer Price	Producer Price
Panel C: OLS estimates								
Ch. Imports LIC	-0.141	-0.148	-0.167	-0.039	-0.032	0.017	0.017	
(in % of U.S. Industry Size)	[0.079]	[0.079]	[0.092]	[0.121]	[0.081]	[0.039]	[0.039]	
Ch. NET Imports LIC								-0.003
(in % of U.S. Industry Size)								[0.033]
	Not Displayed: Estimations Include Controls of Panel B							
Panel B: IV Estimates								
Ch. Imports LIC	1.754	1.711	1.896	-2.141	-2.339		***(6) to (8) weakly identified***	
(in % of US Industry Size)	[1.365]	[1.442]	[1.434]	[2.133]	[0.561]**			
Ch. NET Imports LIC								
(in % of U.S. Industry Size)								
U.S. Productivity Growth		0.008						
		[0.027]						
Lag 1 of Ch. Ln. Wage			-0.319					
			[0.034]**					
Panel A: First Stage Estimation - Dep. Var. is the y/y Change of:								
	Imports LIC	**Imports LIC**	**Imports LIC**	**Imports LIC**	**Imports LIC**	**Imports LIC**	**Imports LIC**	**NET Imp. LIC**
Labor Share * Ch.% LIC	0.601	0.568	0.627	0.585	1.479	-0.510	-0.803	0.252
Manfacturing Output	[0.227]**	[0.227]*	[0.237]**	[0.304]	[0.218]**	[0.501]	[0.604]	[0.582]
Lag 1 Labor Share * Ch.%							1.096	
LIC Manfacturing Output							[0.557]*	
Lagf 2 Labor Share * Ch.%							0.093	
LIC Manfacturing Output							[0.525]	
U.S. Productivity Growth		0.011						
		[0.006]						
Lag 1 of Ch. Ln. Wage			-0.007					
			[0.009]					
Observations	1843	1843	1521	1142	1116	1116	999	1116
Sectors	325	325	325	289	138	138	138	138
R-Square (first stage)	0.08	0.08	0.11	0.05	0.13	0.13	0.13	0.04

Notes: Panels B and C of Table 5 presents the relation between changes in U.S. imports from nine LICs and changes in production worker wages, cost of inputs, or producer prices. Panel C displays the OLS results and Panel B the two-stage least-squares estimations. Worker wage is defined as total wage payments to production workers divided by the total amount of hours worked. Input Costs is defined as the ratio of the cost of inputs over turnover (domestic shipments). Columns (5) to (8) examine the role of intermediate inputs. Column (5) only includes sectors which do not include any 10-digit HS goods code containing the words "Parts," "Input," or related acronyms and a non-zero trade flow. Columns (6) to (8) contain only these sectors. The second-stage estimation in (6) to (8) is not displayed since the estimation is weakly identified. "Ch. Imports LIC" is defined as the y/y absolute change in (LIC Imports/U.S. Industry Size). U.S. Industry Size is defined as the 1997-2006 average value of U.S. shipments plus world imports. Also "Net imports LIC" is normalized by U.S. industry size. "Ch. % LIC Manufacturing Output" is the weighted average growth rate of manufacturing output in the nine LICs. The instrument employed is the labor intensity times Ch. % LIC manufacturing output. All estimations include fixed effects by sector and year dummies; * significant at 5%; ** significant at 1%

Table 6 - LIC Imports, Markups, and Elasticity of Demand (Fixed Effects Panel Estimations with Year Dummies)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Basic	*Markup Productivty*	*Lag. Markup*	*Profits per Revenue*	*Dep. Var is Sigma <5.55*	*Ch. Ln. Price Sigma>5.55*	*Dep. Var is Sigma <5.55*	*Ch. Ln. Productivity Sigma>5.55*
	Sample: 6 Digit NAICS Manufacturing Industries from 97-06 (311111- 3399999)							
	Dependent Variable (Panel B and C) is the Ln Change of:							
	1+ Markup	1+ Markup	1+ Markup	Profits	Producer Price		Productivity	
Panel C: OLS estimates								
Ch. Imports LIC	0.161	0.141	0.193	0.864	0.052	0.025	0.452	0.278
(in % of U.S. Industry Size)	[0.046]**	[0.045]**	[0.055]**	[0.342]*	[0.092]	[0.055]	[0.192]*	[0.125]*
U.S. Productivity Growth		0.084						
		[0.010]**						
Lag 1 of Ch. Ln. Markup			-0.250					
			[0.029]**					
Panel B: IV Estimates								
Ch. Imports LIC	-0.339	-0.842	-0.622	-5.426	-8.65	*-1.516*	*5.692*	*1.493*
(in % of US Industry Size)	[0.704]	[0.807]	[0.777]	[5.503]	[3.843]*	[0.504]**	[3.346]	[1.008]
U.S. Productivity Growth		0.096						
		[0.015]**						
Lag 1 of Ch. Ln. Markup			-0.254					
			[0.031]**					
Panel A: First Stage Estimation - Dep. Var. is the y/y change in (Imports LIC / U.S. industry Size)								
Labor Share * Ch.% LIC	0.601	0.568	0.634	1.018	0.490	1.61	0.488	1.490
Manfacturing Output	[0.227]**	[0.227]*	[0.237]**	[0.184]**	[0.204]*	[0.335]**	[0.205]*	[0.364]**
U.S. Productivity Growth		0.011						
		[0.006]						
Lag 1 of Ch. Ln. Markup			-0.004					
			[0.015]					
Observations	1843	1843	1521	2890	1333	1334	1159	1158
Sectors	325	325	325	325	162	163	162	163
R-Square (first stage)	0.08	0.08	0.11	0.12	0.12	0.16	0.12	0.15

Notes: Columns (1) to (4) of Table 6 presents the relation between changes in U.S. imports from nine LICs and changes in markups, profits, prices and productivity. Panel C displays the OLS results and Panel B the two-stage least-squares estimations. Markups are defined as one minus the ratio variable costs over the value of shipments and profits are defined as one minus total costs over the value of shipments. Columns (5) to (8) split the sample by the median elasticity of substitution (5.55). The elasticity of each six-digit NAICS sector is the unweighted average of the underlying HS 10 elasticities from Broda and Weinstein (2006). "Ch. Imports LIC" is defined as the y/y absolute change in (LIC Imports/U.S. Industry Size). U.S. Industry Size is defined as the 1997-2006 average value of U.S. shipments plus world imports. Also "Net imports LIC" is normalized by U.S. industry size. "Ch. % LIC Manufacturing Output" is the weighted average growth rate of manufacturing output in the nine LICs. The instrument employed is the labor intensity times Ch. % LIC manufacturing output. All estimations include fixed effects by sector and year dummies; * significant at 5%; ** significant at 1%

Table 7 - The Long Run Response of U.S. Prices (Fixed Effects Panel Estimations with Year Dummies)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Only first Stage Regressions					*Reduced From Equations*			
	Lag1	*Lags 1-2*	*Lags 1-3*	*Sigma <5.55*	*Sigma>5.55*	*(6) - (8) all sectors*			*Sigma <5.55*	*Sigma>5.55*
	Sample: 6 Digit NAICS Manufacturing Industries from 97-06 (311111- 3399999)									
Panel B: Reduced Form Estimates - Dependent Variable is the y/y Change of Ln Price PPI										
Labor Share * Ch.						-2.452	-2.525	-2.489	-2.671	-2.297
% LIC Manfct. Output						[0.504]**	[0.495]**	[0.544]**	[0.805]**	[0.734]**
Lag 1 Labor Share * Ch.						-0.124	0.389	-0.192	0.477	-0.858
% LIC Manfct. Output						[0.472]	[0.511]	[0.572]	[0.844]	[0.779]
Lag 2 Labor Share * Ch.							-0.363	-0.102	-0.295	0.111
% LIC Manfct. Output							[0.470]	[0.527]	[0.787]	[0.706]
Lag 3 Labor Share * Ch.								-1.768	-3.027	-0.742
% LIC Manfct. Output								[0.661]**	[0.995]**	[0.890]
Lag 1 Ch. PPI Price						-0.026	-0.058	-0.088	-0.08	-0.095
						[0.018]	[0.019]**	[0.022]**	[0.032]*	[0.030]**
Lag 2 Ch. PPI Price							-0.112	-0.139	-0.109	-0.157
							[0.019]**	[0.022]**	[0.033]**	[0.029]**
Lag 3 Ch. PPI Price								-0.03	-0.041	-0.033
								[0.023]	[0.035]	[0.032]
Panel A: Dependent Variable is the y/y change of Imports LIC / US industry Size										
Labor Share * Ch.	1.006	1.091	1.100	0.671	1.487					
% LIC Manfct. Output	[0.184]**	[0.206]**	[0.226]**	[0.259]**	[0.363]**					
Lag 1 Labor Share * Ch.	0.287	0.262	0.167	-0.227	0.537					
% LIC Manfct. Output	[0.177]	[0.189]	[0.235]	[0.266]	[0.383]					
Lag 2 Labor Share * Ch.		0.351	0.411	0.161	0.612					
% LIC Manfct. Output		[0.176]*	[0.200]*	[0.232]	[0.320]					
Lag 3 Labor Share * Ch.			-0.053	-0.326	0.207					
% LIC Manfct. Output			[0.238]	[0.274]	[0.382]					
Year dummies	y	y	y	y	y	y	y	y	y	y
Observations	2890	2568	2245	1129	1116	2345	2021	1700	851	849
Sectors	325	325	325	163	162	325	325	289	146	143
R-Square (within)	0.12	0.14	0.14	0.17	0.14	-	-	-	-	-

Notes: Table 7 displays the long-run effect of LIC trade on U.S prices and productivity. Panel B presents the results relating imports or growth in LCIs to U.S. prices and Panel A presents the first-stage estimation relating LIC output growth to LIC imports. In Panel A, Columns (1) to (5), the estimation adds lagged values of the interaction of LIC growth and labor intensity directly to prices. Columns (5) to (10) display reduced-form estimations that relate the (lagged) interaction of LIC growth and labor intensity directly to prices. Columns (4), (5), (9), and (10) split the sample by the median elasticity of substitution (5.55). Elasticities are from Broda and Weinstein (2006). "Ch. Imports LIC" is defined as the y/y absolute change in (LIC Imports/U.S. Industry Size). U.S. Industry Size is defined as the 1997-2006 average value of U.S. shipments plus world imports. Also "Net imports LIC" is normalized by U.S. industry size. "Ch. % LIC Manufacturing Output" is the weighted average growth rate of manufacturing output in the nine LICs. The instrument employed is the labor intensity times Ch. % LIC manufacturing output. All estimations include fixed effects by sector and year dummies; * significant at 5%; ** significant at 1%

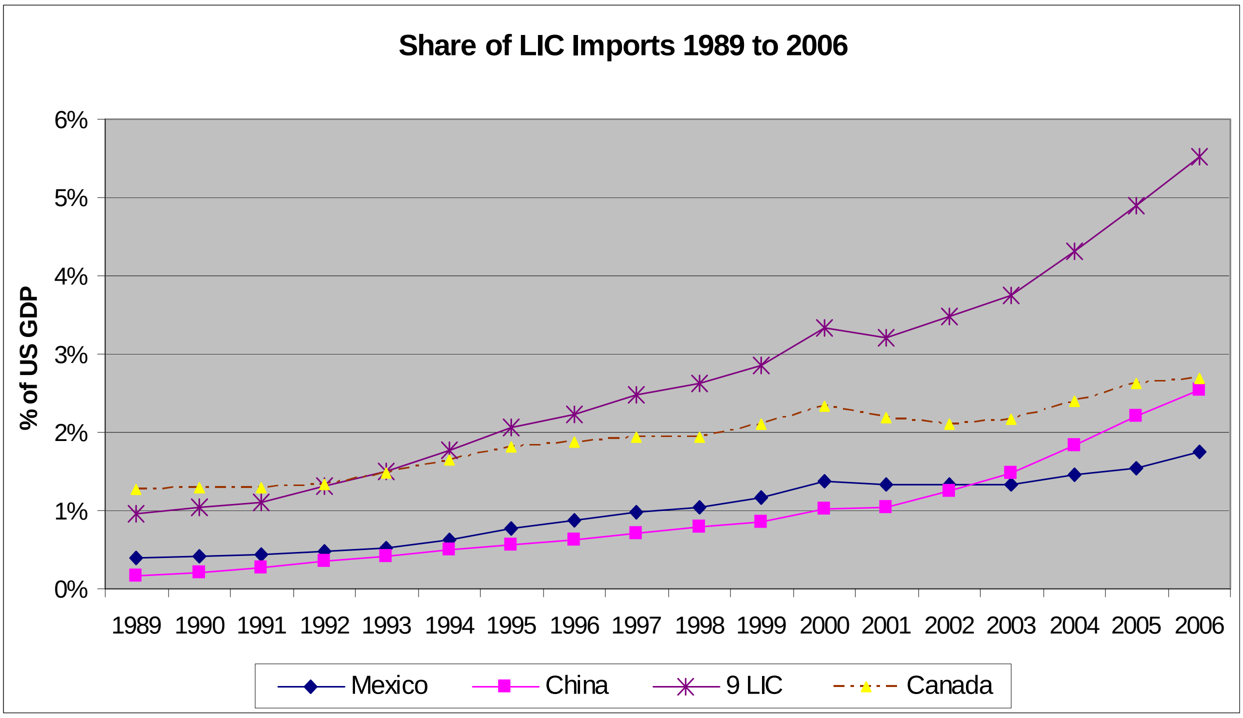
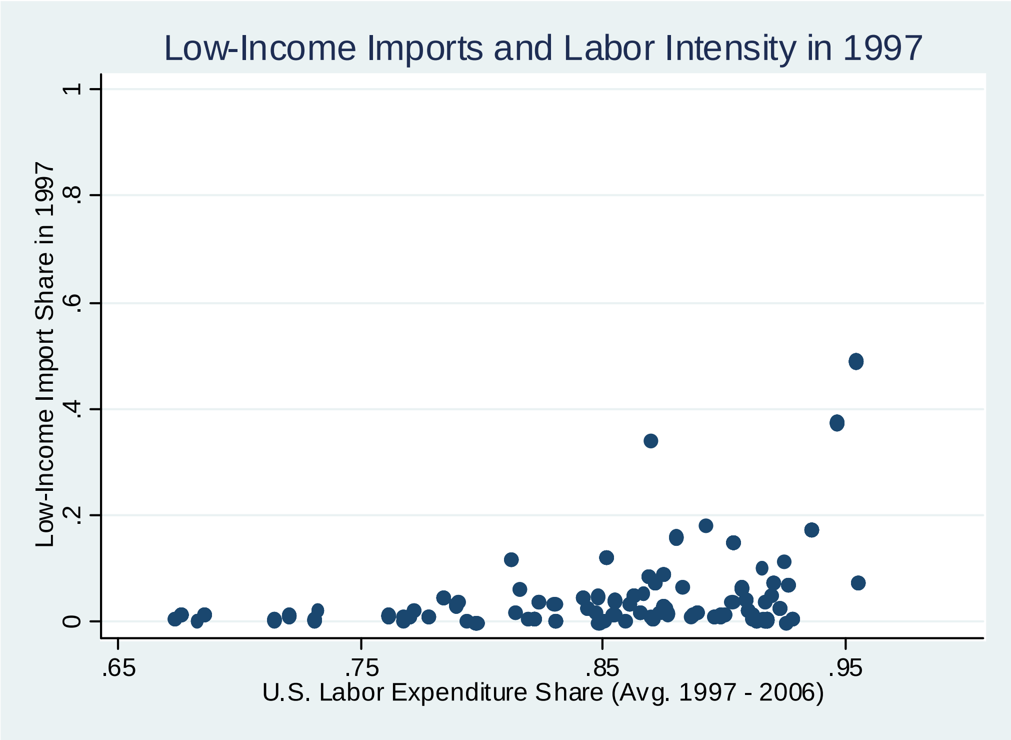

Share of LIC Imports 1989 to 2006
% of US GDP
6%
5%
4%
3%
2%
1%
0%
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Mexico
China
9 LIC
Canada

Figure 1


Low-Income Imports and Labor Intensity in 1997
Low-Income Import Share in 1997
0
.2
.4
.6
.8
1
.65
.75
.85
.95
U.S. Labor Expenditure Share (Avg. 1997 - 2006)


Low-Income Imports and Labor Intensity in 2006
Low-Income Import Share in 2006
0
.2
.4
.6
.8
1
.65
.75
.85
.95
U.S. Labor Expenditure Share (Avg. 1997 - 2006)

Figure2

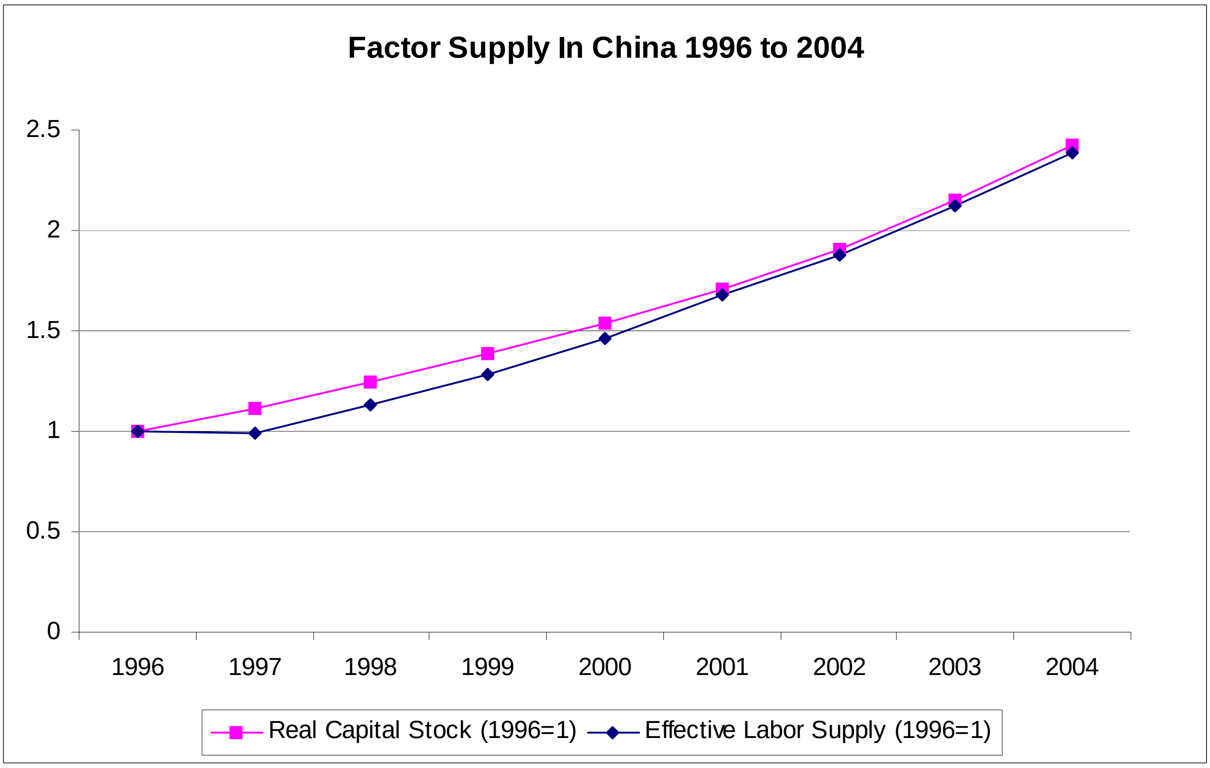

Factor Supply In China 1996 to 2004
2.5
2
1.5
1
0.5
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
Real Capital Stock (1996=1)
Effective Labor Supply (1996=1)

Figure 3