Trade Imbalances and Wage Inequality*

Rosario Crinò†
CEMFI

Paolo Epifani‡
Bocconi University,
IGIER & P.Baffi Centre

April 2013

Abstract

We study, both theoretically and empirically, how trade imbalances affect wage inequality. We show that, in a Heckscher-Ohlin model with a continuum of goods, a Southern (Northern) trade surplus leads to an increase (reduction) in the average skill intensity of exports, in the relative demand for skills and in the skill premium in both countries. We provide robust evidence in support of these predictions using a large panel of countries and a panel of US manufacturing industries observed over the past three decades. Our results suggest that the large and growing North-South trade imbalances arisen over the last three decades may have exacerbated wage inequality worldwide.

JEL Classification: F1; *Keywords*: North-South Trade Imbalances; Average Skill Intensity of Exports; Skill Upgrading; Skill Premia.

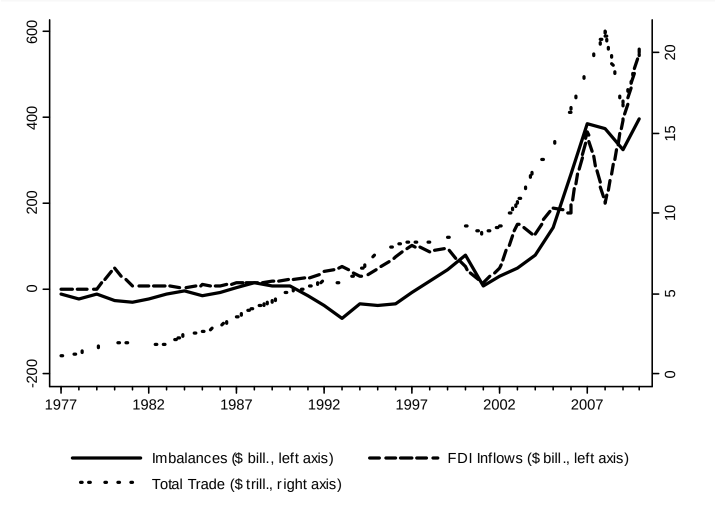
1 Introduction

In this paper we illustrate a new channel, related to global imbalances, through which international trade may increase wage inequality worldwide. To motivate our analysis, Figure 1 plots world trade flows (dotted line), as well as North-South FDI flows (dashed line) and North-South trade deficits (solid line) between 1977 and 2010. The main message from the figure is that the rise of trade and investment flows which has characterized the latest wave of globalization has been accompanied by accelerating trade imbalances. It

*We are grateful to Paolo Bertoletti, Gino Gancia, Elhanan Helpman, Alessia Lo Turco, Kiminori Matsuyama and seminar participants at University of Ancona and the 2013 Conference of the Royal Economic Society for helpful comments and suggestions. All errors are our own.

†Centro de Estudios Monetarios y Financieros (CEMFI), Casado del Alisal 5, 28014, Madrid (Spain). E-mail: crino@cemfi.es.

‡Department of Economics, IGIER and P. Baffi Centre, Università Bocconi, Via Röntgen 1, 20136 Milan (Italy). E-mail: paolo.epifani@unibocconi.it.



The solid line is the manufacturing trade surplus of the South with the North. The dashed line represents the net FDI inflow to the South. The dotted line is total world trade (exports plus imports). The South consists of seventy-one low-income countries (see Table A1). Source: Feenstra et al. (2005), UNCTAD, UN Comtrade and World Development Indicators.

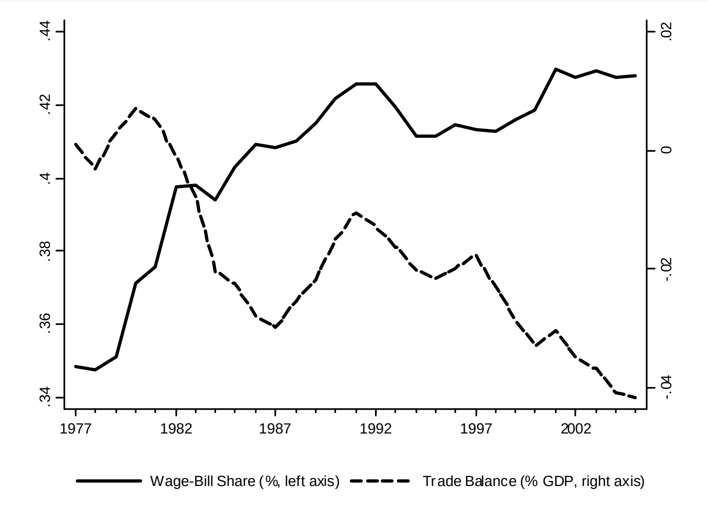
Figure 1: Trade, FDI and Imbalances

follows that the impact of globalization on wage inequality, one of the most important and controversial issues in international economics, is unlikely to be fully understood without considering the specific role of trade imbalances. The aim of this paper is therefore to develop and test a simple theory which provides new insight on the distributional implications of globalization *cum* imbalances, thereby filling an important gap in the trade literature.

To have a sense of the relationship between trade imbalances and wage inequality, Figure 2 plots the US manufacturing trade surplus as a share of GDP (dashed line) and the wage-bill share of non-production workers in manufacturing (solid line) between 1977 and 2005. The latter is a standard proxy for the relative demand for skills. The two variables are strongly negatively correlated, which suggests that the large and growing trade deficits experienced by the US economy over the past 30 years may have played a role for the rise of wage inequality in this country.[1]

Next consider Figure 3, which broadens the picture by contemplating two skill-rich countries, the US and Japan, and two skill-poor countries, China and Chile. The figure

[1] In this paper, when we speak of an increase in wage inequality we refer to a rise in the average relative wage of high skill workers (skill premium).

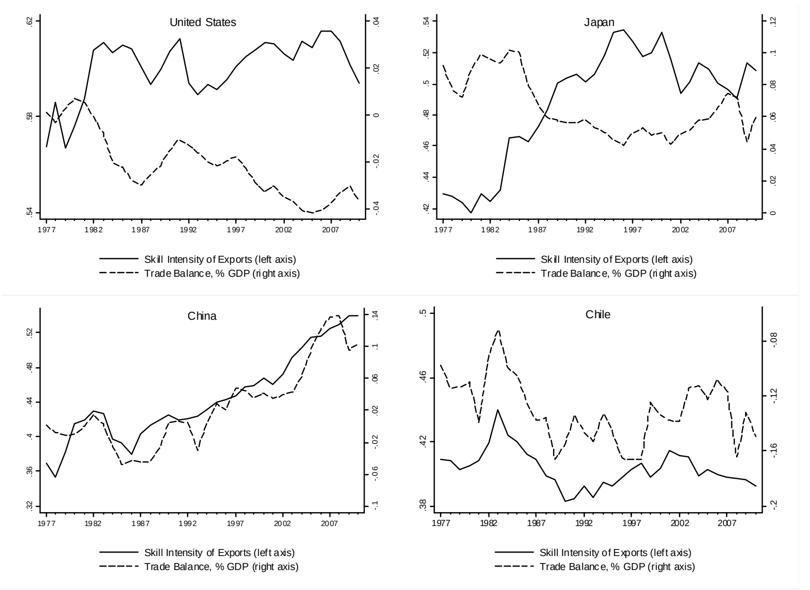


The dashed line is the manufacturing trade balance of the US in percentage of GDP. The solid line is the average wage-bill share of non-production workers across 380 (6-digit NAICS) US manufacturing industries (see Table A2). Source: NBER Productivity Database (1958-2005 Version) and World Development Indicators.

Figure 2: Trade Imbalances and Relative Demand for Skills in US Manufacturing

plots the manufacturing trade surplus over GDP (dashed line) and a proxy for the average skill intensity of manufacturing exports (solid line) over the period 1977-2010. The latter will turn out to be a key determinant of the relative demand for skills in our theory. The figure suggests that trade surpluses and the skill intensity of exports are strongly negatively correlated in skill-rich countries and strongly positively correlated in skill-poor countries.

In Section 2, we formulate a simple theory that can naturally account for the above patterns. To this purpose, we use a version of the Heckscher-Ohlin model with a continuum of goods by Dornbusch, Fischer and Samuelson (1980, henceforth DFS80) in which we allow for trade imbalances, modeled as transfers as in Dornbusch, Fischer and Samuelson (1977, henceforth DFS77). Our model predicts an increase in the Southern (Northern) trade surplus (deficit) to increase wage inequality in both regions. The intuition behind this result is the same as for why North-South FDI flows are skill biased in the seminal paper by Feenstra and Hanson (1996), or Southern catching-up is skill biased in an interesting recent contribution by Chun Zhu and Trefler (2005). The basic idea is that a Southern trade surplus is associated with Southern countries expanding into 'comparative disadvantage' industries which are more skill intensive than the Southern average, whereas the North partly deindustrializes by losing those industries which are less skill



The skill intensity of exports is computed as the weighted average of the industries' shares in total manufacturing exports. The weights are given by the normalized ranking of industries in terms of skill intensity. The sample includes 380 6-digit NAICS industries. Industry-level export data are sourced from Feenstra et al. (2005) and UN Comtrade. The skill intensity of each industry is proxied by the employment share of non-production workers in the year 1997, computed using data for the US (source: NBER Productivity Database, 1958-2005 Version).

Figure 3: Trade Imbalances and Average Skill Intensity of Exports

intensive than the Northern average. Consequently, the average skill intensity of exports, and thus the relative demand for skills and the skill premium, increase in both regions. The converse is true in the presence of a Northern trade surplus, as in this case the North expands into relatively low skill-intensive industries, whereas the South loses some of its most skill-intensive industries.

Our theory builds on a well-understood mechanism and is perhaps not too surprising. It is surprising, instead, that the explanation we propose has been unnoticed so far. In particular because, as noted above, trade imbalances are no less salient feature of the latest wave of globalization than growing FDI or Southern catching-up. Moving from these considerations, in Section 3 we test the key mechanism underlying the skill bias of trade imbalances according to our theory by studying how imbalances affect the allocation of resources between and within industries.

We first test whether Southern (Northern) trade surpluses (deficits) are associated with a systematic increase in the average skill intensity of exports due to between-industry re-allocations. To this purpose, we construct a panel of more than 100 countries observed over three decades. Consistent with the suggestive evidence illustrated in Figure 3, we find that a trade surplus has a positive or negative impact on the average skill intensity of a country's exports depending on whether the country is skill poor or skill rich relative to the world economy, a result that proves strikingly robust across specifications and estimation methods. We also find that trade liberalization, endowment changes and productivity growth have the expected impact on between-industry reallocations. The estimated impact of these variables is however generally smaller and less robust than that of trade imbalances. Finally, we find no evidence in our data of a significant impact of FDI and trade in intermediate goods on between-industry reallocations after controlling for trade imbalances.

Next, following the methodology proposed by Feenstra and Hanson (1999), we use a panel of US manufacturing industries to test whether trade deficits are associated with a systematic increase in the relative demand for skills due to within-industry reallocations. Consistent with the evidence reported in Figure 2, we find a strong impact of sectorial trade deficits on skill upgrading within US industries. Moreover, in our data the estimated impact of trade imbalances on within-industry reallocations is larger and more robust than that of standard proxies for offshoring, trade liberalization and skill-biased technical change.

Our paper is related to a growing literature on the effects of globalization on wage inequality, whose recent contributions move from some observations seemingly inconsistent with the standard trade theory. In particular, the evidence of skill upgrading in the manufacturing sector of most industrial countries, and that of rising skill premia in those developing countries that have experienced a drastic and successful trade liberalization (Goldberg and Pavcnik, 2007), have called into question the validity of the Stolper-Samuelson theorem, according to which trade liberalization leads to lower skill premia in skill-poor countries and skill downgrading in skill-rich countries. A number of alternative explanations have therefore been proposed to account for the observed trends. Some of them look at the implications of offshoring rather than international trade (e.g., Feenstra and Hanson, 1996, 1999; Grossman and Rossi-Hansberg, 2008; Acemoglu, Gancia and Zilibotti, 2013).[2] Others look instead at the distributional implications of intra-industry rather than inter-industry trade in the presence of sectorial asymmetries in the returns to scale (e.g., Epifani and Gancia, 2006, 2008), firm heterogeneity and selection into export markets (e.g., Bernard and Jensen, 1997; Yeaple, 2005; Verhoogen, 2008; Monte, 2011; Bustos, 2011), and labor market imperfections (e.g., Helpman, Itskhoki and Redding, 2010; Helpman et al., 2011). Our main contribution to this important literature is to show that the above mentioned trends can be reconciled with the neoclassical trade theory, provided that trade liberalization is accompanied by the type of imbalances recently

[2] See also Crinò (2009, 2010) for empirical evidence on the distributional effects of offshoring.

experienced by the world economy.

As mentioned earlier, our paper is more closely related to Feenstra and Hanson (1996) and Chun Zhu and Trefler (2005). Feenstra and Hanson (1996) were the first to notice that North-South capital flows are skill biased in a Hecksher-Ohlin model with a continuum of goods. We show that the same logic applies to North-South trade imbalances, and that the latter are empirically more relevant in our data. Chun Zhu and Trefler (2005) use instead a model *à la* DFS80 to show that Southern catching-up is skill biased, and propose an innovative strategy to test their model's implications. Our empirical strategy builds on theirs, the main innovation being that we can derive an explicit relationship between the average skill intensity of countries' exports and the model's key parameters. This will allow us to formulate a rigorous and more general test of the determinants of countries' export structure in a world *à la* Heckscher-Ohlin with a continuum of goods.

2 Theory

In this section we formulate a simple Heckscher-Ohlin model *à la* DFS80 consisting of two countries, South and North (indexed by $c = s, n$), a continuum of traded goods (indexed by $z \in [0, 1]$), one nontraded good (denoted by the superscript nt), and two primary factors, high and low skill labor, denoted by H and L, respectively. The South is skill poor relative to the North, i.e., $h_s < h_n$, where $h_c = H_c/L_c$ is country c's skill ratio. We focus on a free trade equilibrium with factor price differences (FPD), i.e., an equilibrium with $s_s > s_n$, where $s_c = w_{Hc}/w_{Lc}$ is the relative wage of high skill workers (henceforth, the skill premium). Finally, and more importantly, we allow for trade imbalances, which we model, as in DFS77, as a transfer T from the South to the North. Our main aim is to show how trade imbalances affect wage inequality across countries in a world in which international specialization is driven by endowment-based comparative advantage.

2.1 Setup

Preferences Consumers share the same preferences across countries, represented by the following Cobb-Douglas utility function:

$$U = m \int_0^1 \ln d(z) dz + (1 - m) \ln d^{nt}, \tag{1}$$

where $d(z)$ is consumption of the traded good z, d^{nt} is consumption of a nontraded good, and m is the expenditure share on traded goods. We introduce a nontraded sector, or else a transfer would have no impact on specialization and factor prices in this setup (see DFS77).

Technology All goods are produced under perfect competition and constant returns to scale. Specifically, in country c good z is produced with the following Cobb-Douglas production function:

$$q_c(z) = \frac{1}{a_c}\left(\frac{H_c(z)}{z}\right)^z\left(\frac{L_c(z)}{1-z}\right)^{1-z}, \tag{2}$$

where $q_c(z)$ is the output, $1/a_c$ is productivity, and $H_c(z)$ and $L_c(z)$ are the units of high and low skill labor used in industry z. Note that, as in Romalis (2004), this formulation implies that z also indexes the skill intensity of traded industries.

Borderline Commodity The unit cost function associated with (2) is

$$C_c(z) = a_c w_{H,c}^z w_{L,c}^{1-z} = a_c w_{L,c} s_c^z.$$

The unit cost of good z in the South relative to the North is thus

$$C(z) = \frac{C_s(z)}{C_n(z)} = \omega a s^z, \tag{3}$$

where $\omega = w_{L,s}/w_{L,n}$ is the wage of Southern low skill workers relative to Northern workers, $a = a_s/a_n$ is the reciprocal of Southern relative productivity, and $s = s_s/s_n$ is the Southern relative skill premium. Recall that $s > 1$ in a free trade equilibrium with FPD. Thus, $\partial \ln C(z)/\partial \ln z = z \ln s > 0$, implying that $C(z)$ is upward sloping for given factor prices, as illustrated in Figure 4.

The trade pattern is pinned down by the borderline commodity z_s, which is equally priced in the two regions and is therefore defined by the condition

$$C(z_s) = \omega a s^{z_s} = 1. \tag{4}$$

It follows that country c produces and exports all goods $z \in I_c(z_s)$, where

$$I_c(z_s) = \begin{cases} [0, z_s), & c = s \\ (z_s, 1], & c = n \end{cases}.$$

The borderline commodity z_s is instead produced in both countries.

Nontraded Sector We assume that the nontraded good q_c^{nt} is produced in each country by costlessly assembling locally produced manufacturing goods with the following Cobb-

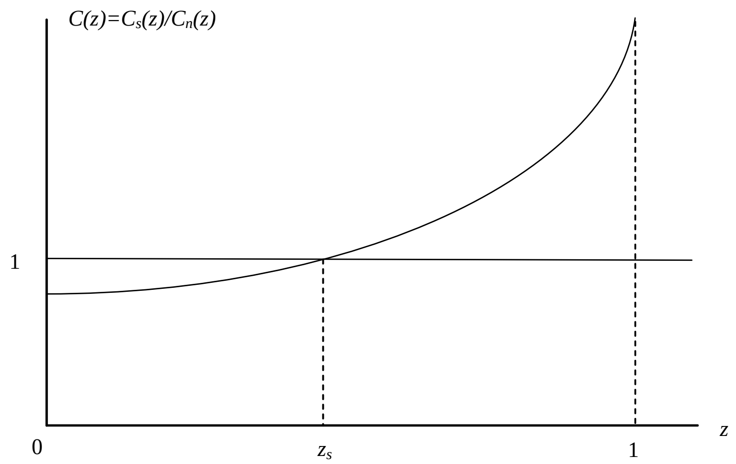


Figure 4: The Borderline Commodity

Douglas production function (expressed in logs):

$$\ln q_c^{nt} = \frac{1}{z_c} \int_{z \in I_c(z_s)} \ln \left(z_c q_c(z) \right) dz, \tag{5}$$

where $z_c = z_s$ for $c = s$, and $z_c = 1 - z_s$ for $c = n$. The log unit cost associated with (5) is

$$\ln C_c^{nt} = \frac{1}{z_c} \int_{z \in I_c(z_s)} \ln C_c(z) dz = \ln a_c w_{L,c} + Z_c \ln s_c,$$

where Z_c is the average skill intensity of goods produced and exported by country c:

$$Z_c = \frac{1}{z_c} \int_{z \in I_c(z_s)} z dz = \begin{cases} \frac{1}{2} z_s, & c = s \\ \frac{1}{2}\left(1 + z_s\right), & c = n \end{cases}. \tag{6}$$

A convenient property of this formulation is that in each country the nontraded sector features the same skill intensity as the average traded industry and is therefore neutral on relative factor rewards.

Factor Market Clearing Cobb-Douglas production functions and perfect competition imply factor costs to equal a constant share of industry revenue. In particular, z and $1 - z$ are the cost shares of H_c and L_c, respectively, in industry z, whereas Z_c and $1 - Z_c$

are the cost shares in the nontraded sector. Moreover, the Cobb-Douglas utility function in (1) and goods market equilibrium imply revenue to equal a constant share m of total world expenditure $E_w = E_s + E_n$ in any traded industry, and a share $1 - m$ of national expenditure E_c in the nontraded sector. Thus, using (6), market clearing conditions for factors H_c and L_c can be written in value terms as follows:

$$\begin{aligned} w_{H,c} H_c &= mE_w \int_{z \in I_c(z_s)} z dz + (1-m) E_c Z_c = A Z_c, \\ w_{L,c} L_c &= mE_w \int_{z \in I_c(z_s)} (1-z) dz + (1-m) E_c (1 - Z_c) = A (1 - Z_c), \end{aligned}$$

where $A = mE_w z_c + (1-m) E_c$. Taking the ratio of the two factor market clearing conditions and solving for the skill premium yields:

$$s_c = \frac{1}{h_c} \frac{Z_c}{1 - Z_c} = \begin{cases} \frac{1}{h_s} \frac{z_s}{2 - z_s}, & c = s \\ \\ \frac{1}{h_n} \frac{1+z_s}{1-z_s}, & c = n \end{cases} . \tag{7}$$

Note that the skill premium is decreasing in the skill ratio. More interestingly, it is increasing in z_s in both regions. Thus, (7) captures in a simple and elegant way the idea, first shown by Feenstra and Hanson (1996), and then by Chun Zhu and Trefler (2005) in a more general setup, that in a Heckscher-Ohlin world with a continuum of goods and FPD, a shock to the trade pattern that changes the equilibrium value of z_s may affect wage inequality in the same direction in both regions. The reason is that, since by (6) the average skill intensity of production and exports is increasing in z_s in both regions, an increase in z_s leads to a worldwide increase in the relative demand for high skill workers.

FPD Using (7) yields an expression for the relative skill premium:

$$s = \frac{s_s}{s_n} = \frac{z_s (1 - z_s)}{h (2 - z_s)(1 + z_s)}, \tag{8}$$

where $h = h_s / h_n$ is the Southern relative skill ratio. An equilibrium with complete specialization and FPD requires the model's parameters to be consistent with $s > 1$ and hence, by (8):

$$h < \frac{z_s (1 - z_s)}{(2 - z_s)(1 + z_s)}. \tag{9}$$

As shown in Figure 5, an equilibrium with FPD requires $z_s \in (z_{\min}, z_{\max})$. Thus, it is more likely when the Southern relative skill ratio h is low and z_s takes on intermediate values, namely, when North-South asymmetries are large in terms of endowments and small in

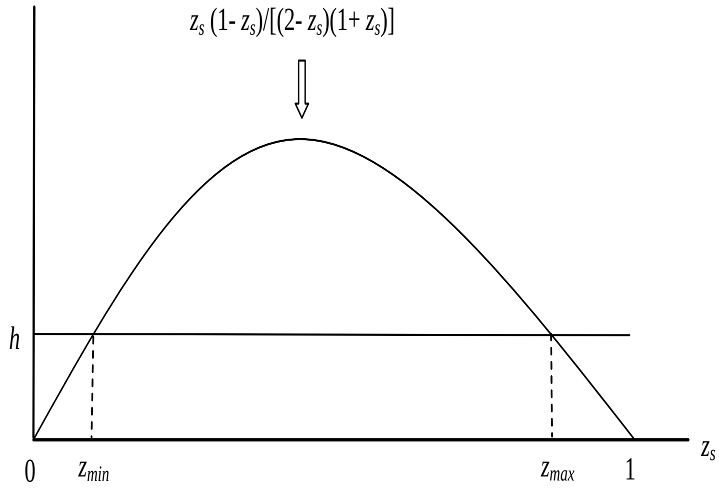


Figure 5: Conditions for an Equilibrium with FPD

terms of size.

Trade (Im)balance Condition Our key assumption is that trade is imbalanced. Following DFS77, we model trade imbalances as a transfer T from the South to the North. A positive transfer ($T > 0$) is therefore equivalent to a trade surplus in the South, whereas a negative transfer ($T < 0$) corresponds to a trade surplus in the North. Trade imbalances also imply that expenditure does not equal income R_c. In particular, we have that $E_s = R_s - T$ and $E_n = R_n + T$.

The trade (im)balance condition can therefore be written as:

$$T = \int_0^{z_s} E_n dz - \int_{z_s}^{1} E_s dz = z_s m (R_n + T) - (1 - z_s) m (R_s - T),$$

where the two terms on the RHS represent Southern exports and imports, respectively. Thus, rearranging,

$$R_s = \frac{z_s}{1 - z_s} R_n - \frac{1 - m}{m} \frac{T}{1 - z_s}, \tag{10}$$

where, using (7), income equals

$$R_c = w_{L,c} L_c (s_c h_c + 1) = \begin{cases} \frac{2 w_{L,s} L_s}{2 - z_s}, & c = s \\ \\ \frac{2 w_{L,n} L_n}{1 - z_s}, & c = n \end{cases}. \tag{11}$$

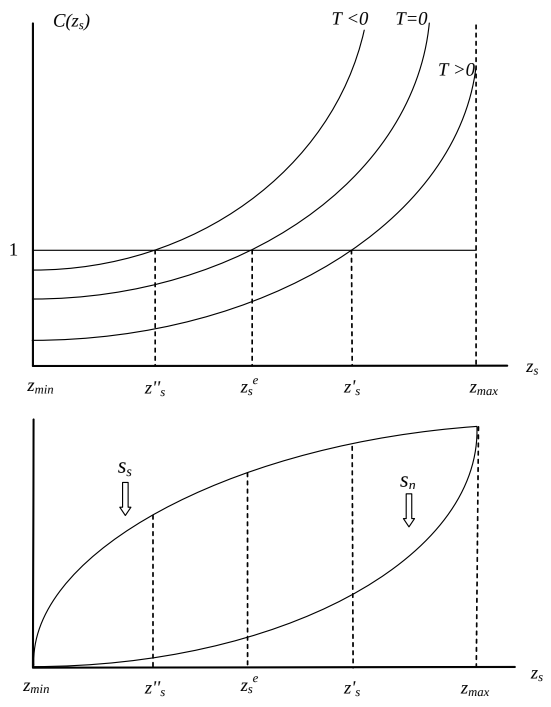


Figure 6: Trade Imbalances, Skill Intensity and Skill Premia

Substituting (11) into (10), and setting $w_{L,n} = 1$ by choice of numeraire, finally yields:

$$\omega = \frac{z_s(2 - z_s)}{(1 - z_s)^2 L} - \frac{2 - z_s}{2(1 - z_s)} \frac{1 - m}{m} \frac{T}{L_s}, \tag{12}$$

where $L = L_s/L_n$.

General Equilibrium The general equilibrium is summarized by equations (4), (8) and (12). Using (8) and (12) in (4) to eliminate s and ω from $C(z_s)$, and simplifying, yields:

$$C(z_s) = \frac{a}{h^{z_s}} \left[\frac{F(z_s)}{L} - \frac{1 - m}{m} \frac{T}{L_s} G(z_s) \right], \tag{13}$$

where

$$
\begin{aligned}
F(z_s) &= \frac{z_s^{1+z_s}(2-z_s)^{1-z_s}}{(1-z_s)^{2-z_s}(1+z_s)^{z_s}}, \quad F'(z_s) > 0, \\
G(z_s) &= \left(\frac{z_s}{1+z_s}\right)^{z_s}\left(\frac{2-z_s}{1-z_s}\right)^{1-z_s}, \quad G'(z_s) < 0.
\end{aligned}
$$

Note that $F(z_s)$ and h^{-z_s} are monotonically increasing in z_s, whereas $G(z_s)$ is monotonically decreasing. It follows that $C(z_s)$ is monotonically increasing, and thus the equilibrium is unique.

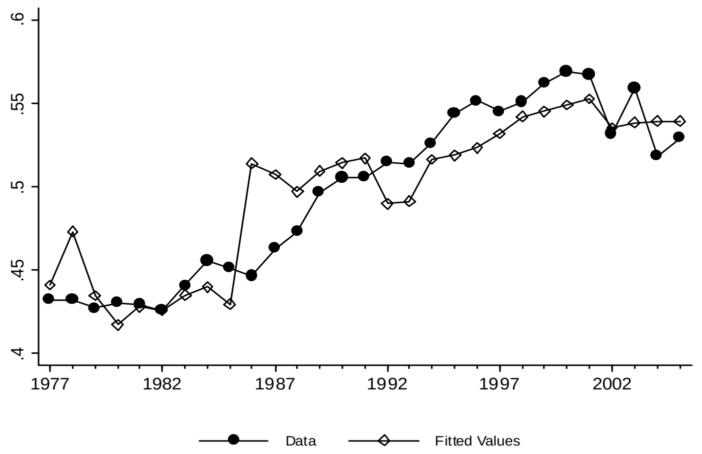
2.1.1 The Skill Bias of Trade Imbalances

Equation (13) allows us to immediately prove our main result. A transfer from the South to the North ($T > 0$) shifts the curve $C(z_s)$ downwards, thereby increasing the equilibrium value of z_s and leading, by (7), to a higher skill premium in both regions. Conversely, a transfer from the North to the South ($T < 0$) leads to a reduction in z_s and a generalized fall in the skill premia. Figure 6 illustrates. The model therefore suggests that the size and direction of trade imbalances crucially affects income distribution. To reiterate, the reason is that T affects the average skill intensity of exports (and thus the relative demand for skills and the skill premium) in both countries. This crucial implication will be tested in the next Section.

Finally, (13) shows that an increase in Southern relative productivity $1/a$, relative population L and relative skill ratio h induce a downward shift in the curve $C(z_s)$, thereby leading to a higher equilibrium value of z_s. Thus, an increase in Southern relative economic size leads to an increase in z_s and is therefore skill biased, whereas the opposite is true of an increase in Northern relative size. These further implications will also be tested in the next Section.

3 Empirical Evidence

In this Section, we test the key mechanism underlying the skill bias of trade imbalances according to our theory. As a preliminary step, in Section (3.1) we show that, by affecting the skill intensity of US exports, trade imbalances can account for a potentially large portion of the recent change in the US manufacturing skill premium. Then, we turn to our main empirical tests in Sections (3.2) and (3.3).



The figure reports the log average relative wage of non-production workers across 380 6-digit NAICS US manufacturing industries. Full circles denote the series of actual data, drawn from the NBER Productivity Database (1958-2005 Version). Hollow circles denote the series of fitted values from a regression of the log skill premium on: a constant; log $Z_t/(1\text{-}Z_t)$, where Z_t is the average skill intensity of exports in US manufacturing; the log relative employment of non-production workers; and two dummies for the period 1986-2000 and 2001-2005, respectively.

Figure 7: Actual and Predicted Skill Premium in US Manufacturing

3.1 Changes in the US Skill Premium through the Lens of Our Model

Eq. (7) illustrates a simple relationship between the skill premium s_c, the relative supply of skills h_c and the average skill intensity of exports Z_c. Using data for US manufacturing–sourced from the *NBER Productivity Database*, Feenstra et al. (2005) and *UN Comtrade*–we can estimate (7) to have a sense of how well our model accounts for the recent changes in the US skill premium. In particular, expressing (7) in logs, we have estimated the following regression using 29 yearly observations from 1977 to 2005:

$$\ln s_t = \underset{(0.2)}{0.1} \underset{(0.1)}{-0.4} \times \ln h_t + \underset{(0.1)}{0.4} \times \ln\left(\frac{Z_t}{1-Z_t}\right) + \underset{(0.0)}{0.1} \times D_{86\text{-}00} + \underset{(0.0)}{0.1} \times D_{01\text{-}05}, \quad R^2 = 0.8, \quad (14)$$

where t indexes time, and s_t and h_t are proxied, respectively, by the relative wage and employment of non-production workers; Z_t is a proxy for the average skill intensity of US manufacturing exports, detailed in the next Section; $D_{86\text{-}00}$ and $D_{01\text{-}05}$ are dummies for the periods 1986-00 and 2001-05, respectively, and account for breaks in the series (see, e.g., Acemoglu and Autor, 2011).

Needless to say, our model is too simple to lend itself to a rigorous structural estimation. In particular, according to (7), h_t and $\ln(Z_t/1 - Z_t)$ should enter (14) with coefficients equal to -1 and 1, respectively, whereas the estimated coefficients are equal to -0.4 and 0.4. Interestingly, however, the two variables have equal and opposite coefficients, just as implied by the model, and are both precisely estimated.

Next, to have a sense of the model's fit, Figure 7 plots the actual (full circles) and fitted values (hollow circles) of $\ln s_t$. Note that the model tracks reasonably closely the skill premium over time. Moreover, using the estimated coefficient on $\ln(Z_t/1 - Z_t)$ and the observed change in this variable over the period of analysis (0.17), we obtain that Z_t contributed by almost 70% to the observed increase in the skill premium (0.1) between 1977 and 2005 ($0.4 \times \frac{0.17}{0.1} = 0.68$).

Finally, we show that the impact of trade imbalances on s_t through Z_t is potentially large.[3] In this respect, our model predicts that, in a skill-rich country such as the US, the average skill intensity of exports is decreasing in the trade surplus T_t. Using yearly data from 1977 to 2005, we have therefore estimated the following simple regression:

$$\ln\left(\frac{Z_t}{1 - Z_t}\right) = \underset{(0.1)}{0.7} + \underset{(0.1)}{0.4} \times \ln h_t + \underset{(0.9)}{0.3} \times t - \underset{(0.7)}{1.7} \times T_t, \; R^2 = 0.69,$$

where T_t is the manufacturing trade surplus over GDP, and t is a linear trend capturing technical change (among other things). Note that, as expected, a trade surplus has a strong negative impact on the average skill intensity of exports. Using the estimated impact of T_t on $\ln(Z_t/1 - Z_t)$ and the observed increase in the US trade deficit over the period of analysis (3 percentage points), we obtain that the contribution of trade imbalances to the variation in $\ln(Z_t/1 - Z_t)$ is 30% $\left(-1.7 \times \frac{-0.03}{0.17}\right)$. Finally, multiplying the latter by the contribution of Z_t to the change in s_t, we obtain that trade imbalances might explain 20% of the overall increase in the US skill premium (0.3×0.68).

These back-of-the-envelope calculations suggest trade imbalances to have a potentially large impact on the US export structure and skill premium. Moving from these encouraging results, in the next two Sections we provide two complementary approaches to rigorously test the key mechanism underlying the distributional implications of trade imbalances in our theory. First, and more importantly, we test whether, as predicted by our model, trade imbalances are associated with systematic changes in the average skill intensity of exports due to between-industry reallocations. We test this prediction using country-level panel data. Second, we argue that our model can also be reinterpreted, in the spirit of Feenstra and Hanson (1996), as describing the allocation of resources across *activities* with different skill intensities performed *within* industries. In this case, the

[3] More systematic evidence on the impact of trade imbalances on the skill intensity of exports is provided in the next Section.

model would predict trade imbalances to systematically affect the skill intensity of industries (skill upgrading/downgrading) due to within-industry reallocations. We test this prediction using a panel of US industries.[4]

3.2 Trade Imbalances and Between-Industry Reallocations

Recall that Southern (Northern) trade surpluses (deficits) are skill biased, according to our theory, because they increase the average skill intensity of exports Z_c in both regions. Moreover, by (7), Z_c only depends on the equilibrium value of the borderline commodity z_s and is monotonically increasing in both regions:

$$Z_s = \frac{1}{2} z_s, \quad Z_n = \frac{1}{2}\left(1 + z_s\right).$$

Importantly it follows that, even if we do not observe z_s, we can proxy for it using Z_c.[5] This allows us to test our key mechanism by studying how trade imbalances affect the average skill intensity of exports.

Our baseline test consists in a regression of the following form:

$$\Delta Z_{c,t} = \alpha_1 \Delta T_{c,t} + \alpha_2 \left(\Delta T_{c,t} \times h_c\right) + \alpha_3 h_c + \varepsilon_{c,t}, \tag{15}$$

where c and t index countries and time, respectively; $\Delta Z_{c,t}$ is the yearly change in the average skill intensity of exports; $\Delta T_{c,t}$ is the yearly change in the normalized trade surplus $(T/L)_c$; h_c is country c's skill ratio; and $\varepsilon_{c,t}$ is a random disturbance. Our coefficients of interests are α_1 and α_2. The coefficient α_1 captures the impact on Z_c of an increase in the trade surplus by a country with a skill ratio $h_c = 0$. Given that we standardize all variables to have zero mean and standard deviation equal to one (so as to better compare their regression coefficients), $h_c = 0$ corresponds to the average skill ratio for the world economy. Our prior is therefore that $\alpha_1 = 0$. At the same time, the model predicts that $\alpha_2 < 0$, namely, that an increase in the trade surplus leads to a rise in the skill intensity of exports in a skill-poor country ($h_c < 0$) and to a fall in the skill intensity of exports in a skill-rich country ($h_c > 0$). In all specifications, we will correct the standard errors for two-way clustering by country and continent-year (Cameron, Gelbach and Miller, 2011), in order to accommodate autocorrelated shocks in each country, as well as correlated shocks

[4] Note that the simple quantitative exercise presented in this Section does not capture these additional effects because, as explained below, the variable Z_t is not influenced, by construction, by within-industry reallocations.

[5] As pointed out by Chun Zhu and Trefler (2005), aggregation bias prevents from observing z_s in practice because, at the level of industry aggregation at which trade data are usually reported, most countries export most goods.

across countries in the same continent.[6]

3.2.1 *Data and Variables*

To estimate (15), we use data for a panel of countries observed yearly between 1977 and 2007. To work with a consistent sample over time, we aggregate countries, such as Yugoslavia and the Soviet Union, that have separated during the period of analysis.[7] As a result, we have data for 109 countries (listed in Table A1), accounting for 98% of world merchandise exports in 2007.

Trade data are disaggregated at the 4-digit level of the SITC classification. These are drawn from Feenstra et al. (2005) for the period 1977-2000, and from *UN Comtrade* for more recent years. SITC data are converted into the 6-digit NAICS classification using a converter provided by Feenstra, Romalis and Schott (2002). Overall, we have data for 380 6-digit NAICS industries (listed in Table A2), spanning the entire manufacturing sector.

To construct our dependent variable (the average skill intensity of exports $Z_{c,t}$), following Romalis (2004) and Chun Zhu and Trefler (2005) we first rank industries by their skill intensity, using 6-digit NAICS data for US manufacturing industries drawn from the *NBER Productivity Database*.[8] Specifically, we proxy for industry i's skill intensity $z(i)$ with its normalized ranking based on the share of non-production workers in total employment in 1997. Then, we compute the average skill intensity of country c's exports in year t as

$$Z_{c,t} = \sum_{i=1}^{380} z(i) x_{c,t}(i), \tag{16}$$

where $x_{c,t}(i)$ is industry i's share of country c's total manufacturing exports in year t.[9]

Finally, as for our main regressors, we proxy for $T_{c,t}$ using the trade surplus (the difference between total manufacturing exports and imports) as a share of GDP, sourced from Feenstra et al. (2005) and *UN Comtrade*. Moreover, we obtain the interaction term $\Delta T_{c,t} \times h_c$ by proxying for h_c using the Barro and Lee (2010) data on average years of schooling in the workforce in 1995.

[6] We have also experimented by adding lags of $\Delta T_{c,t}$ and $\Delta T_{c,t} \times h_c$ to (15), in order to accommodate possible delayed effects of trade imbalances on the skill intensity of exports. The coefficients on these terms, however, always turned out to be small and insignificant. We thus proceed with the more parsimonious specification in (15).

[7] To ensure consistency across data sources, we aggregate countries also in a few other instances.

[8] Note that, under the assumption of no factor intensity reversal, as in our model, the ranking of factor intensities is the same across countries.

[9] Note that, given that the terms $z(i)$ are kept constant over time, $Z_{c,t}$ is unaffected by skill upgrading within industries, and can therefore change only due to export reallocations between industries.

3.2.2 Baseline Results

Our first set of results is reported in Table 1. In column (1), we estimate (15) without controls. Note that the coefficient on $\Delta T_{c,t}$ is essentially zero, whereas the coefficient on the interaction term $\Delta T_{c,t} \times h_c$ is large, negative and statistically significant beyond the 1% level. Thus, consistent with our theory, larger trade surpluses are associated with a higher average skill intensity of exports in skill-poor countries, and with a lower skill intensity of exports in skill-rich countries.

In columns (2), we add time fixed effects to control for common shocks to the composition of exports arising, e.g., from changes in preferences or technology. In column (3), we further add country fixed effects which, given our specifications in first differences, control for country-specific trends in the *level* of our variables. The skill ratio h_c is subsumed in the country fixed effects, and thus drops from this latter specification. In both cases our results are unchanged.

Recall that in our model z_c (and thus Z_c) are increasing in the relative skill ratio h. In column (4), we therefore add the change in the skill ratio $\Delta h_{c,t}$.[10] As expected, the coefficient on $\Delta h_{c,t}$ is positive and precisely estimated, and our coefficients of interest are unaffected. The model also predicts an increase in relative productivity $1/a$ and in the low skill labor force L to have a positive (negative) impact on Z_c in skill-poor (skill-rich) countries. In column (5), we therefore add the change in labor productivity $\Delta LP_{c,t}$ and its interaction with the skill ratio $\Delta LP_{c,t} \times h_c$.[11] As expected, the coefficient on $\Delta LP_{c,t} \times h_c$ is negative and precisely estimated, and that on $\Delta LP_{c,t}$ is zero. The other results are unchanged. Finally, in column (6) we add the change in population $\Delta L_{c,t}$, both linearly and interacted with h_c, to proxy for the impact of L. These additional variables are statistically insignificant and leave the other results unaffected. In the next Section, we therefore use the regression in column (5) as the baseline specification for the the robustness checks.

3.2.3 Robustness Checks

Our baseline results in Table 1 are strongly consistent with our theory and reasonably stable across specifications. We now run a battery of tests to check their robustness.

[10] Our proxy for h_c (average years of schooling) is available from the Barro-Lee database only at 5-year intervals between 1950 and 2010. We therefore use a cubic interpolation to fill in the values for intermediate years within each interval. Moreover, we impute the value for 1977 with that for 1975.

[11] To proxy for labor productivity, we use manufacturing value added per worker. Value added data come from the national accounts database of the *United Nations Statistics Division*, while labor force data are sourced from the *World Development Indicators* (WDI).

Alternative Samples and Specifications The first set of tests is reported in Table 2. In columns (1)-(3), we check the robustness of our results with respect to sample size. In particular, in column (1) we exclude all countries with a population of less than 5 millions in 2007 to check that the results are not driven by small countries playing a minor role in the global economy. In columns (2) and (3) we exclude instead the largest trading economies (US, China, Germany and Japan) and the oil exporting countries, respectively. In all cases, the results are equally strong.

The remaining specifications in Table 2 address potential issues related to the measurement of countries' skill endowment. Our results crucially hinge on the Barro-Lee proxy for educational attainment to properly measure h_c. Moreover, h_c is likely to be correlated with other country characteristics (in particular those related to the level of development) which are not directly relevant for our theory. To address measurement error, we follow Kraay and Ventura (2000) and use the ranking of countries in terms of the Barro-Lee proxy as an instrument for h_c in all interaction terms involving it. The Two-Stage Least Squares results reported in column (4) are equally strong.

Next, to address the potential issue of correlation between h_c and omitted country characteristics, we show how the results change when replacing h_c with the capital stock per worker k_c, per capita GDP y_c, and two different proxies for institutional quality IQ_c, namely, the ratings of countries in terms of political rights and civil liberties.[12] The results are reported in columns (5)-(12) and show a strikingly similar pattern. In particular, when the interaction between $\Delta T_{c,t}$ and each of the above variables is included *in place* of $\Delta T_{c,t} \times h_c$ (columns 5, 7, 9 and 11), its coefficient is always negative and precisely estimated, which is consistent with h_c being positively correlated with all these variables. Interestingly, however, when the new interaction terms are included *jointly* with $\Delta T_{c,t} \times h_c$ (columns 6, 8, 10 and 12), their coefficients drop to zero, whereas the coefficient on the 'right' interaction term is little affected.

Endogeneity In the rest of this Section we address the two other main potential sources of endogeneity, simultaneity bias and reverse causality. The former may arise if our variables are jointly driven by factors omitted from the baseline specifications. An especially important concern is that the co-evolution of trade imbalances and export structure may

[12] All these variables are measured in the year 1995. Data on per capita GDP are drawn from the WDI. Data on institutional quality are instead sourced from the *Freedom House*. Finally, to compute the capital stock per worker, we apply the perpetual inventory method to investment data drawn from the *Penn World Tables*. Following Hall and Jones (1999), we estimate the initial capital stock of country c as $K_{c,0} = I_{c,0}/(g_c + d)$, where $I_{c,0}$ is investment in the first available year, g_c is the geometric mean of the growth rates of investment in the ten subsequent periods, and d is a 6% depreciation rate. We then cumulate investment over time, thereby obtaining the capital stock in year t is as $K_{c,t} = (1 - d) * K_{c,t-1} + I_{c,t}$.

reflect underlying trends that are not fully accounted for by using variables in first differences. We tackle this issue in Table 3. To begin with, we account for the role of heterogeneous trends arising from the initial level of some variable. The basic idea is that the change over time in a variable may depend on its initial value, as is the case, e.g., with conditional convergence. To account for this, following Goldberg et al. (2010), in columns (1)-(10) we add a full set of interaction terms between the year dummies and the 1977 value of the country characteristics indicated in the columns' headings. These terms enter both linearly and interacted with h_c. In column (11), we follow instead a complementary approach by including a full set of country-specific linear trends. Note that, strikingly, our results are virtually unchanged in all cases.

Reverse causality could instead arise if countries changed their export structure due to some unobserved shocks, and this in turn led to the emergence of trade imbalances. For example, shocks to countries' competitiveness may expand the range of industries run domestically and lead to greater trade surpluses as a result. These shocks are not controlled for by either the time dummies or the country-specific time trends. They would be controlled for by a full set of country-year dummies, but including the latter in the specification is clearly unfeasible as they would be perfectly collinear with $\Delta T_{c,t}$. However, under the assumption that unobserved shocks are correlated with observed changes in some country characteristics, we can devise a simple empirical strategy to control for their impact on the main results. Specifically, we can divide countries into ten bins of equal size based on the average change in a number of observable characteristics over the period of analysis. Then, we can create a dummy for each of these bins and interact it with the year dummies. In this way, we can control for shocks that affected in a similar manner all countries experiencing similar changes in that characteristic. Our coefficients of interest are identified only from the remaining variation within a given year across all countries in the same bin. The results are reported in columns (1)-(11) of Table 4. Each column's heading indicates the variable we use to construct the bins for that specification. In column (12), we instead use a complementary approach by including a full set of continent-year dummies. Strikingly, our results are robust across all these very demanding specifications.

Finally, we resort to Instrumental Variables (IV) as an additional way of isolating the exogenous variation in the trade surplus. In particular, we use the government consumption share of GDP as an instrument for $\Delta T_{c,t}$, and its interaction with h_c as an instrument for $\Delta T_{c,t} \times h_c$.[13] Our prior is that an increase in government consumption, by raising factor demand, should increase domestic relative to foreign factor prices, thereby

[13] Data on government consumption come from the *Penn World Tables.*

deteriorating the trade balance.[14] Insofar as the induced increase in the size of the public sector leaves relative factor rewards unchanged (as is the case in our model, in which the size of the non-traded sector is neutral on relative factor prices), government consumption should have no direct impact on the composition of countries' exports. We find that, as expected, government consumption has a negative and statistically significant impact on the trade surplus in the first stage. The value of the F-statistics is however low (≈ 2), signalling a potential problem of weak instruments. While the second stage results reported in column (13) are therefore to be interpreted with caution, it is nevertheless reassuring that our main evidence is still there.[15]

3.2.4 Competing Explanations

According to the conventional wisdom, trade liberalization, offshoring and skill-biased technical change are the main drivers of the recent worldwide increase in wage inequality. In Table 5, we therefore compare our theory with these alternative explanations. We start, in columns (1) and (2), by adding the change in the openness ratio $\Delta open_{c,t}$ and its interaction with the skill ratio $\Delta open_{c,t} \times h_c$.[16] Provided that openness is inversely related to trade costs, the Heckscher-Ohlin model predicts the coefficient on the interaction term to be positive, as trade liberalization should induce skill-rich (skill-poor) countries to reallocate resources towards (away from) skill-intensive goods. Note that the coefficient on the interaction term is positive and statistically significant at the 1% level, whereas the coefficient on the linear term is imprecisely estimated. When including the terms involving the trade surplus, the size and statistical significance of the interaction term involving openness are slightly reduced, whereas the coefficients on our variables of interest are unaffected. These results, which are broadly supportive of both our theory and the Heckscher-Ohlin model, suggest that trade liberalization *cum* trade deficits tends to strengthen specialization in skill-intensive goods by skill-rich countries, thereby exacerbating wage inequality ceteris paribus. In skill-poor countries, instead, the standard forces of endowment-based comparative advantage tend to dampen the reallocations towards skill-intensive goods induced by trade surpluses.

Next we study how our theory fares when compared to foreign direct investment (FDI)

[14] See, e.g., Epifani and Gancia (2009) on this point.

[15] Note that the coefficient on $\Delta T_{c,t} \times h_c$ is larger than its OLS counterpart. This may also be due to the fact that IV regressions address also attenuation bias arising from measurement error. The latter may arise, for instance, because trade imbalances are measured in terms of sales rather than value added (see, e.g., Johnson and Noguera, 2012).

[16] Openness is defined as the ratio of imports plus exports over GDP. It is computed using trade data from Feenstra et al. (2005) and *UN Comtrade*.

and imported intermediate inputs, the two main channels through which offshoring may affect the structure of countries' exports according to the empirical trade literature. Thus, in columns (3) and (4) we add the change in FDI, $\Delta FDI_{c,t}$, and its interaction with h_c, $\Delta FDI_{c,t} \times h_c$. We proxy for FDI with the change in the stock of inward foreign investment over GDP, sourced from *Unctad*. In columns (5) and (6) we add instead the change in intermediate goods imports as a share of GDP, $\Delta II_{c,t}$, and its interaction with h_c, $\Delta II_{c,t} \times h_c$. Following the standard practice in the empirical literature, we measure imported inputs as imports of products classified in Sections 5-7 of the SITC Rev. 2 classification.[17] Note that the impact of both offshoring proxies is small and imprecisely estimated in our data, and our main results are unaffected. This probably suggests that offshoring plays a minor role for between-industry reallocations, which however does not mean that it is little relevant empirically. Indeed, starting with the seminal paper by Feenstra and Hanson (1996), the empirical trade literature has emphasized the impact of offshoring on within- rather than between-industry reallocations. This important point will be further discussed in the next Section.

Finally, we consider the role of skill-biased technical change for between-industry reallocations. So far, following our model, we have controlled for technical change by including the change in productivity and its interaction with the skill ratio. The coefficient on the interaction term turned out to be negative and generally precisely estimated, thereby suggesting, in line with the results in Chun Zhu and Trefler (2005), that Southern catching-up is skill biased. The coefficient on the term $\Delta LP_{c,t}$ was instead generally small and imprecisely estimated, suggesting that productivity growth is neutral for between-industry reallocations in the average country (in terms of relative skill endowment). Note however that, if technical change has a differential impact across manufacturing industries, the term $\Delta LP_{c,t}$ does not fully capture the potential skill bias of technology. To address this issue we control for a new variable, $\Delta SBTC_{c,t}$, constructed similarly to our dependent variable, except that in (16) we replace $z(i)$ with the normalized ranking of industries in terms of TFP growth (sourced from the *NBER Productivity Database*). This variable controls for the fact that countries reallocating exports towards more skill-intensive industries may also have experienced faster productivity growth in those industries. The results are reported in columns (7) and (8). Note that the coefficient on $\Delta SBTC_{c,t}$ is always positive, large and precisely estimated, suggesting that technical change may be an important determinant of between-industry reallocations. We also control for the interaction term $\Delta SBTC_{c,t} \times h_c$, whose coefficient is however insignificantly different from zero, suggesting

[17] Section 5 includes "Chemicals and Related Products, NES", Section 6 "Manufactured Goods Classified Chiefly by Material", and Section 7 "Machinery and Transport Equipment".

that the impact of sector- and skill-biased technical change on between-industry reallocations is independent of countries' skill endowment. More importantly for our purposes, the coefficients on the terms involving trade imbalances are little affected.

Finally, in column (9) we include all the variables discussed in this Section in the same specification and find that, strikingly, our main results are unchanged. Using these estimates, we can compare the size of the effect of trade imbalances with that of the competing explanations. In particular our results imply that, in a country like Japan that falls in the 9th decile of the distribution of skill endowments, an increase of 1 standard deviation in $\Delta T_{c,t}$, $\Delta open_{c,t}$, $\Delta LP_{c,t}$ and $\Delta SBTC_{c,t}$ is associated with a change in $\Delta Z_{c,t}$ of -10%, 9%, -3.5% and 29% of a standard deviation, respectively. Conversely, in a country like Ivory Coast that falls in the 1st decile of the distribution of h_c, $\Delta Z_{c,t}$ would change by 13%, -12%, 4.5% and 29% of a standard deviation. Thus, the impact of trade imbalances is reasonably large even when compared to that of the main drivers of wage inequality according to the conventional wisdom.

3.3 Within-Industry Reallocations

So far, we have documented a strong and robust impact of trade imbalances on between-industry reallocations. As mentioned earlier, however, the main alternative explanations for the recent increase in the relative demand for skills focus on within-industry reallocations. Although the model illustrated in Section 2 is formally silent on this–as it assumes that sectorial production functions are Cobb-Douglas, which implies constant factor cost shares–its key insight applies equally well to within-industry reallocations. The model can in fact be reinterpreted, in the spirit of Feenstra and Hanson (1996), as illustrating the impact of trade imbalances on the average skill intensity Z_c of activities performed within some industry. In this case, z_c represents the skill intensity of the borderline activity, so that a trade deficit (surplus), by increasing z_c and Z_c in a skill-rich (skill-poor) country, leads to an increase in the cost share of high skill workers (skill upgrading).

Using industry-level data for the US, sourced from the *NBER Productivity Database*, we can therefore test whether sectorial trade imbalances affect the relative demand for skills within industries. Following Feenstra and Hanson (1999), we estimate a fixed-effects regression of the following form:

$$WSH_{i,t} = \phi_i + \phi_t + \phi_Y Y_{i,t} + \phi_K (K/Y)_{i,t} + \phi_T T_{i,t} + \varepsilon_{i,t}, \tag{17}$$

where i indexes 6-digit NAICS manufacturing industries (380 industries overall) and t indexes years (from 1977 to 2005); $WSH_{i,t} \equiv \left(\frac{w_H H}{w_H H + w_L L}\right)_{i,t}$ is industry i's wage-bill share of non-production workers and proxies for the relative demand for skills; $T_{i,t}$ is industry i's trade *deficit* over value added; ϕ_i and ϕ_t are industry and time fixed effects; $Y_{i,t}$ and $(K/Y)_{i,t}$ are real output and the capital/output ratio, respectively; and $\varepsilon_{i,t}$ is a random disturbance.[18]

Our coefficient of interest is ϕ_T and our prior is that $\phi_T > 0$, namely, that a higher trade deficit leads to skill upgrading in a skill-rich country such as the US. We are equally interested, however, in how well our theory fares when compared to other theories explicitly aimed at explaining skill upgrading. To this purpose, we enrich our baseline specification by including three proxies for trade liberalization, offshoring, and skill-biased technical change, respectively. As in the previous Section, we proxy for trade liberalization using the openness ratio $OPEN_{i,t}$, defined as imports plus exports over industry value added. Following Feenstra and Hanson (1999), we proxy for offshoring using $MOS_{i,t}$, defined as the share of imported inputs in total non-energy input purchases. Finally, we proxy for skill-biased technical change using the industry TFP index.

3.3.1 Results

Baseline Estimates The main results are reported in Table 6. In columns (1)-(4) we estimate (17) by including only $T_{i,t}$, $MOS_{i,t}$, $TFP_{i,t}$ or $OPEN_{i,t}$. As expected, all variables enter with a positive and statistically significant coefficient at the 1% level. The results are broadly similar when including $T_{i,t}$ jointly with one of the above variables (see columns 5-7), but the coefficient on offshoring is now smaller and significant only at the 10% level. In column (8), we include the four variables in the same specification. Except for the coefficient on offshoring, which is now insignificantly different from zero, the coefficients on the other variables are all significant at the 1% level and roughly similar in magnitude. Finally, in column (9) we show that the results are unchanged when also including the skill premium $(w_H/w_L)_{i,t}$. Interestingly, across all specifications, the coefficient on $T_{i,t}$ is close in size to that on $OPEN_{i,t}$ and $TFP_{i,t}$ and much larger than that on $MOS_{i,t}$.

Robustness Checks Proceeding as in the previous Section, in Tables 7 and 8 we address simultaneity bias and reverse causality by controlling for underlying trends based on initial industry characteristics, and for contemporaneous shocks hitting in a similar way industries that experience similar developments. Specifically, in columns (1)-(7) of

[18] Eq. (17) can be obtained by applying Shephard's lemma on a short-run translog cost function, where high and low skill labor are the variable inputs, capital is a fixed production factor, and the trade deficit acts as a cost-shifter. Following a large empirical literature (e.g., Machin and Van Reenen, 1998), we omit the skill premium $(w_H/w_L)_{i,t}$ from our baseline specifications to avoid endogeneity. As shown below, however, controlling for the skill premium does not affect the main results.

Table 7 we interact the time dummies with the initial value of the industry characteristics indicated in columns' headings. The results are largely unchanged, except that $MOS_{i,t}$ enters with the wrong sign in one specification. In column (8) we control instead for industry-specific linear time trends. Note that the coefficients on TFP and openness are now imprecisely estimated, implying that both variables are dominated by a trend. The coefficient on $T_{i,t}$ is instead positive and significant at the 5% level.

In columns (1)-(7) of Table 8 we divide industries into ten bins of equal size based on the average change over the sample period in the variables indicated in columns' headings. We then interact a dummy for each of these bins with the year dummies. Note that, except for offshoring, all our variables of interest fare reasonably well. The main evidence is preserved also in column (8), where we control for 2-digit industry-time dummies. As a final robustness check, in Table 9 we repeat the same specifications as in Table 6, except that the variables are now computed as differences between five-year averages. Note that, although standard errors are generally larger, the main pattern of results is confirmed.

To conclude, the results in this Section suggest that trade imbalances matter a great deal also for within-industry reallocations, and that their impact seems empirically no less relevant than that of trade liberalization, offshoring or technical change. Indeed, our results suggest that Feenstra and Hanson (1996)'s original insight that, under certain conditions, globalization can be skill biased in a Heckscher-Ohlin world with a continuum of goods, seems to be especially relevant in the case in which trade liberalization is accompanied by growing North-South trade imbalances.

4 Conclusion

We have studied the impact of globalization *cum* trade imbalances on wage inequality. By taking off the shelf some standard tools provided by the neoclassical trade theory, we have formulated and tested a simple theory according to which Southern (Northern) trade surpluses are skill (unskill) biased. Contrary to the conventional wisdom, our theory suggests that trade liberalization, skill upgrading in the North and rising skill premia in the South are broadly consistent with the standard trade theory, provided that they are accompanied by Southern trade surpluses, as was indeed the case in the recent past. By implication, it also suggests that a rebalancing of the world economy would lead to a generalized reduction in wage inequality.

References

[1] Acemoglu, D. and D. Autor, 2011, "Skills, tasks and technologies: implications for employment and earnings," in (D. Card and O. Ashenfelter eds.) *Handbook of Labor Economics*, 4B, pp. 1043-1171.

[2] Acemoglu, D., Gancia, G. and F. Zilibotti, 2013, "Offshoring and directed technical change," *Working Paper, CREI.*

[3] Barro, R. and J. Lee, 2010, "A new data set of educational attainment in the world, 1950-2010," *NBER Working Paper 15902.*

[4] Bernard, A. and J. B. Jensen, 1997, "Exporters, skill upgrading and the wage gap," *Journal of International Economics*, 42, pp. 3-31.

[5] Bustos, P., 2011, "The impact of trade liberalization on skill upgrading. Evidence from Argentina," *Working Paper, CREI.*

[6] Cameron, C. A., Gelbach, J. B. and D. L. Miller, 2011, "Robust inference with multiway clustering," *Journal of Business and Economic Statistics*, 29, pp. 238-249.

[7] Chun Zhu, S. and D. Trefler, 2005, "Trade and inequality in developing countries: a general equilibrium analysis," *Journal of International Economics*, 65, pp. 21-48.

[8] Crinò, R., 2009, "Offshoring, multinationals and labour market: a review of the empirical literature," *Journal of Economic Surveys*, 23, pp. 197-249.

[9] Crinò, R., 2010, "Service offshoring and white-collar employment," *Review of Economic Studies*, 77, pp. 595-632.

[10] Dornbusch, R., Fischer, S. and P. Samuelson, 1977, "Comparative advantage, trade and payments in a Ricardian model with a continuum of goods," *American Economic Review*, 67, pp. 823-839.

[11] Dornbusch, R., Fischer, S. and P. Samuelson, 1980, "Heckscher-Ohlin trade theory with a continuum of goods," *Quarterly Journal of Economics*, 95, pp. 203-224.

[12] Epifani, P. and G. Gancia, 2006, "Increasing returns, imperfect competition and factor prices," *Review of Economics and Statistics*, 88, pp. 583-598.

[13] Epifani, P. and G. Gancia, 2008, "The skill bias of world trade," *Economic Journal*, 118, pp. 927-960.

[14] Epifani, P. and G. Gancia, 2009, "Openness, government size and the terms of trade," *Review of Economic Studies*, 76, pp. 629-668.

[15] Feenstra, R. C. and G. H. Hanson, 1996, "Foreign investment, outsourcing and relative wages," in (R. C. Feenstra *et al.* eds.) *The Political Economy of Trade Policy: Papers in Honor of Jagdish Bhagwati*, MIT Press, pp. 89-127.

[16] Feenstra, R. C. and G. H. Hanson, 1999, "The impact of outsourcing and high-technology capital on wages: estimates for the United States, 1979-1990," *Quarterly Journal of Economics*, 114, pp. 907-940.

[17] Feenstra, R. C., Lipsey, R. E., Deng, H., Ma, A. C. and H. Mo, 2005, "World trade flows: 1962-2000," *NBER Working Paper 11040*.

[18] Feenstra, R. C., Romalis, J. and P. K. Schott, 2002, "U.S. imports, exports and tariff data," *NBER Working Paper 9387*.

[19] Goldberg, P. K., Khandelwal, A. K., Pavcnik, N. and P. Topalova, 2010, "Imported intermediate inputs and domestic product growth: evidence from India," *Quarterly Journal of Economics*, 125, pp. 1727-1767.

[20] Goldberg, P. K. and N. Pavnick, 2007, "Distributional effects of globalization in developing countries," *Journal of Economic Literature*, 45, pp. 39-82.

[21] Grossman, G. M. and E. Rossi-Hansberg, 2008, "Trading tasks: a simple theory of offshoring," *American Economic Review*, 98, pp. 1978-1997.

[22] Hall, R. E. and C. I. Jones, 1999, "Why do some countries produce so much more output per worker than others?" *Quarterly Journal of Economics*, 114, pp. 83-116.

[23] Helpman, E., Itskhoki, O., Muendler, M. and S. Redding, 2011, "Trade and inequality: from theory to estimation," *Working Paper, Princeton University*.

[24] Helpman, E., Itskhoki, O. and S. Redding, 2010, "Inequality and unemployment in a global economy," *Econometrica*, 78, pp. 1239-1283.

[25] Johnson, R. and G. Noguera, 2012, "Accounting for intermediates: production sharing and trade in value added," *Journal of International Economics*, 86, pp. 224-236.

[26] Kraay, A. and J. Ventura, 2000, "Current accounts in debtor and creditor countries," *Quarterly Journal of Economics*, 115, pp. 1137-1166.

[27] Machin, S. and J. Van Reenen, 1998, "Technology and changes in skill structure: evidence from seven OECD countries," *Quarterly Journal of Economics*, 113, pp. 1215-1244.

[28] Monte, F., 2011, "Skill bias, trade, and wage dispersion," *Journal of International Economics*, 83, pp. 202-218.

[29] Romalis, J., 2004, "Factor proportions and the structure of commodity trade," *American Economic Review*, 94, pp. 67-97.

[30] Verhoogen, E., 2008, "Trade, quality upgrading and wage inequality in the Mexican manufacturing sector," *Quarterly Journal of Economics*, 123, pp. 489-530.

[31] Yeaple, S. R., 2005, "A simple model of firm heterogeneity, international trade and wages," *Journal of International Economics*, 65, pp. 1-20.

Table 1 - Between-Industry Reallocations: Baseline Estimates

Dependent Variable: Change in the Average Skill-Intensity of Exports, $\Delta Z_{c,t}$

	(1)	(2)	(3)	(4)	(5)	(6)
	No Controls	Adding Time Effects	Adding Country Effects	Adding the Skill Ratio	Adding Labor Productivity	Adding Population
$\Delta T_{c,t}$	0.001	-0.005	-0.010	-0.010	-0.011	-0.010
	(0.053)	(0.050)	(0.049)	(0.049)	(0.049)	(0.050)
$\Delta T_{c,t} * h_c$	-0.101***	-0.099***	-0.100***	-0.100***	-0.102***	-0.102***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.028)	(0.028)
h_c	0.056***	0.056***				
	(0.009)	(0.004)				
$\Delta h_{c,t}$				0.059**	0.057**	0.054**
				(0.025)	(0.024)	(0.026)
$\Delta LP_{c,t}$					0.026	0.029
					(0.018)	(0.019)
$\Delta LP_{c,t} * h_c$					-0.050**	-0.048**
					(0.021)	(0.020)
$\Delta L_{c,t}$						-0.002
						(0.014)
$\Delta L_{c,t} * h_c$						0.027
						(0.018)
Observations	3,131	3,131	3,131	3,131	3,127	3,123
R-squared	0.014	0.032	0.029	0.030	0.034	0.034
Year FE	no	yes	yes	yes	yes	yes
Country FE	no	no	yes	yes	yes	yes

All specifications are estimated on a panel of 109 countries over the period 1977-2007. *T* is manufacturing trade surplus over GDP; *h* is the average number of years of schooling; *LP* is labor productivity (manufacturing value added per worker); *L* is total population. All coefficients are beta coefficients. Standard errors are corrected for two-way clustering by country and continent-year. ***, **, *: indicate significance at the 1, 5 and 10% level, respectively.

Table 2 - Between-Industry Reallocations: Alternative Samples and Specifications

Dependent Variable: Change in the Average Skill-Intensity of Exports, $\Delta Z_{c,t}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Excl. Small Countries	Excl. US, China, Japan and Germany	Excl. Oil Exporters	Instrumenting the Skill Ratio	Alternative Proxy for Skill Endowment: K/L		Alternative Proxy for Skill Endowment: Per Capita GDP		Alternative Proxy for Skill Endowment: Civil Liberties		Alternative Proxy for Skill Endowment: Political Rights	
$\Delta T_{c,t}$	-0.013	-0.011	-0.010	-0.011	0.051	0.042	0.056	0.056	-0.029	-0.030	-0.034	-0.029
	(0.059)	(0.050)	(0.052)	(0.049)	(0.041)	(0.040)	(0.036)	(0.036)	(0.056)	(0.054)	(0.059)	(0.057)
$\Delta T_{c,t}$ * h_c	-0.111***	-0.102***	-0.106***	-0.073***		-0.087***		-0.095**		-0.094***		-0.103***
	(0.040)	(0.028)	(0.028)	(0.025)		(0.031)		(0.042)		(0.036)		(0.035)
$\Delta T_{c,t}$ * k_c					-0.081***	0.005						
					(0.031)	(0.049)						
$\Delta T_{c,t}$ * y_c							-0.067***	0.010				
							(0.026)	(0.041)				
$\Delta T_{c,t}$ * IQ_c									-0.083**	-0.044	-0.069*	-0.024
									(0.038)	(0.044)	(0.041)	(0.045)
$\Delta h_{c,t}$	0.054*	0.058**	0.052*	0.057**	0.048*	0.047*	0.062**	0.061**	0.054**	0.054**	0.055**	0.055**
	(0.029)	(0.026)	(0.028)	(0.024)	(0.026)	(0.025)	(0.029)	(0.028)	(0.025)	(0.024)	(0.025)	(0.024)
$\Delta LP_{c,t}$	0.040*	0.025	0.023	0.028	0.031	0.028	0.035	0.034	0.020	0.025	0.020	0.026
	(0.021)	(0.019)	(0.022)	(0.018)	(0.021)	(0.022)	(0.022)	(0.022)	(0.021)	(0.019)	(0.021)	(0.019)
$\Delta LP_{c,t}$ * h_c	-0.066***	-0.051**	-0.052**	-0.042**	-0.031*	-0.033*	-0.039*	-0.040*	-0.050**	-0.051**	-0.050**	-0.050**
	(0.025)	(0.021)	(0.022)	(0.019)	(0.018)	(0.018)	(0.021)	(0.021)	(0.022)	(0.021)	(0.022)	(0.021)
Observations	2,351	3,007	2,638	3,127	3,073	3,073	3,113	3,113	3,072	3,072	3,072	3,072
R-squared	0.046	0.034	0.036	0.033	0.028	0.033	0.030	0.035	0.029	0.036	0.027	0.035
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

k is capital stock per worker; *y* is per capita GDP; *IQ* is a proxy for institutional quality (see the headings of columns 9-12). Column (1) excludes countries with less than 5 million people in 2007. Column (4) instruments the interaction terms involving *h* with the ranking of countries in terms of skill ratios. All coefficients are beta coefficients. Standard errors are corrected for two-way clustering by country and continent-year. ***, **, *: indicate significance at the 1, 5 and 10% level, respectively. See also notes to previous tables.

Table 3 - Between-Industry Reallocations: Controls for Underlying Trends

Dependent Variable: Change in the Average Skill-Intensity of Exports, ΔZc,t

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Skill-Intensity of Exports	Trade Balance	Skill Endowment	Labor Productivity	Capital Stock per Worker	Trade Openness	Inward FDI	Imported Inputs	Civil Liberties	Political Rights	Country-Spec. Time Trends
$\Delta T_{c,t}$	-0.018	-0.021	-0.010	-0.003	-0.010	-0.008	-0.010	-0.008	-0.020	-0.023	-0.011
	(0.049)	(0.046)	(0.047)	(0.045)	(0.047)	(0.048)	(0.050)	(0.050)	(0.050)	(0.052)	(0.049)
$\Delta T_{c,t} * h_c$	-0.082***	-0.125***	-0.093***	-0.086***	-0.087***	-0.095***	-0.097***	-0.099***	-0.098***	-0.101***	-0.101***
	(0.025)	(0.032)	(0.025)	(0.021)	(0.024)	(0.023)	(0.024)	(0.025)	(0.024)	(0.026)	(0.027)
$\Delta h_{c,t}$	0.056**	0.055**	0.055**	0.066**	0.067**	0.061***	0.062**	0.061**	0.054**	0.061**	0.054
	(0.024)	(0.024)	(0.027)	(0.027)	(0.030)	(0.022)	(0.025)	(0.025)	(0.026)	(0.025)	(0.036)
$\Delta LP_{c,t}$	0.027	0.027	0.028	0.021	0.023	0.032*	0.030	0.031*	0.029	0.033	0.023
	(0.019)	(0.019)	(0.021)	(0.020)	(0.019)	(0.019)	(0.020)	(0.019)	(0.020)	(0.021)	(0.019)
$\Delta LP_{c,t} * h_c$	-0.041*	-0.056***	-0.038	-0.048*	-0.051*	-0.054**	-0.048*	-0.054**	-0.046*	-0.043*	-0.048**
	(0.023)	(0.021)	(0.026)	(0.028)	(0.028)	(0.026)	(0.026)	(0.022)	(0.025)	(0.025)	(0.022)
Observations	3,127	3,127	3,127	3,127	3,113	3,127	3,127	3,127	3,072	3,072	3,127
R-squared	0.081	0.083	0.069	0.073	0.078	0.068	0.049	0.082	0.059	0.060	0.053
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Columns (1)-(10) include controls for underlying trends based on pre-existing characteristics (coefficients unreported). These controls are obtained by interacting the time dummies with the initial value of the country characteristics indicated in columns' headings. The resulting variables are included both linearly and interacted with *h* Column (11) includes a full set of country-specific time trends. All coefficients are beta coefficients. Standard errors are corrected for two-way clustering by country and continent-year. ***, **, *: indicate significance at the 1, 5 and 10% level, respectively. See also notes to previous tables.

Table 4 - Between-Industry Reallocations: Controls for Contemporaneous Shocks

Dependent Variable: Change in the Average Skill-Intensity of Exports, ΔZc,t

	(1) Skill-Intensity of Exports	(2) Trade Balance	(3) Skill Endowment	(4) Labor Productivity	(5) Real Exchange Rate	(6) Capital Stock per Worker	(7) Trade Openness	(8) Inward FDI	(9) Imported Inputs	(10) Civil Liberties	(11) Political Rights	(12) Continent-Time Dummies	(13) Instrumenting the Trade Balance
$\Delta T_{c,t}$	0.001	-0.015	-0.019	-0.009	-0.024	-0.008	-0.011	0.006	-0.011	-0.033	-0.021	0.006	0.124
	(0.046)	(0.043)	(0.047)	(0.049)	(0.040)	(0.048)	(0.052)	(0.043)	(0.047)	(0.048)	(0.047)	(0.043)	(0.636)
$\Delta T_{c,t}$ * h_c	-0.092***	-0.110***	-0.108***	-0.101***	-0.097***	-0.089***	-0.109***	-0.110***	-0.111***	-0.097***	-0.103***	-0.091***	-0.263***
	(0.022)	(0.034)	(0.028)	(0.029)	(0.025)	(0.026)	(0.029)	(0.030)	(0.028)	(0.028)	(0.028)	(0.027)	(0.094)
$\Delta h_{c,t}$	0.064***	0.072***	0.062**	0.053***	0.048*	0.054**	0.059**	0.057**	0.048*	0.060**	0.056**	0.049*	0.045
	(0.025)	(0.028)	(0.029)	(0.018)	(0.028)	(0.025)	(0.023)	(0.024)	(0.027)	(0.025)	(0.025)	(0.027)	(0.031)
$\Delta LP_{c,t}$	0.014	0.025	0.031	0.036**	0.022	0.024	0.023	0.014	0.029	0.032**	0.028	0.032	0.025
	(0.022)	(0.015)	(0.020)	(0.018)	(0.019)	(0.021)	(0.020)	(0.020)	(0.020)	(0.016)	(0.020)	(0.021)	(0.026)
$\Delta LP_{c,t}$ * h_c	-0.050**	-0.053**	-0.032	-0.047**	-0.031	-0.049**	-0.041**	-0.043*	-0.051**	-0.043**	-0.054**	-0.042*	-0.055**
	(0.021)	(0.022)	(0.023)	(0.020)	(0.022)	(0.021)	(0.019)	(0.025)	(0.021)	(0.022)	(0.021)	(0.025)	(0.025)
Observations	3,127	3,127	3,127	3,127	3,009	3,113	3,127	3,127	3,127	3,072	3,072	3,127	3,088
R-squared	0.124	0.117	0.128	0.126	0.155	0.122	0.111	0.130	0.121	0.112	0.099	0.072	-
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Columns (1)-(11) include controls for contemporaneous shocks (coefficients unreported). These controls are obtained by dividing countries into ten bins of equal size, based on the average change (over 1977-2007) in the characteristics indicated in columns' headings. A dummy for each bin is then interacted with a full set of year dummies. Column (12) includes a full set of continent-year dummies. In column (13), $\Delta T_{c,t}$ and $\Delta T_{c,t} * h_c$ are instrumented using the first lag of the government consumption share of GDP, and its interaction with h_c. All coefficients are beta coefficients. Standard errors are corrected for two-way clustering by country and continent-year. ***, **, *: indicate significance at the 1, 5 and 10% level, respectively. See also notes to previous tables.

Table 5 - Between-Industry Reallocations: Competing Explanations

Dependent Variable: Change in the Average Skill-Intensity of Exports, ΔZc,t

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Trade Openness		Inward FDI		Imported Inputs		Technical Change		All Controls
$\Delta T_{c,t}$		-0.004		-0.011		-0.000		-0.024	-0.040
		(0.048)		(0.049)		(0.051)		(0.039)	(0.052)
$\Delta T_{c,t} * h_c$		-0.093***		-0.100***		-0.106***		-0.080***	-0.095***
		(0.028)		(0.027)		(0.034)		(0.029)	(0.035)
$\Delta open_{c,t}$	0.073	0.070							0.108
	(0.068)	(0.068)							(0.079)
$\Delta open_{c,t} * h_c$	0.074***	0.057*							0.082**
	(0.027)	(0.029)							(0.036)
$\Delta FDI_{c,t}$			0.034	0.034					0.036
			(0.059)	(0.060)					(0.063)
$\Delta FDI_{c,t} * h_c$			-0.035	-0.029					-0.035
			(0.030)	(0.034)					(0.031)
$\Delta II_{c,t}$					0.031	0.026			-0.070
					(0.039)	(0.035)			(0.056)
$\Delta II_{c,t} * h_c$					0.036	-0.009			-0.074*
					(0.035)	(0.032)			(0.039)
$\Delta SBTC_{c,t}$							0.287***	0.291***	0.286***
							(0.090)	(0.096)	(0.090)
$\Delta SBTC_{c,t} * h_c$							-0.076	-0.062	-0.062
							(0.057)	(0.061)	(0.059)
$\Delta h_{c,t}$	0.061**	0.060**	0.048*	0.049*	0.060**	0.057**	0.025**	0.028*	0.019
	(0.024)	(0.024)	(0.026)	(0.026)	(0.024)	(0.025)	(0.013)	(0.015)	(0.015)
$\Delta LP_{c,t}$	0.037**	0.037**	0.025	0.027	0.028	0.028	0.012	0.021	0.032
	(0.018)	(0.017)	(0.020)	(0.019)	(0.019)	(0.018)	(0.026)	(0.024)	(0.021)
$\Delta LP_{c,t} * h_c$	-0.039*	-0.043**	-0.045**	-0.048**	-0.045**	-0.050**	-0.034	-0.039	-0.032
	(0.023)	(0.021)	(0.022)	(0.020)	(0.022)	(0.021)	(0.025)	(0.025)	(0.023)
Observations	3,127	3,127	3,129	3,127	3,127	3,127	3,236	3,127	3,127
R-squared	0.030	0.039	0.024	0.035	0.024	0.034	0.124	0.136	0.144
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes

Open is exports plus imports over GDP. *FDI* is the stock of inward foreign direct investment over GDP. *II* is imports of intermediate inputs over GDP. *SBTC* is a proxy for technical change: it is obtained as the weighted average of the industries' shares in total manufacturing exports, with weights given by the normalized ranking of industries in terms of TFP growth over the sample period. All coefficients are beta coefficients. Standard errors are corrected for two-way clustering by country and continent-year. ***, **, *: indicate significance at the 1, 5 and 10% level, respectively. See also notes to previous tables.

Table 6 - Within-Industry Reallocations: Baseline Estimates

Dependent Variable: Wage-Bill Share of Non-Production Workers, WSHi,t

	(1) Trade Deficit	(2) Offshoring	(3) TFP	(4) Trade Openness	(5) Trade Deficit and Offshoring	(6) Trade Deficit and TFP	(7) Trade Deficit and Trade Openness	(8) All Variables	(9) Controlling for the Skill Premium
$Ti_{,t}$	0.080***				0.078***	0.071***	0.075***	0.067***	0.066***
	(0.012)				(0.012)	(0.012)	(0.012)	(0.011)	(0.011)
$MOS_{i,t}$		0.040***			0.026*			0.016	0.012
		(0.015)			(0.015)			(0.015)	(0.013)
$TFP_{i,t}$			0.071***			0.060***		0.053***	0.063***
			(0.011)			(0.011)		(0.011)	(0.010)
$OPEN_{i,t}$				0.083***			0.067***	0.056***	0.067***
				(0.019)			(0.018)	(0.017)	(0.016)
$(K/Y)_{i,t}$	0.137***	0.133***	0.247***	0.131***	0.138***	0.234***	0.137***	0.224***	0.241***
	(0.018)	(0.018)	(0.025)	(0.018)	(0.018)	(0.025)	(0.018)	(0.025)	(0.023)
$(Y)_{i,t}$	0.132***	0.098***	0.073**	0.094***	0.134***	0.112***	0.133***	0.118***	0.137***
	(0.029)	(0.030)	(0.029)	(0.029)	(0.029)	(0.028)	(0.029)	(0.029)	(0.027)
$(w_H/w_L)_{i,t}$									0.200***
									(0.011)
Observations	10,875	10,875	10,875	10,770	10,875	10,875	10,770	10,770	10,770
R-squared	0.948	0.947	0.948	0.947	0.948	0.949	0.948	0.948	0.953
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes	yes

All specifications are estimated on a panel of 380 6-digit NAICS US manufacturing industries. The sample period is 1977-2005. T is the trade defict over value added; MOS is the share of imported inputs in total non-energy input purchases; TFP is the TFP index; $OPEN$ is imports plus exports over value added; K/Y is the capital-output ratio; Y is real output; w_H/w_L is the relative wage of non-production workers. All coefficients are beta coefficients. All regressions are weighted by the industries' shares in total manufacturing wage-bill in the year 1977. Robust standard errors are reported in round brackets. ***, **, *: indicate significance at the 1, 5 and 10% level, respectively. See also notes to previous tables.

Table 7 - Within-Industry Reallocations: Controls for Underlying Trends

Dependent Variable: Wage-Bill Share of Non-Production Workers, WSHi,t

	(1) Wage-Bill Share	(2) Trade Deficit	(3) Capital-Output Ratio	(4) Real Output	(5) Offshoring	(6) Trade Openness	(7) TFP	(8) Industry-Specific Time Trends
$Ti_{,t}$	0.066***	0.073***	0.044***	0.055***	0.067***	0.052***	0.063***	0.031**
	(0.012)	(0.012)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.013)
$MOS_{i,t}$	0.013	0.027*	0.027*	0.013	0.016	-0.028*	0.015	-0.036**
	(0.015)	(0.014)	(0.015)	(0.015)	(0.016)	(0.016)	(0.015)	(0.015)
$TFP_{i,t}$	0.054***	0.056***	0.116***	0.038***	0.053***	0.050***	-0.016	-0.005
	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)	(0.016)	(0.011)
$OPEN_{i,t}$	0.047***	0.053***	0.052***	0.029*	0.058***	0.151***	0.036**	0.016
	(0.015)	(0.017)	(0.016)	(0.016)	(0.017)	(0.017)	(0.017)	(0.013)
$(K/Y)_{i,t}$	0.193***	0.227***	0.221***	0.183***	0.224***	0.224***	0.189***	0.124***
	(0.025)	(0.025)	(0.023)	(0.024)	(0.025)	(0.025)	(0.025)	(0.022)
$(Y)_{i,t}$	0.048	0.115***	0.035	0.060**	0.118***	0.137***	0.089***	-0.034
	(0.031)	(0.029)	(0.027)	(0.028)	(0.029)	(0.030)	(0.030)	(0.040)
Observations	10,770	10,770	10,770	10,770	10,770	10,770	10,770	10,770
R-squared	0.949	0.949	0.951	0.950	0.948	0.950	0.949	0.979
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes

Columns (1)-(7) include controls for underlying trends based on pre-existing characteristics (coefficients unreported). These controls are obtained by interacting the time dummies with the initial value of the industry characteristics indicated in columns' headings. Column (8) includes a full set of industry-specific time trends. All coefficients are beta coefficients. All regressions are weighted by the industries' shares in total manufacturing wage-bill in the year 1977. Robust standard errors are reported in round brackets. ***, **, *: indicate significance at the 1, 5 and 10% level, respectively. See also notes to previous tables.

Table 8 - Within-Industry Reallocations: Controls for Contemporaneous Shocks

Dependent Variable: Wage-Bill Share of Non-Production Workers, WSHi,t

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Wage-Bill Share	Trade Deficit	Capital-Output Ratio	Real Output	Offshoring	Trade Openness	TFP	Industry-Time Effects
$T_{i,t}$	0.013**	0.037***	0.050***	0.044***	0.059***	0.066***	0.060***	0.062***
	(0.007)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
$MOS_{i,t}$	-0.020**	-0.038**	0.010	0.010	0.033*	0.013	0.014	0.006
	(0.008)	(0.015)	(0.015)	(0.014)	(0.018)	(0.013)	(0.015)	(0.015)
$TFP_{i,t}$	0.056***	0.053***	0.046***	0.029***	0.041***	0.051***	0.074***	0.059***
	(0.008)	(0.011)	(0.010)	(0.010)	(0.010)	(0.011)	(0.012)	(0.011)
$OPEN_{i,t}$	0.021**	0.045***	0.043***	0.049***	0.044***	0.068***	0.034**	0.027
	(0.009)	(0.015)	(0.015)	(0.014)	(0.016)	(0.021)	(0.015)	(0.017)
$(K/Y)_{i,t}$	0.129***	0.245***	0.212***	0.148***	0.203***	0.204***	0.254***	0.251***
	(0.015)	(0.025)	(0.026)	(0.028)	(0.023)	(0.022)	(0.024)	(0.025)
$(Y)_{i,t}$	0.003	0.146***	0.148***	-0.009	0.116***	0.095***	0.138***	0.140***
	(0.015)	(0.032)	(0.031)	(0.054)	(0.026)	(0.026)	(0.031)	(0.029)
Observations	10,770	10,770	10,770	10,770	10,770	10,770	10,770	10,770
R-squared	0.974	0.953	0.951	0.952	0.951	0.951	0.951	0.951
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes

Columns (1)-(7) include controls for contemporaneous shocks (coefficients unreported). These controls are obtained by dividing industries into ten bins of equal size, based on the average change (over 1977-2005) in the characteristics indicated in columns' headings. A dummy for each bin is then interacted with a full set of year dummies. Column (8) includes a full set of 2-digit industry-time effects. All coefficients are beta coefficients. All regressions are weighted by the industries' shares in total manufacturing wage-bill in the year 1977. Robust standard errors are reported in round brackets. ***, **, *: indicate significance at the 1, 5 and 10% level, respectively. See also notes to previous tables.

Table 9 - Within-Industry Reallocations: Five-Year Differences

Dependent Variable: Change in the Wage-Bill Share of Non-Production Workers, ΔWSHi,t

	(1) Trade Deficit	(2) Offshoring	(3) TFP	(4) Trade Openness	(5) Trade Deficit and Offshoring	(6) Trade Deficit and TFP	(7) Trade Deficit and Trade Openness	(8) All Variables	(9) Controlling for the Skill Premium
$\Delta Ti_{,t}$	0.079**				0.079**	0.072**	0.076**	0.072**	0.076**
	(0.037)				(0.037)	(0.037)	(0.036)	(0.037)	(0.031)
$\Delta MOS_{i,t}$		0.012			-0.001			-0.012	0.001
		(0.038)			(0.039)			(0.040)	(0.039)
$\Delta TFP_{i,t}$			0.094**			0.086*		0.082*	0.091**
			(0.048)			(0.048)		(0.049)	(0.047)
$\Delta OPEN_{i,t}$				0.033			0.028	0.025	0.031
				(0.026)			(0.025)	(0.025)	(0.023)
$\Delta(K/Y)_{i,t}$	0.242***	0.238***	0.317***	0.229***	0.242***	0.314***	0.234***	0.303***	0.327***
	(0.052)	(0.053)	(0.073)	(0.052)	(0.052)	(0.073)	(0.052)	(0.074)	(0.069)
$\Delta(Y)_{i,t}$	0.074	0.062	0.048	0.063	0.074	0.061	0.076	0.062	0.089**
	(0.049)	(0.049)	(0.046)	(0.048)	(0.049)	(0.046)	(0.048)	(0.046)	(0.045)
$\Delta(w_H/w_L)_{i,t}$									0.319***
									(0.042)
Observations	2,250	2,250	2,250	2,231	2,250	2,250	2,231	2,231	2,231
R-squared	0.113	0.109	0.113	0.109	0.113	0.116	0.113	0.116	0.197
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes	yes

All variables are differences between five-year averages. All coefficients are beta coefficients. All regressions are weighted by the industries' shares in total manufacturing wage-bill in the initial year. Robust standard errors are reported in round brackets. ***, **, *: indicate significance at the 1, 5 and 10% level, respectively. See also notes to previous tables.

Table A1 - Countries Included in the Sample

Albania (LI)	Kuwait
Algeria (LI)	Macao
Argentina (LI)	Malawi (LI)
Australia	Malaysia (LI)
Austria	Malta
Bahrain	Mauritius (LI)
Bangladesh (LI)	Mexico (LI)
Barbados	Mongolia (LI)
Belgium and Luxemburg	Morocco (LI)
Belize (LI)	Nepal (LI)
Benin (LI)	Netherlands
Bolivia (LI)	New Zealand and Cook Islands
Brazil (LI)	Nicaragua (LI)
Bulgaria (LI)	Niger (LI)
Burundi (LI)	Norway
Cambodia (LI)	Pakistan (LI)
Cameroon (LI)	Papua New Guinea (LI)
Canada	Paraguay (LI)
Central African Republic (LI)	Peru (LI)
Chile (LI)	Philippines (LI)
China (LI)	Poland
Colombia (LI)	Portugal
Costa Rica (LI)	Qatar
Cuba (LI)	Rwanda (LI)
Cyprus	Saudi Arabia
Denmark and Faeroe Islands	Senegal (LI)
Dominican Republic (LI)	Sierra Leone (LI)
Ecuador (LI)	Singapore
Egypt (LI)	South Africa (includes Botswana, Lesotho, Namibia and Swaziland) (LI)
El Salvador (LI)	South Korea
Fiji and Tonga (LI)	Spain
Finland	Sri Lanka (LI)
France	Sudan (LI)
Gabon (LI)	Sweden
Gambia (LI)	Switzerland
Germany	Syria (LI)
Ghana (LI)	Tanzania (LI)
Greece	Thailand (LI)
Guatemala (LI)	Togo (LI)
Guyana (LI)	Trinidad and Tobago
Honduras (LI)	Tunisia (LI)
Hong Kong	Turkey (LI)
Hungary	United Kingdom
Iceland	United States
India (LI)	USSR (Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan) (LI)
Indonesia (includes Maldives and Timor Leste) (LI)	Uganda (LI)
Iran (LI)	United Arab Emirates
Ireland	Uruguay (LI)
Israel	Venezuela (LI)
Italy	Vietnam (LI)
Ivory Coast (LI)	Yemen (LI)
Jamaica and Turks-Caicos Islands (LI)	Yugoslavia (Bosnia and Herzegovina, Croatia, Macedonia, Serbia and Montenegro, Slovenia) (LI)
Japan	Zambia (LI)
Jordan (LI)	Zimbabwe (LI)
Kenya (LI)	

LI denotes low-income countries, i.e. countries classified as low- or middle-income by the World Bank.

Table A2 - Industries Included in the Sample

Dog and Cat Food Manufacturing(311111)	Manufactured Home (Mobile Home) Manufacturing(321991)	Steel Wire Drawing(331222)	Electron Tube Manufacturing(334411)
Other Animal Food Manufacturing(311119)	Prefabricated Wood Building Manufacturing(321992)	Alumina Refining(331311)	Bare Printed Circuit Board Manufacturing(334412)
Flour Milling(311211)	All Other Miscellaneous Wood Product Manufacturing(321999)	Primary Aluminum Production(331312)	Electronic Capacitor Manufacturing(334414)
Rice Milling(311212)	Pulp Mills(322110)	Secondary Smelting and Alloying of Aluminum(331314)	Electronic Resistor Manufacturing(334415)
Malt Manufacturing(311213)	Paper (except Newsprint) Mills(322121)	Aluminum Sheet, Plate, and Foil Manufacturing(331315)	Electronic Coil, Transformer, and Other Inductor Manufacturing(334416)
Wet Corn Milling(311221)	Newsprint Mills(322122)	Aluminum Extruded Product Manufacturing(331316)	Electronic Connector Manufacturing(334417)
Soybean Processing(311222)	Paperboard Mills(322130)	Other Aluminum Rolling and Drawing(331319)	Other Electronic Component Manufacturing(334419)
Other Oilseed Processing(311223)	Corrugated and Solid Fiber Box Manufacturing(322211)	Primary Smelting and Refining of Copper(331411)	Electromedical and Electrotherapeutic Apparatus Manufacturing(334510)
Fats and Oils Refining and Blending(311225)	Folding Paperboard Box Manufacturing(322212)	Primary Smelting and Refining of Nonferrous Metal (except Copper and Aluminum)(331419)	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing(334511)
Breakfast Cereal Manufacturing(311230)	Setup Paperboard Box Manufacturing(322213)	Copper Rolling, Drawing, and Extruding(331421)	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use(334512)
Chocolate and Confectionery Manufacturing from Cacao Beans(311320)	Fiber Can, Tube, Drum, and Similar Products Manufacturing(322214)	Copper Wire (except Mechanical) Drawing(331422)	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables(334513)
Nonchocolate Confectionery Manufacturing(311340)	Nonfolding Sanitary Food Container Manufacturing(322215)	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing, and Extruding(331491)	Totalizing Fluid Meter and Counting Device Manufacturing(334514)
Frozen Fruit, Juice, and Vegetable Manufacturing(311411)	Coated and Laminated Paper Manufacturing(322222)	Secondary Smelting, Refining, and Alloying of Nonferrous Metal (except Copper and Aluminum)(331492)	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals(334515)
Fruit and Vegetable Canning(311421)	Plastics, Foil, and Coated Paper Bag Manufacturing(322223)	Iron Foundries(331511)	Analytical Laboratory Instrument Manufacturing(334516)
Specialty Canning(311422)	Uncoated Paper and Multiwall Bag Manufacturing(322224)	Crown and Closure Manufacturing(332115)	Irradiation Apparatus Manufacturing(334517)
Dried and Dehydrated Food Manufacturing(311423)	Envelope Manufacturing(322232)	Cutlery and Flatware (except Precious) Manufacturing(332211)	Watch, Clock, and Part Manufacturing(334518)
Fluid Milk Manufacturing(311511)	Stationery, Tablet, and Related Product Manufacturing(322233)	Hand and Edge Tool Manufacturing(332212)	Other Measuring and Controlling Device Manufacturing(334519)
Cheese Manufacturing(311513)	Sanitary Paper Product Manufacturing(322291)	Saw Blade and Handsaw Manufacturing(332213)	Prerecorded Compact Disc (except Software), Tape, and Record Reproducing(334612)
Dry, Condensed, and Evaporated Dairy Product Manufacturing(311514)	All Other Converted Paper Product Manufacturing(322299)	Kitchen Utensil, Pot, and Pan Manufacturing(332214)	Magnetic and Optical Recording Media Manufacturing(334613)
Ice Cream and Frozen Dessert Manufacturing(311520)	Manifold Business Forms Printing(323116)	Prefabricated Metal Building and Component Manufacturing(332311)	Electric Lamp Bulb and Part Manufacturing(335110)
Animal (except Poultry) Slaughtering(311611)	Books Printing(323117)	Fabricated Structural Metal Manufacturing(332312)	Residential Electric Lighting Fixture Manufacturing(335121)
Rendering and Meat Byproduct Processing(311613)	Blankbook, Looseleaf Binders, and Devices Manufacturing(323118)	Metal Window and Door Manufacturing(332321)	Other Lighting Equipment Manufacturing(335129)
Poultry Processing(311615)	Other Commercial Printing(323119)	Sheet Metal Work Manufacturing(332322)	Electric Housewares and Household Fan Manufacturing(335211)
Seafood Canning(311711)	Prepress Services(323122)	Ornamental and Architectural Metal Work Manufacturing(332323)	Household Vacuum Cleaner Manufacturing(335212)
Flour Mixes and Dough Manufacturing from Purchased Flour(311822)	Petroleum Refineries(324110)	Power Boiler and Heat Exchanger Manufacturing(332410)	Household Cooking Appliance Manufacturing(335221)
Dry Pasta Manufacturing(311823)	Asphalt Paving Mixture and Block Manufacturing(324121)	Metal Tank (Heavy Gauge) Manufacturing(332420)	Household Refrigerator and Home Freezer Manufacturing(335222)
Roasted Nuts and Peanut Butter Manufacturing(311911)	Asphalt Shingle and Coating Materials Manufacturing(324122)	Metal Can Manufacturing(332431)	Household Laundry Equipment Manufacturing(335224)
Other Snack Food Manufacturing(311919)	Petroleum Lubricating Oil and Grease Manufacturing(324191)	Other Metal Container Manufacturing(332439)	Other Major Household Appliance Manufacturing(335228)
Coffee and Tea Manufacturing(311920)	Petrochemical Manufacturing(325110)	Hardware Manufacturing(332510)	Power, Distribution, and Specialty Transformer Manufacturing(335311)
Flavoring Syrup and Concentrate Manufacturing(311930)	Industrial Gas Manufacturing(325120)	Spring (Heavy Gauge) Manufacturing(332611)	Motor and Generator Manufacturing(335312)
Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing(311941)	Inorganic Dye and Pigment Manufacturing(325131)	Other Fabricated Wire Product Manufacturing(332618)	Switchgear and Switchboard Apparatus Manufacturing(335313)
Spice and Extract Manufacturing(311942)	Synthetic Organic Dye and Pigment Manufacturing(325132)	Bolt, Nut, Screw, Rivet, and Washer Manufacturing(332722)	Relay and Industrial Control Manufacturing(335314)
All Other Miscellaneous Food Manufacturing(311999)	Alkalies and Chlorine Manufacturing(325181)	Industrial Valve Manufacturing(332911)	Storage Battery Manufacturing(335911)
Soft Drink Manufacturing(312111)	Carbon Black Manufacturing(325182)	Fluid Power Valve and Hose Fitting Manufacturing(332912)	Primary Battery Manufacturing(335912)
Bottled Water Manufacturing(312112)	All Other Basic Inorganic Chemical Manufacturing(325188)	Plumbing Fixture Fitting and Trim Manufacturing(332913)	Fiber Optic Cable Manufacturing(335921)
Ice Manufacturing(312113)	Gum and Wood Chemical Manufacturing(325191)	Other Metal Valve and Pipe Fitting Manufacturing(332919)	Other Communication and Energy Wire Manufacturing(335929)
Breweries(312120)	Cyclic Crude and Intermediate Manufacturing(325192)	Ball and Roller Bearing Manufacturing(332991)	Current-Carrying Wiring Device Manufacturing(335931)
Wineries(312130)	Ethyl Alcohol Manufacturing(325193)	Small Arms Ammunition Manufacturing(332992)	Noncurrent-Carrying Wiring Device Manufacturing(335932)
Distilleries(312140)	All Other Basic Organic Chemical Manufacturing(325199)	Small Arms Manufacturing(332994)	Carbon and Graphite Product Manufacturing(335991)
Cigarette Manufacturing(312221)	Plastics Material and Resin Manufacturing(325211)	Other Ordnance and Accessories Manufacturing(332995)	All Other Miscellaneous Electrical Equipment and Component Manufacturing(335999)
Other Tobacco Product Manufacturing(312229)	Synthetic Rubber Manufacturing(325212)	Industrial Pattern Manufacturing(332997)	Automobile Manufacturing(336111)
Yarn Spinning Mills(313111)	Cellulosic Organic Fiber Manufacturing(325221)	Enameled Iron and Metal Sanitary Ware Manufacturing(332998)	Heavy Duty Truck Manufacturing(336120)
Thread Mills(313113)	Noncellulosic Organic Fiber Manufacturing(325222)	All Other Miscellaneous Fabricated Metal Product Manufacturing(332999)	Motor Vehicle Body Manufacturing(336211)
Broadwoven Fabric Mills(313210)	Nitrogenous Fertilizer Manufacturing(325311)	Farm Machinery and Equipment Manufacturing(333111)	Truck Trailer Manufacturing(336212)
Narrow Fabric Mills(313221)	Pesticide and Other Agricultural Chemical Manufacturing(325320)	Construction Machinery Manufacturing(333120)	Motor Home Manufacturing(336213)
Nonwoven Fabric Mills(313230)	Medicinal and Botanical Manufacturing(325411)	Mining Machinery and Equipment Manufacturing(333131)	Travel Trailer and Camper Manufacturing(336214)
Other Knit Fabric and Lace Mills(313249)	Pharmaceutical Preparation Manufacturing(325412)	Oil and Gas Field Machinery and Equipment Manufacturing(333132)	Vehicular Lighting Equipment Manufacturing(336321)
Textile and Fabric Finishing (except Broadwoven Fabric) Mills(313312)	Biological Product (except Diagnostic) Manufacturing(325414)	Sawmill and Woodworking Machinery Manufacturing(333210)	Other Motor Vehicle Electrical and Electronic Equipment Manufacturing(336322)
Fabric Coating Mills(313320)	Paint and Coating Manufacturing(325510)	Plastics and Rubber Industry Machinery Manufacturing(333220)	Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing(336330)
Carpet and Rug Mills(314110)	Adhesive Manufacturing(325520)	Paper Industry Machinery Manufacturing(333291)	Motor Vehicle Brake System Manufacturing(336340)
Curtain and Drapery Mills(314121)	Soap and Other Detergent Manufacturing(325611)	Textile Machinery Manufacturing(333292)	Motor Vehicle Transmission and Power Train Parts Manufacturing(336350)
Other Household Textile Product Mills(314129)	Polish and Other Sanitation Good Manufacturing(325612)	Printing Machinery and Equipment Manufacturing(333293)	Motor Vehicle Seating and Interior Trim Manufacturing(336360)
Textile Bag Mills(314911)	Surface Active Agent Manufacturing(325613)	Food Product Machinery Manufacturing(333294)	Motor Vehicle Metal Stamping(336370)
Canvas and Related Product Mills(314912)	Toilet Preparation Manufacturing(325620)	Semiconductor Machinery Manufacturing(333295)	Motor Vehicle Air-Conditioning Manufacturing(336391)
Rope, Cordage, and Twine Mills(314991)	Printing Ink Manufacturing(325910)	All Other Industrial Machinery Manufacturing(333298)	Aircraft Manufacturing(336411)
Tire Cord and Tire Fabric Mills(314992)	Explosives Manufacturing(325920)	Automatic Vending Machine Manufacturing(333311)	Aircraft Engine and Engine Parts Manufacturing(336412)
All Other Miscellaneous Textile Product Mills(314999)	Photographic Film, Paper, Plate, and Chemical Manufacturing(325992)	Office Machinery Manufacturing(333313)	Other Aircraft Parts and Auxiliary Equipment Manufacturing(336413)
Outerwear Knitting Mills(315191)	All Other Miscellaneous Chemical Product and Preparation Manufacturing(325998)	Optical Instrument and Lens Manufacturing(333314)	Guided Missile and Space Vehicle Manufacturing(336414)
Men's and Boys' Cut and Sew Underwear and Nightwear Manufacturing(315221)	Plastics Packaging Film and Sheet (including Laminated) Manufacturing(326112)	Photographic and Photocopying Equipment Manufacturing(333315)	Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing(336415)
Men's and Boys' Cut and Sew Suit, Coat, and Overcoat Manufacturing(315222)	Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing(326113)	Other Commercial and Service Industry Machinery Manufacturing(333319)	Railroad Rolling Stock Manufacturing(336510)
Men's and Boys' Cut and Sew Shirt (except Work Shirt) Manufacturing(315223)	Unlaminated Plastics Profile Shape Manufacturing(326121)	Air Purification Equipment Manufacturing(333411)	Ship Building and Repairing(336611)
Men's and Boys' Cut and Sew Trouser, Slack, and Jean Manufacturing(315224)	Plastics Pipe and Pipe Fitting Manufacturing(326122)	Industrial and Commercial Fan and Blower Manufacturing(333412)	Boat Building(336612)
Men's and Boys' Cut and Sew Other Outerwear Manufacturing(315228)	Plastics Bottle Manufacturing(326160)	Heating Equipment (except Warm Air Furnaces) Manufacturing(333414)	Motorcycle, Bicycle, and Parts Manufacturing(336991)
Women's and Girls' Cut and Sew Lingerie, Loungewear, and Nightwear Manufacturing(315231)	Plastics Plumbing Fixture Manufacturing(326191)	Air-Conditioning and Warm Air Heating Equipment (333415)	Military Armored Vehicle, Tank, and Tank Component Manufacturing(336992)
Women's and Girls' Cut and Sew Blouse and Shirt Manufacturing(315232)	Resilient Floor Covering Manufacturing(326192)	Industrial Mold Manufacturing(333511)	Wood Kitchen Cabinet and Countertop Manufacturing(337110)
Women's and Girls' Cut and Sew Dress Manufacturing(315233)	All Other Plastics Product Manufacturing(326199)	Machine Tool (Metal Cutting Types) Manufacturing(333512)	Upholstered Household Furniture Manufacturing(337121)
Women's and Girls' Cut and Sew Suit, Coat, Tailored Jacket, and Skirt Manufacturing(315234)	Tire Manufacturing (except Retreading)(326211)	Machine Tool (Metal Forming Types) Manufacturing(333513)	Metal Household Furniture Manufacturing(337124)
Women's and Girls' Cut and Sew Other Outerwear Manufacturing(315239)	Tire Retreading(326212)	Special Die and Tool, Die Set, Jig, and Fixture Manufacturing(333514)	Institutional Furniture Manufacturing(337127)
Infants' Cut and Sew Apparel Manufacturing(315291)	Rubber and Plastics Hoses and Belting Manufacturing(326220)	Cutting Tool and Machine Tool Accessory Manufacturing(333515)	Wood Television, Radio, and Sewing Machine Cabinet Manufacturing(337129)
Fur and Leather Apparel Manufacturing(315292)	All Other Rubber Product Manufacturing(326299)	Rolling Mill Machinery and Equipment Manufacturing(333516)	Wood Office Furniture Manufacturing(337211)
All Other Cut and Sew Apparel Manufacturing(315299)	Vitreous China Plumbing Fixture and China and Earthenware Bathroom Accessories Manufacturing(327111)	Turbine and Turbine Generator Set Units Manufacturing(333611)	Office Furniture (except Wood) Manufacturing(337214)
Hat, Cap, and Millinery Manufacturing(315991)	Vitreous China, Fine Earthenware, and Other Pottery Product Manufacturing(327112)	Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing(333612)	Showcase, Partition, Shelving, and Locker Manufacturing(337215)
Glove and Mitten Manufacturing(315992)	Porcelain Electrical Supply Manufacturing(327113)	Mechanical Power Transmission Equipment Manufacturing(333613)	Mattress Manufacturing(337910)
Men's and Boys' Neckwear Manufacturing(315993)	Brick and Structural Clay Tile Manufacturing(327121)	Other Engine Equipment Manufacturing(333618)	Blind and Shade Manufacturing(337920)
Other Apparel Accessories and Other Apparel Manufacturing(315999)	Ceramic Wall and Floor Tile Manufacturing(327122)	Pump and Pumping Equipment Manufacturing(333911)	Surgical and Medical Instrument Manufacturing(339112)
Leather and Hide Tanning and Finishing(316110)	Other Structural Clay Product Manufacturing(327123)	Air and Gas Compressor Manufacturing(333912)	Surgical Appliance and Supplies Manufacturing(339113)
Rubber and Plastics Footwear Manufacturing(316211)	Clay Refractory Manufacturing(327124)	Measuring and Dispensing Pump Manufacturing(333913)	Dental Equipment and Supplies Manufacturing(339114)
House Slipper Manufacturing(316212)	Nonclay Refractory Manufacturing(327125)	Elevator and Moving Stairway Manufacturing(333921)	Ophthalmic Goods Manufacturing(339115)
Men's Footwear (except Athletic) Manufacturing(316213)	Flat Glass Manufacturing(327211)	Conveyor and Conveying Equipment Manufacturing(333922)	Jewelry (except Costume) Manufacturing(339911)
Women's Footwear (except Athletic) Manufacturing(316214)	Other Pressed and Blown Glass and Glassware Manufacturing(327212)	Overhead Traveling Crane, Hoist, and Monorail System Manufacturing(333923)	Silverware and Hollowware Manufacturing(339912)
Other Footwear Manufacturing(316219)	Glass Container Manufacturing(327213)	Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing(333924)	Jewelers' Material and Lapidary Work Manufacturing(339913)
Luggage Manufacturing(316991)	Glass Product Manufacturing Made of Purchased Glass(327215)	Power-Driven Handtool Manufacturing(333991)	Costume Jewelry and Novelty Manufacturing(339914)
Women's Handbag and Purse Manufacturing(316992)	Cement Manufacturing(327310)	Welding and Soldering Equipment Manufacturing(333992)	Sporting and Athletic Goods Manufacturing(339920)
Personal Leather Good (except Women's Handbag and Purse) Manufacturing(316993)	Ready-Mix Concrete Manufacturing(327320)	Packaging Machinery Manufacturing(333993)	Doll and Stuffed Toy Manufacturing(339931)
All Other Leather Good Manufacturing(316999)	Concrete Block and Brick Manufacturing(327331)	Industrial Process Furnace and Oven Manufacturing(333994)	Game, Toy, and Children's Vehicle Manufacturing(339932)
Sawmills(321113)	Other Concrete Product Manufacturing(327390)	Fluid Power Cylinder and Actuator Manufacturing(333995)	Pen and Mechanical Pencil Manufacturing(339941)
Wood Preservation(321114)	Lime Manufacturing(327410)	Fluid Power Pump and Motor Manufacturing(333996)	Lead Pencil and Art Good Manufacturing(339942)
Hardwood Veneer and Plywood Manufacturing(321211)	Gypsum Product Manufacturing(327420)	Scale and Balance (except Laboratory) Manufacturing(333997)	Marking Device Manufacturing(339943)
Softwood Veneer and Plywood Manufacturing(321212)	Abrasive Product Manufacturing(327910)	All Other Miscellaneous General Purpose Machinery Manufacturing(333999)	Carbon Paper and Inked Ribbon Manufacturing(339944)
Engineered Wood Member (except Truss) Manufacturing(321213)	Cut Stone and Stone Product Manufacturing(327991)	Electronic Computer Manufacturing(334111)	Sign Manufacturing(339950)
Truss Manufacturing(321214)	Ground or Treated Mineral and Earth Manufacturing(327992)	Computer Storage Device Manufacturing(334112)	Gasket, Packing, and Sealing Device Manufacturing(339991)
Reconstituted Wood Product Manufacturing(321219)	Mineral Wool Manufacturing(327993)	Telephone Apparatus Manufacturing(334210)	Musical Instrument Manufacturing(339992)
Wood Window and Door Manufacturing(321911)	All Other Miscellaneous Nonmetallic Mineral Product Manufacturing(327999)	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing(334220)	Fastener, Button, Needle, and Pin Manufacturing(339993)
Other Millwork (including Flooring)(321918)	Iron and Steel Mills(331111)	Other Communications Equipment Manufacturing(334290)	Broom, Brush, and Mop Manufacturing(339994)
Wood Container and Pallet Manufacturing(321920)	Electrometallurgical Ferroalloy Product Manufacturing(331112)	Audio and Video Equipment Manufacturing(334310)	All Other Miscellaneous Manufacturing(339999)