Trade Imbalances, Export Structure and Wage Inequality*

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Abstract

We study, both theoretically and empirically, how trade imbalances affect the structure of countries' exports and 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 support for the mechanism underlying these predictions using a large panel of countries observed over the past 30 years. 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 Premia.

1 Introduction

In this paper we illustrate a new channel, related to global imbalances, through which international trade may increase wage inequality worldwide.[1] 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

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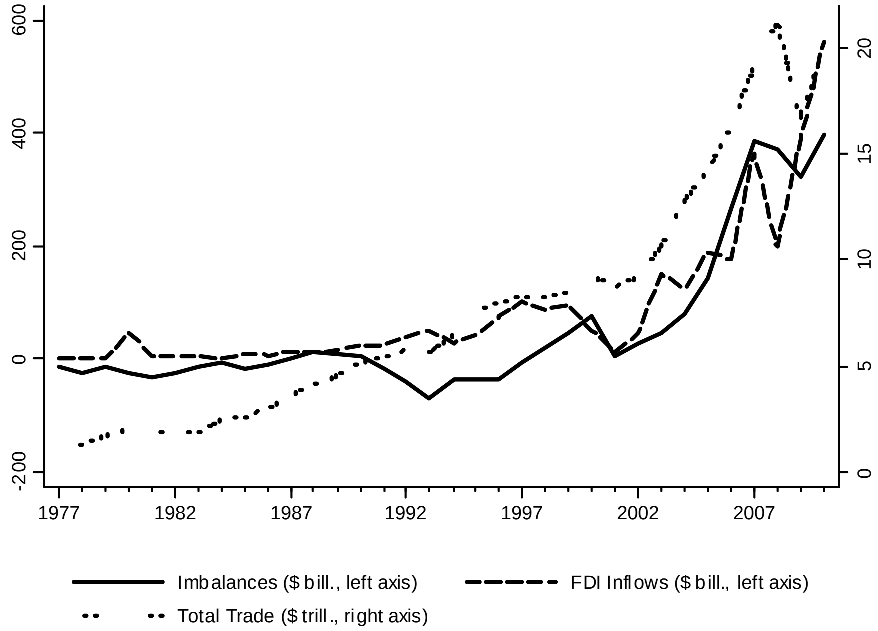
[1]In this paper, whenever we speak of an increase in wage inequality, we refer to a rise in the average relative wage of high skill workers (skill premium).

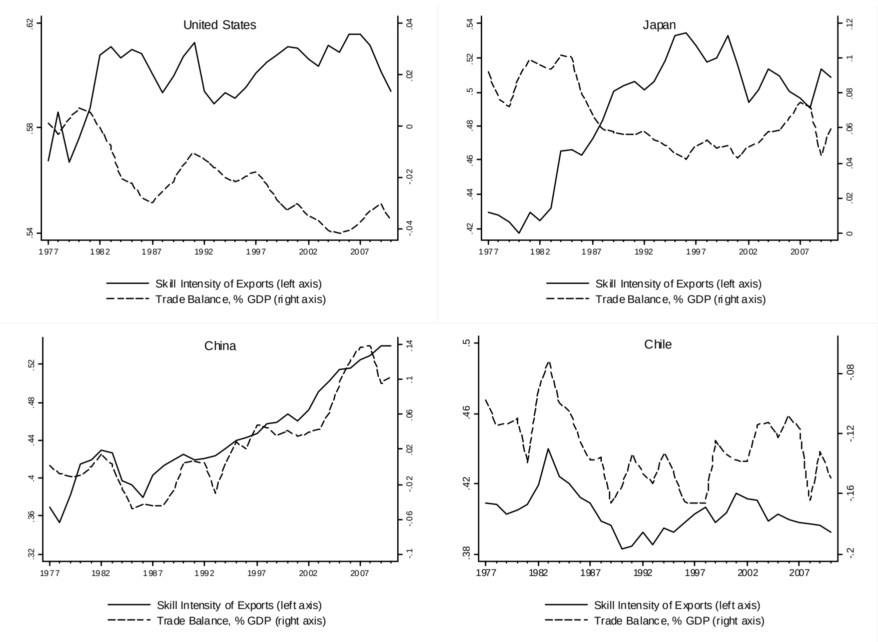


The solid line is the Southern manufacturing trade surplus. The dashed line represents net FDI inflows to the South. The dotted line is total world trade (manufacturing exports plus imports). The South consists of 71 countries classified as low- or middle-income by the World Bank. Source: Feenstra et al. (2005), *UNCTAD*, *UN Comtrade* and *World Development Indicators*.

Figure 1: Trade, FDI and Imbalances

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 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 that provides a novel view on the distributional implications of globalization *cum* imbalances, thereby filling an important gap in the trade literature.

To preview the key pattern in our data, in Figure 2 we consider two skill-rich countries, the US and Japan, and two skill-poor countries, China and Chile. The figure 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 1977-10. The latter variable will turn out to be a crucial determinant of the relative demand for skills according to our theory. The figure suggests that trade surpluses and the skill intensity of exports are



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 skill intensity of each industry is proxied by the 1997 share of non-production workers in total employment, based on US data from the *NBER Productivity Database*. The sample includes 380 6-digit NAICS industries. Industry-level export data are sourced from Feenstra et al. (2005) and *UN Comtrade*.

Figure 2: Trade Imbalances and Average Skill Intensity of Exports

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 pattern. To this purpose, we use a version of the Heckscher-Ohlin model with a continuum of goods introduced 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). The model predicts an increase in the Southern (Northern) trade surplus (deficit) to raise the average skill intensity of exports and 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 a more 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 industries which are less skill 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. This is especially so 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 therefore bring our theory to the data. We start by showing that, in a sample of 33 countries including the US, variation in the average skill intensity of exports has a potentially large impact on the skill premium. Next, we test the key mechanism underlying the skill bias of trade imbalances according to our theory, whereby Southern (Northern) trade surpluses (deficits) are associated with a systematic increase in the average skill intensity of exports. To this purpose, we construct a panel of more than 100 countries observed over the last three decades. Consistent with the suggestive evidence illustrated in Figure 2, 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 compare our theory with the main alternative explanations for the recent increase in wage inequality. We find, *inter alia*, that proxies for trade liberalization, offshoring, technical progress and endowment changes have the expected impact on the structure of countries' exports. Except for technical progress, however, their effect is smaller and less robust than that of trade imbalances.

Our paper is related to a vast literature on the effects of globalization on wage inequality, whose recent contributions move from some observations that are 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 developing countries that have experienced a drastic and successful trade liberalization (Goldberg and Pavcnik, 2007), called into question the validity of the Stolper-Samuelson theorem, according to which trade liberalization should lead to lower skill premia in skill-poor countries and skill downgrading in skill-rich countries. A number of alternative explanations have therefore been proposed in the literature 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] or at various forms of trade-induced skill-biased technical change (Acemoglu, 2003; Thoenig and Verdier, 2003; Matsuyama, 2007) and capital-skill complementarity (e.g., Burstein, Cravino and Vogel, 2013; Parro, 2013). Others look in-

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

stead 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; Bustos, 2011; Monte, 2011), and labor market imperfections (e.g., Helpman, Itskhoki and Redding, 2010; Helpman et al., 2011). Finally, in a recent contribution, Burstein and Vogel (2012) develop a multi-country quantitative trade model which embeds ingredients of both traditional and new explanations, and find, again, that Stolper-Samuelson effects are small relative to trade-induced skill-biased technical change. Our main contribution to this important literature is to show that a worldwide increase in the skill premium can be reconciled with the neoclassical trade theory, provided that trade liberalization is accompanied by the type of imbalances recently 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 Heckscher-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.

Finally, and equally important, our paper is related to a small but influential trade literature allowing a specific role for trade imbalances. In particular, recent work by Dekle, Eaton and Kortum (2007, 2008) has revived interest in the topic by analyzing the welfare effects of trade imbalances (also modeled as transfers) in a quantitative Ricardian model with a continuum of goods. Although their framework is not well suited to study income distribution issues, they also find strong distributional implications of a hypothetical rebalancing of the world economy under the assumption of labor immobility between traded and nontraded industries. It is also interesting to notice that an early empirical literature documenting the increase in the US skill premium in the 1980's found the US trade deficit to have a significant impact on the relative demand for skills.[3] However, lacking a theo-

[3] In particular, Murphy and Welch (1992) found that an increase in the US durable goods deficit equal to 1 percent of GNP reduces wages of young and less educated workers by roughly 3 percent, and increases wages of older and more educated workers by 1 to 2 percent. Similarly, Borjas, Freeman and Katz (1991) argued that up to 25 percent of the observed increase in the college premium between 1980 and 1985 is

retical foundation for a link between trade deficits and skill premia, these findings were interpreted through the lens of the standard Stolper-Samuelson theorem. This soon led to discredit the trade explanation in favor of skill-biased technical change (e.g., Bound and Johnson, 1992; Berman, Bound and Griliches, 1994) because, as mentioned earlier, the Stolper-Samuelson theorem was seemingly inconsistent with the evidence. In this respect, our main contribution is to propose a consistent mechanism whereby trade imbalances can have a large impact on the relative demand for skills.

2 Theory

Overview 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 a transfer T from the South to the North. Our main aim is to show how trade imbalances affect countries' export structure and wage inequality in a world in which international specialization is driven by endowment-based comparative advantage.[4]

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 of 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

due to the concomitant increase in the US trade deficit.

[4] In the Appendix, we show how our key results extend to a multi-country version of the baseline model.

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 3.

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 $C(z_s) = 1$. It follows that country c 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 (potentially) 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-Douglas production function (expressed in logs):

$$\ln q_c^{nt} = \frac{1}{z_c} \int_{z \in I_c(z_s)} \ln \left(z_c q_c(z) \right) dz, \tag{4}$$

where $z_c = z_s$ for $c = s$, and $z_c = 1 - z_s$ for $c = n$. The log unit cost associated with (4) is

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

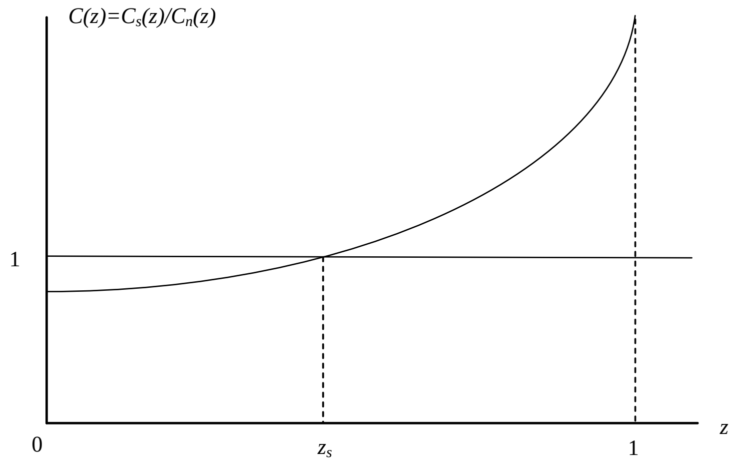


Figure 3: Borderline Commodity and Trade Pattern

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

$$Z_c = \frac{1}{z_c}\int_{z\in I_c(z_s)} zdz = \begin{cases} \frac{1}{2}z_s, & c=s \\ \\ \frac{1}{2}\left(1+z_s\right), & c=n \end{cases}. \tag{5}$$

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 (5), market clearing conditions for factors H_c and L_c can be written in value terms as follows:

$$\begin{aligned} w_{H,c}H_c &= mE_w\int_{z\in I_c(z_s)} zdz + (1-m)E_cZ_c = A_cZ_c, \\ w_{L,c}L_c &= mE_w\int_{z\in I_c(z_s)} (1-z)dz + (1-m)E_c\left(1-Z_c\right) = A_c\left(1-Z_c\right), \end{aligned} \tag{6}$$

where $A_c = mE_w z_c + (1-m)E_c$. 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 (5) 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.

Trade Imbalances 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:

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

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

$$R_s = \frac{z_s}{1-z_s} R_n - \frac{1-m}{m}\frac{T}{1-z_s}, \tag{8}$$

where, using (7), income equals

$$R_c = w_{L,c} L_c \left(s_c h_c + 1\right) = \begin{cases} \frac{2w_{L,s}L_s}{2-z_s}, & c = s \\ \\ \frac{2w_{L,n}L_n}{1-z_s}, & c = n \end{cases}. \tag{9}$$

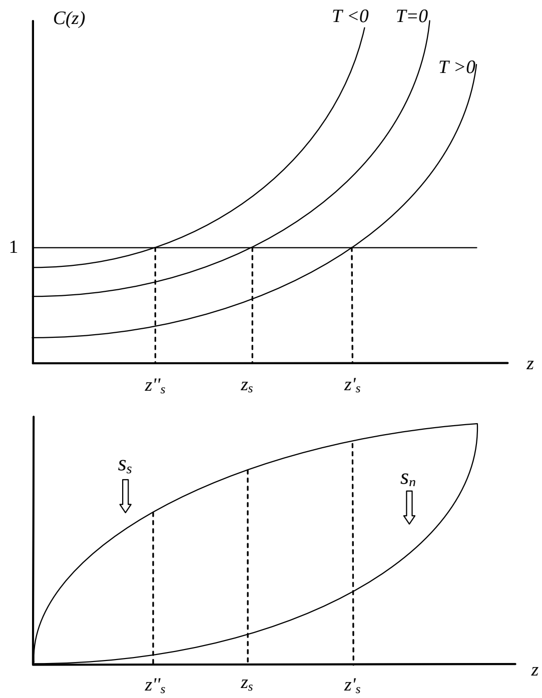


Figure 4: Trade Imbalances, Export Structure and Skill Premia

Substituting (9) into (8), and setting $w_{L,n} = 1$ by choice of numeraire, finally yields:

$$\omega = \frac{z_s\,(2 - z_s)}{(1 - z_s)^2\,L} - \frac{2 - z_s}{2\,(1 - z_s)}\,\frac{1 - m}{m}\,\frac{T}{L_s}, \tag{10}$$

where $L = L_s/L_n$.

General Equilibrium The general equilibrium is fully characterized by the borderline commodity z_s, whose equilibrium value is determined by the condition $C(z_s) = 1$. To obtain z_s, denote now by z a hypothetical value of z_s; using (7) and (10) to eliminate s and ω from $C(z)$, and simplifying, yields:

$$C(z) = \frac{a}{h^z}\left[\frac{F(z)}{L} - \frac{1 - m}{m}\,\frac{T}{L_s}G(z)\right], \tag{11}$$

where

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

Note that $F(z)$ and h^{-z} are monotonically increasing in z, whereas $G(z)$ is monotonically decreasing. It follows that $C(z)$ is monotonically increasing, and thus the equilibrium is unique.[5]

The Skill Bias of Trade Imbalances Equation (11) allows us to immediately prove our main result. A transfer from the South to the North ($T > 0$) shifts the curve $C(z)$ 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 reduction in the skill premia. Figure 4 illustrates. The model therefore suggests that the size and direction of trade imbalances crucially affect 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 key implication will be tested in the next section.

Equation (11) also 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 $C(z)$, thereby leading to a higher equilibrium value of z_s. Thus, an increase in Southern relative economic size brings about an increase in z_s, 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

We start by showing that changes in the structure of countries' exports explain a potentially large portion of the recent increase in the skill premia both in the US and across countries (Section 3.1). Then, we propose a test of the key mechanism underlying the skill bias of trade imbalances according to our theory (Section 3.2).

[5] It is also possible to show that s has an inverted u-shaped relationship with L/a, and is monotonically decreasing in h. It follows that an equilibrium with FPD ($s > 1$) is more likely when the two regions are very different in terms of skill ratios but not too different in terms of size (as proxied by low skill workers in effective units).

3.1 Changes in Skill Premia 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. Thus, to have a sense of how well our model accounts for the recent increase in the US skill premium, we have estimated the log of (7) using 29 yearly observations for the US manufacturing sector between 1977 and 2005:

$$\ln s_t = \underset{(0.2)}{-0.1} \underset{(0.1)}{-0.4} \times \ln h_t + \underset{(0.1)}{0.4} \times \ln\left(\frac{Z_t}{1-Z_t}\right) + \underset{(0.0)}{0.1} \times D_{86\text{-}00} + \underset{(0.0)}{0.1} \times D_{01\text{-}05}, \quad R^2 = 0.8, \quad (12)$$

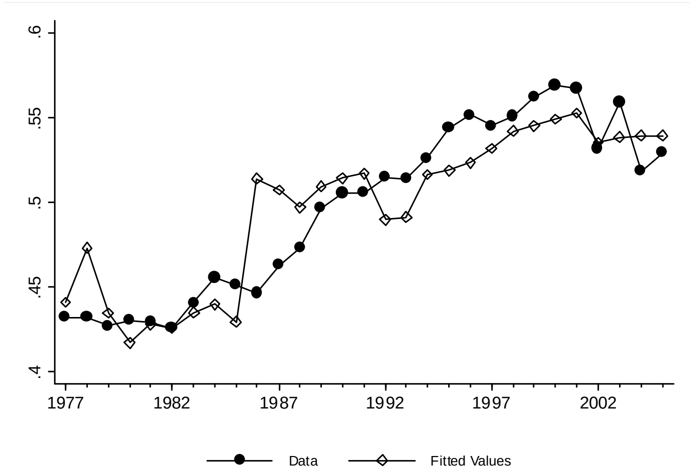
where t indexes time; s_t and h_t are proxied, respectively, by the relative wage and employment of non-production workers, sourced from the *NBER Productivity Database*; Z_t is a proxy for the average skill intensity of US manufacturing exports, detailed in the next section; $D_{86\text{-}00}$ and $D_{01\text{-}05}$ 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), $\ln h_t$ and $\ln(Z_t/1-Z_t)$ should enter (12) with coefficients equal to -1 and 1, respectively, whereas the estimated coefficients are equal to -0.4 and 0.4. Interestingly, however, the coefficients on the two variables are precisely estimated, and are equal in magnitude and opposite in sign. To have a sense of the model's fit, Figure 5 plots the actual values (full circles) and the fitted values (hollow circles) of $\ln s_t$. Note that the model tracks reasonably closely the US 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 US skill premium (0.1) between 1977 and 2005 (i.e., $0.4 \times \frac{0.17}{0.1} = 0.68$).

Next, to broaden the picture, we estimate (7) on a panel of countries. As is well known, data on skill premia are hardly available and comparable both across countries and over time. We can however rely on the *World Input-Output Database* (WIOD), the richest source of cross-country and time-series wage data disaggregated by skill. After combining the WIOD with our proxy for the average skill intensity of exports, we are left with 33 countries observed over the period 1995-07. Estimating (7) on these data yields the following results:

$$\ln s_{c,t} = \underset{(0.29)}{-0.94} \times \ln h_{c,t} + \underset{(0.16)}{0.47} \times \ln\left(\frac{Z_{c,t}}{1-Z_{c,t}}\right), \quad R^2 = 0.32,$$

where c indexes countries; $s_{c,t}$ is proxied by the relative wage of workers with upper secondary or tertiary education; and $h_{c,t}$ is proxied by the average number of years of



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*. Hollow circles denote the series of fitted values from a regression of the log skill premium on: a constant; log $Z_t/(1-Z_t)$, 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 periods 1986-00 and 2001-05, respectively.

Figure 5: Actual and Predicted Skill Premia in US Manufacturing

schooling in the workforce (sourced from Barro and Lee, 2013). The specification also controls for country and year fixed effects, and observations are weighted by initial country size. Note that the positive association between $Z_{c,t}$ and $s_{c,t}$ is strongly confirmed also in these data.

These preliminary exercises suggest that, as implied by our model, changes in the average skill intensity of exports are associated with potentially large changes in skill premia. Moving from these encouraging results, in the next section we provide a more rigorous test of our theory using data for virtually all countries in the world over the last 30 years.

3.2 Testing the Impact of Trade Imbalances on Export Structure

3.2.1 From Theory to Empirics

We now address the most challenging issues involved in linking our theory to empirics. First, note that in our model trade imbalances affect the skill premium through the borderline commodity z_s, which is unobserved.[6] Importantly, however, by (7) the average

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

skill intensity of exports Z_c only depends on z_s, and is monotonically increasing in both regions:

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

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

Another issue arises from the fact that we will test the implications of a two-country comparative advantage model using multi-country data. This approach, which is consistent with a recent literature (e.g., Romalis, 2004; Levchenko, 2007; Nunn, 2007), will allow us to address the standard degrees-of-freedom problem that would occur if we tested our model using data for a single country pair. In this respect, note that the model can be properly interpreted as describing the effects of trade between a given country c and the rest of the world, although at the cost of ignoring that the rest of the world (similarly to most large countries) is an aggregate of heterogeneous regions. In any case, in the Appendix we show that the key prediction of the two-country model holds also in a multi-country framework. Specifically, we show that a trade surplus increases or reduces the average skill intensity of exports depending on whether a country is skill poor or skill rich relative to the rest of the world. Consistently, in our empirical test we use multi-country data on exports to the rest of the world.[7]

Thus, our baseline test consists in a regression of the following form:

$$\Delta Z_{c,t} = \alpha_1 \Delta T_{c,t} + \alpha_2 (\Delta T_{c,t} \times h_c) + \alpha_3 h_c + \varepsilon_{c,t}, \tag{13}$$

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; h_c is country c's skill ratio; and $\varepsilon_{c,t}$ is a random disturbance.[8]

Our coefficients of interest are α_1 and α_2. The coefficient α_1 captures the impact on

[7] Alternatively, the model could be interpreted as describing the effects of bilateral trade between two individual countries. This interpretation is potentially appealing when bilateral trade among the main trading partners accounts for an overwhelming share of total trade, so that the effects of trade with third countries can be ignored. This is not the case, however, in our data. In particular, we have sourced from Feenstra et al. (2005) and *UN Comtrade* bilateral trade data over 1977-07, covering the 50 high-income countries and the 50 low-income countries with the highest share in world merchandise exports in 2007. For each country c, we have computed the yearly shares of every other country l in its total imports and exports, denoted by $\pi_{cl,t}$ and $\pi_{lc,t}$, respectively. Then, we have taken the product of $\pi_{cl,t}$ and $\pi_{lc,t}$, and averaged the result over time: $\bar{\pi}_{cl} = (1/31) \cdot \sum_{t=1977}^{2007} (\pi_{cl,t} \cdot \pi_{lc,t})$. The 95th percentile of the distribution of $\bar{\pi}_{cl}$ equals only 1%.

[8] In estimating (13) we will always correct the standard errors for two-way clustering by country and continent-year (Cameron, Gelbach and Miller, 2011). This will allow us to accommodate autocorrelated shocks in each country as well as correlated shocks across countries in the same continent.

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 (which also allows us to better compare their regression coefficients), $h_c = 0$ corresponds to the average skill ratio for the world economy. The model therefore predicts that $\alpha_1 = 0$. Moreover, it predicts that $\alpha_2 < 0$, namely, that an increase in the trade surplus leads to a rise in the skill intensity of exports Z_c in a skill-poor country ($h_c < 0$), and to a reduction in Z_c in a skill-rich country ($h_c > 0$).

A causal interpretation of the coefficients in (13) would require trade imbalances, as well as country endowments and industry characteristics, to be exogenous to the trade pattern. Given that our model (and virtually any other trade model) is silent on the determinants of these variables, we cannot fully address this issue. Nonetheless, we can implicitly suggest causality by carefully showing that the main correlations are strong and robust enough not to be coincidental. Specifically, we will run a battery of robustness checks to ensure that our results are not obviously driven by either omitted variables inducing simultaneity bias or unobserved shocks inducing reverse causality.

Finally, note that (13) focuses our test on the model's predictions concerning the export side of countries' trade. Yet the model yields clear-cut predictions also about the import side. Specifically, it predicts that an increase in Z_c should also be associated with an increase in the average skill intensity of imports. However, if the average country is small relative to the world economy, as is the case in our data, then the range of exported goods is small relative to the range of imported goods, and the latter is largely unaffected by a change in the borderline commodity. Consequently, it is harder to identify our mechanism using import data.[9]

3.2.2 Data and Variables

We estimate (13) using a large panel of countries observed yearly between 1977 and 2007. To work with a consistent sample over time, we aggregate countries that have separated during the period of analysis (e.g., Yugoslavia and the Soviet Union).[10] As a result, we have data for 109 countries accounting for 98% of world merchandise exports in 2007.[11]

[9] For instance, the South exports goods in the range $[0, z_s)$ and imports goods in the range $(z_s, 1]$. It follows that the z_s-elasticity of the mass of exported and imported goods equals 1 and $-z_s/(1 - z_s)$, respectively. Note that the latter tends to zero for z_s small. In unreported experiments we have also estimated (13) using the average skill intensity of imports as the dependent variable. Consistently, we found qualitatively similar results, but with smaller coefficients on the interaction term and larger standard errors.

[10] To ensure consistency across data sources, we also aggregate countries in a few other instances (see the next footnote for details).

[11] The countries included in our sample are Albania, Algeria, Argentina, Australia, Austria, Bahrain, Bangladesh, Barbados, Belgium and Luxemburg, Belize, Benin, Bolivia, Brazil, Bulgaria, Burundi, Cam-

For each country, we first retrieve trade data at the 4-digit level of the SITC Rev.2 classification, from Feenstra et al. (2005) for the period 1977-00 and from *UN Comtrade* for more recent years. Then, we convert these data into the 6-digit NAICS classification using a converter provided by Feenstra, Romalis and Schott (2002). Overall, we have information for 380 6-digit NAICS industries spanning the entire manufacturing sector of each economy.

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

$$Z_{c,t} = \sum_{i=1}^{380} z(i) x_{c,t}(i), \tag{14}$$

where $x_{c,t}(i)$ is industry i's share of country c's total manufacturing exports in year t.[12] Thus, an increase in $Z_{c,t}$ captures a reallocation of country c's exports towards more skill-intensive industries. In order for (14) to be a valid measure, the ranking of skill intensities must be the same across countries and constant over time. In our model, these are implications of the standard assumption of a common technology featuring no factor intensity reversals. Yet skill intensities, and their ranking, may vary over time also due to technical change, an issue that we carefully address in the next section.[13]

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

[12] Note that in our model, which does not allow a role for intra-industry trade, the export share of each industry is either 0 or 1, whereas in the data $x_{c,t}(i)$ generally takes intermediate values. However, as mentioned earlier, aggregation bias prevents us from interpreting each industry i as a sufficiently close proxy for industry z in the model. Moreover, we are not interested in making inference on any single $x_{c,t}(i)$ *per se*, but in retrieving a closest proxy for the average skill intensity of exports Z_c, as the latter is monotonically related to the (unobserved) z_s.

[13] See also Sampson (2011) on this point.

Note also that, given that the terms $z(i)$ are kept constant in (14), variation in $Z_{c,t}$ is unaffected by a generalized increase in the skill intensities. This implies that $Z_{c,t}$ is not spuriously driven, e.g., by skill upgrading due to skill-biased technical change, as it only captures changes due to between-industry reallocations of exports. Moreover, this also implies that our measure is similarly unaffected by trade-induced within-industry reallocations, and may thus provide a lower bound for the overall impact of trade and imbalances on the structure of countries' exports.[14]

As for our main regressors, we define the normalized trade surplus $T_{c,t}$ as the difference between total manufacturing exports and imports as a share of GDP. We construct it using trade data from Feenstra et al. (2005) and *UN Comtrade*, and GDP data from the *World Development Indicators*. Finally, we obtain the interaction term $\Delta T_{c,t} \times h_c$ by proxying for h_c using the Barro and Lee (2013) data on average years of schooling in the workforce in 1995.[15] Note that valid inference on the interaction term requires the ranking of countries' skill ratios relative to the world economy to be stable over time, a problem we address in our robustness checks.

3.2.3 Baseline Results

Our first set of results is reported in Table 1. In column (1), we estimate (13) without controls. Note that the coefficient on $\Delta T_{c,t}$ is essentially zero, whereas the coefficient on $\Delta T_{c,t} \times h_c$ is negative, large 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 across countries. In column (3), we further add country fixed effects which, given our specification 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_s (and thus Z_c) are increasing in the relative skill ratio h. In column (4), we therefore add the change in the skill ratio $\Delta h_{c,t}$.[16] As expected, the

[14] In a companion paper, Crinò and Epifani (2013), we show that a straightforward extension of our model can also explain reallocations within industries (i.e., skill upgrading/downgrading). Consistently, using a panel of US industries we find that larger trade deficits are associated with strong skill upgrading.

[15] Table A1 reports descriptive statistics on the main variables used in our empirical analysis.

[16] 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 the intermediate years within each interval. Moreover, we impute the value for 1977 with that for 1975.

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 relative 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 $\Delta LP_{c,t} \times h_c$.[17] 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.[18] 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.

3.2.4 Robustness Checks

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

Skill Intensities and Skill Ratios So far, we have closely followed our model in using constant skill intensities to construct $Z_{c,t}$ and constant skill ratios to construct h_c. An important concern is that this assumption may be too restrictive, as our analysis spans a long time period during which some countries have drastically changed their skill ratios and some industries their skill intensities. In this section, we therefore discuss the implications of this assumption for our empirical results.

To this purpose, in a first exercise we exclude industries and countries that have experienced extreme changes in their skill intensities and skill ratios over the sample period. In particular, in columns (1)-(4) of Table 2 we drop industries for which the change in the ranking of skill intensities between 1977 and 2005 falls in the top and bottom q percent of the distribution (with $q = 1, 5, 10, 15$ as indicated in the heading of each column). We then order the remaining industries based on the employment share of non-production workers in 1997, and use the new rankings to reconstruct $Z_{c,t}$. Reassuringly, our main results are largely unaffected, and the coefficient on $\Delta T_{c,t} \times h_c$ is only marginally reduced compared to the baseline estimates. In columns (5)-(8), we instead estimate (13) after excluding countries for which the change in the ranking of skill ratios between 1977 and 2005 falls in the same four percentiles of the distribution. Our results are essentially unchanged, and

[17] To proxy for labor productivity, we use manufacturing value added per worker. Value added data are drawn from the national accounts database of the *United Nations Statistics Division*, and labor force data from the *World Development Indicators*.

[18] Population data are drawn from the *Penn World Tables*.

the coefficient on $\Delta T_{c,t} \times h_c$ is now even larger. Finally, in columns (9)-(12) we combine the two approaches by estimating (13) using the same dependent variables as in columns (1)-(4) and the same samples of countries as in columns (5)-(8). Our coefficients of interest are similar to the baseline estimates reported in Table 1.

In a second exercise, we gradually exclude early years in the sample, thus using data closer to our reference periods (1995 and 1997). In particular, in columns (13)-(15) we exclude data for the periods 1977-84, 1977-89 and 1977-94, respectively. Note that, if anything, the main results are now stronger.

Alternative Samples and Specifications In columns (1)-(3) of Table 3, we check the robustness of our results with respect to sample size. Specifically, in column (1) we exclude all countries with a population of less than 5 million inhabitants 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.

Skill ratios are likely to be correlated with other country characteristics that are not directly relevant to our theory. To address this concern, in columns (4)-(11), we interact $\Delta T_{c,t}$ with the capital stock per worker k_c, per capita GDP y_c, and two different proxies for institutional quality IQ_c, namely, countries' ratings in terms of civil liberties and political rights.[19] We include the new interaction terms either *in place* of $\Delta T_{c,t} \times h_c$ (even-numbered columns) or *together* with it (odd-numbered columns). In the former case, the new interactions have negative and significant coefficients, consistent with k_c, y_c and IQ_c being correlated with h_c. In the latter case, however, the coefficients on the new interactions drop to zero, whereas the coefficients on $\Delta T_{c,t} \times h_c$ are always precisely estimated and close in size to our baseline estimates. To interpret this pattern, we may think of h_c, k_c, y_c and IQ_c as consisting of a common component plus a variable-specific component. In this respect, the above results suggest that the variable-specific component of h_c does have explanatory power in predicting $Z_{c,t}$, whereas those of k_c, y_c and IQ_c do

[19] All these variables are measured in the year 1995. Data on per capita GDP are drawn from the *World Development Indicators*. Data on institutional quality are sourced from the *Freedom House*; the original indexes range from 1 to 7, with lower values denoting better institutions: we use the reciprocals of the indexes in all the regressions. Finally, to compute the capital stock per worker, we apply the perpetual inventory method to investment data drawn from the *Penn World Tables*. Specifically, 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 investments over time, thereby obtaining the capital stock in year t as $K_{c,t} = (1 - d) * K_{c,t-1} + I_{c,t}$. The correlation of h_c with k_c, y_c and IQ_c is roughly 0.6.

not.[20]

Endogeneity We now deal more systematically with potential sources of endogeneity due to simultaneity bias and reverse causality. The former may arise if our variables are jointly driven by factors omitted from the baseline specifications. An important concern in this respect is that the coevolution of trade imbalances and export structures may reflect underlying trends that are not fully accounted for by using variables in first differences. We tackle this issue in Table 4. 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 initial 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 may instead arise if countries change their export structure due to some unobserved shocks, and this in turn leads to the emergence of trade imbalances. Such shocks would not be controlled for by either the time dummies or the country-specific time trends. Instead, they would be controlled for by a full set of country-year dummies, but this is clearly unfeasible as the latter 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 5. The heading of each column indicates the variable we use to construct the bins for that specification. In column (12), we use instead a complementary approach by including a full set of continent-year dummies. Strikingly, our results are robust across all of these very demanding specifications.

[20] See also the discussion in Alfaro, Kalemli-Ozcan and Volosovych (2008) on this point.

3.2.5 Competing Explanations

According to the conventional wisdom, trade liberalization, offshoring and technical change are the main drivers of the recent worldwide increase in wage inequality. In Table 6, we therefore compare our theory with these and other alternative explanations.

Trade Liberalization We start, in column (1), by adding the change in the openness ratio, $\Delta OPEN_{c,t}$, and its interaction with the skill ratio, $\Delta OPEN_{c,t} \times h_c$.[21] 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 indeed positive and statistically significant at the 5% level, whereas the coefficient on the linear term is imprecisely estimated. Moreover, controlling for trade openness does not change the size and statistical significance of the coefficients on our main variables. These results, which are broadly supportive of both our theory and the Heckscher-Ohlin theory, 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.

Offshoring Next, we study how our theory fares when compared with foreign direct investment (FDI) and imported intermediate inputs, the two main channels through which offshoring may affect the structure of countries' exports according to the empirical trade literature.[22] Thus, in column (2) we add the change in FDI, $\Delta FDI_{c,t}$, and its interaction with h_c, $\Delta FDI_{c,t} \times h_c$.[23] In column (3), we add instead the change in intermediate goods imports as a share of GDP, $\Delta II_{c,t}$, and its interaction with h_c, $\Delta II_{c,t} \times h_c$.[24] 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

[21] 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 GDP data from the *World Development Indicators*.

[22] Controlling for imported inputs may also help us address a potential measurement issue arising from the fact that trade data are defined in terms of sales rather than value added, and may therefore be inflated by offshoring. See Johnson and Noguera (2012) on this point.

[23] We proxy for FDI using the stock of inward foreign investment over GDP (sourced from *Unctad*).

[24] Following a standard practice in the empirical literature, we measure imported inputs as imports of products classified in Section 5 ("Chemicals and Related Products, NES"), Section 6 ("Manufactured Goods Classified Chiefly by Material") and Section 7 ("Machinery and Transport Equipment") of the SITC Rev.2 classification.

for reallocations across industries.[25]

Technical Change So far, following our model, we have controlled for technological progress by including the change in productivity $\Delta LP_{c,t}$ 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 Chun Zhu and Trefler (2005), that Southern catching-up is skill biased. The coefficient on $\Delta LP_{c,t}$ was instead generally small and imprecisely estimated, suggesting the neutrality of productivity growth for the average country. Note, however, that the term $\Delta LP_{c,t}$ does not capture the potential sector bias of technology. To address this issue, in column (4) we control for a new variable, $\Delta SBTC_{c,t}$, constructed similarly to our dependent variable, except that in (14) 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 export shares towards more skill-intensive industries may also have experienced faster productivity growth in those industries. Note that the coefficient on $\Delta SBTC_{c,t}$ is positive, large and precisely estimated. We also control for the interaction term $\Delta SBTC_{c,t} \times h_c$, whose coefficient is instead insignificantly different from zero, suggesting that the impact of sector-biased technical change on between-industry reallocations may be independent of countries' skill endowments. More importantly for our purposes, the coefficients on the terms involving trade imbalances are little affected.

Shocks to Expenditure on Nontraded Goods Recall that in our model T affects relative factor prices, and thus z_s, through the expenditure on nontraded goods, $(1-m)E_c$. It follows that any other shock affecting the latter may potentially yield similar results. For instance, if m is country specific, then, like a Southern trade surplus, a reduction in the expenditure share of nontraded goods in the South (i.e., an increase in m_s) may reduce the Southern relative wage, thus shifting the curve $C(z)$ downwards and leading to an increase in z_s. Conversely, like a Northern trade surplus, an increase in m_n may reduce z_s. Similar (and opposite) results may also be brought about by a resource discovery (or some other boom originating outside the manufacturing sector), as the latter could also be modeled as a transfer from abroad (see, e.g., Krugman, 1987).

To address these concerns, we now control for alternative sources of variation in the domestic expenditure on nontraded goods and compare their explanatory power with that of trade imbalances. First, in column (5) we control for variation in the expenditure share

[25] This result is not, however, necessarily inconsistent with Feenstra and Hanson's (1996) original insight, as the latter concerned the impact of offshoring on within-industry reallocations.

of nontraded goods, $\Delta NT_{c,t}$, and its interaction with the skill ratio, $\Delta NT_{c,t} \times h_c$. The variable $NT_{c,t}$ is defined as value added in nontraded sectors over apparent consumption.[26] In column (6), we control instead for variation in the lagged government consumption share of GDP, $\Delta GVT_{c,t}$, and its interaction with h_c.[27] As shown, e.g., by Epifani and Gancia (2009), the import content of government consumption is close to zero, and thus $\Delta GVT_{c,t}$ may act as an alternative source of variation in the expenditure on nontraded goods. Finally, to control for a natural resource shock, in column (7) we include $\Delta OIL_{c,t}$ and its interaction with h_c. The variable $\Delta OIL_{c,t}$ is obtained by multiplying the yearly percentage change in oil prices by the average net fuel exports as a share of GDP over 1970-76, i.e., the decade prior to the beginning of our sample.[28] Note that the coefficients on the new interaction terms are expected to be positive, yet they are all small and imprecisely estimated. More importantly, their inclusion tends to strengthen our main results, as the coefficient on $\Delta T_{c,t} \times h_c$ is consistently larger than the baseline estimate across the three specifications.

Wrap-Up Finally, in column (8) we include all the variables discussed in this section in the same specification, and find that our main results are even stronger. Using the latter set of estimates, we can compare the size of the effect of trade imbalances with that of alternative explanations directly related to trade and technical change. In particular our results imply that, in a country like the Netherlands that falls in the 9th decile of the distribution of skill ratios, 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 -15%, 13%, -2% and 14% of a standard deviation, respectively. Conversely, in a country like Malawi that falls in the 1st decile of the distribution of h_c, $\Delta Z_{c,t}$ would change by 23%, -8%, 14% and 43% of a standard deviation. Thus, the impact of trade imbalances is reasonably large even when compared with that of the main drivers of wage inequality according to the received literature.

[26] Non-traded sectors are: construction; wholesale, retail trade, restaurants and hotels; transport, storage and communication; other activities. Value added data for these sectors come from the national accounts database of the *United Nations Statistics Division*. Apparent consumption is defined as GDP plus imports minus exports, and is constructed using GDP data from the *World Development Indicators* and trade data from *UN Comtrade*.

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

[28] We source data on fuel trade from the *World Development Indicators* and data on oil prices from *FRED* (Federal Reserve Bank of St. Louis).

4 Conclusion

We have studied the impact of globalization *cum* trade imbalances on export structure and 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 increase (decrease) the average skill intensity of exports and are thus skill (unskill) biased. Contrary to the conventional wisdom, our theory suggests that trade liberalization and rising skill premia worldwide 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.

A Trade Imbalances in a Multi-Country World

In this Appendix we show how our key insight extends to a multi-country world. To this purpose, it suffices to consider an extension of the baseline model featuring three countries (denoted by $c = 1, 2, 3$), in which $h_1 < h_2 < h_3$ and $s_1 > s_2 > s_3$ in a free-trade equilibrium with FPD.[29] Assuming for simplicity that $a_c = 1$ for all c, the unit cost of good z in country 1 relative to country 2 is given by

$$C_{12}(z) = \frac{C_1(z)}{C_2(z)} = \frac{w_{L,1}}{w_{L,2}} \left(\frac{s_1}{s_2}\right)^z .$$

Similarly, the unit cost of good z in country 2 relative to country 3 equals

$$C_{23}(z) = \frac{C_2(z)}{C_3(z)} = \frac{w_{L,2}}{w_{L,3}} \left(\frac{s_2}{s_3}\right)^z .$$

Note first that $s_1/s_2 > 1$ and $s_2/s_3 > 1$ imply that $C_{12}(z)$ and $C_{23}(z)$ are upward sloping for given factor prices, as illustrated in Figure 6. Second, the trade pattern is now pinned down by two borderline commodities, z_1 and z_2, defined, respectively, by the conditions $C_{12}(z_1) = 1$ and $C_{23}(z_2) = 1$. Thus, country c exports goods in the range

$$I_c(z_1, z_2) = \begin{cases} [0, z_1), & c = 1 \\ (z_1, z_2), & c = 2 \\ (z_2, 1], & c = 3 \end{cases} .$$

The average skill intensity Z_c of country c's exports is therefore given by

[29] See Collins (1985) and Appleyard, Conway and Field Jr. (1989) for related analyses of international trade in a three-country Ricardian model with a continuum of goods.

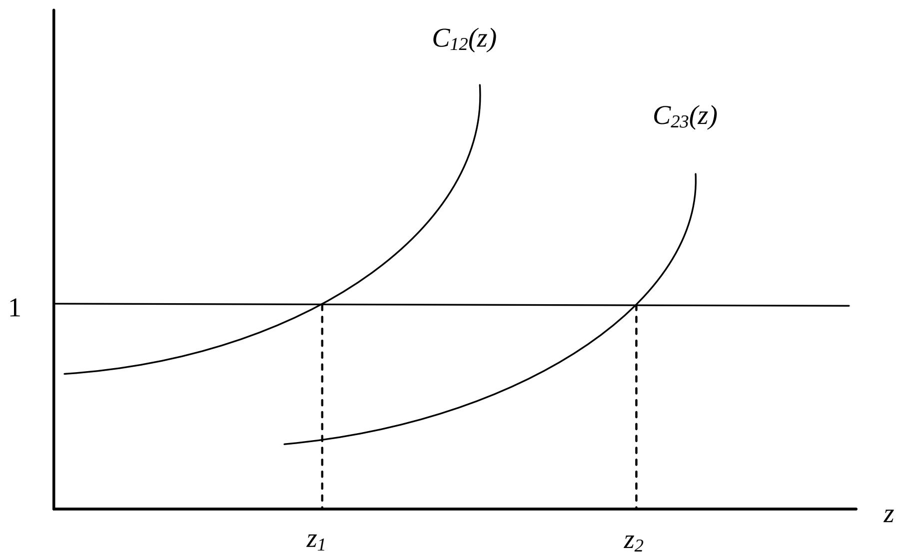


Figure 6: Borderline Commodities and Trade Pattern

$$Z_c = \frac{1}{z_c} \int_{z \in I_c(z_1, z_2)} z dz = \begin{cases} \frac{1}{2} z_1, & c = 1 \\ \frac{1}{2} (z_1 + z_2), & c = 2 \\ \frac{1}{2} (1 + z_2), & c = 3 \end{cases}, \text{ where } z_c = \begin{cases} z_1, & c = 1 \\ z_2 - z_1, & c = 2 \\ 1 - z_2, & c = 3 \end{cases}. \tag{15}$$

Market clearing conditions for factors H_c and L_c are still given by (6). Taking their ratio and solving for the skill premium using (15) yields:

$$s_c = \frac{1}{h_c} \frac{Z_c}{1 - Z_c} = \begin{cases} \frac{1}{h_1} \frac{z_1}{2 - z_1}, & c = 1 \\ \frac{1}{h_2} \frac{z_1 + z_2}{2 - z_1 - z_2}, & c = 2 \\ \frac{1}{h_3} \frac{1 + z_2}{1 - z_2}, & c = 3 \end{cases}. \tag{16}$$

Finally, using (16), income equals

$$R_c = w_{L,c} L_c (s_c h_c + 1) = \frac{w_{L,c} L_c}{1 - Z_c} = \begin{cases} \frac{2 w_{L,1} L_1}{2 - z_1}, & c = 1 \\ \frac{2 w_{L,2} L_2}{2 - z_1 - z_2}, & c = 2 \\ \frac{2 w_{L,3} L_3}{1 - z_2}, & c = 3 \end{cases}. \tag{17}$$

Consider now trade imbalances. We denote by T country 2's total transfer to its trading partners, and treat it as exogenous. Thus, $T = T_{21} + T_{23}$, where T_{21} and T_{23} denote the endogenous bilateral transfers to countries 1 and 3, respectively. Finally, we assume balanced trade between countries 1 and 3, implying that the bilateral transfer T_{13} from country 1 to country 3 is set equal to zero.[30] Under these assumptions, expenditure in the three countries equals

$$E_1 = R_1 + T_{21}, \quad E_2 = R_2 - T, \quad E_3 = R_3 + T_{23},$$

and bilateral trade imbalances are given by:

$$T_{21} = \int_{z_1}^{z_2} E_1 dz - \int_{0}^{z_1} E_2 dz = m(z_2 - z_1)(R_1 + T_{21}) - mz_1 (R_2 - T), \tag{18}$$

$$T_{23} = \int_{z_1}^{z_2} E_3 dz - \int_{z_2}^{1} E_2 dz = m(z_2 - z_1)(R_3 + T_{23}) - m(1 - z_2)(R_2 - T), \tag{19}$$

$$T_{13} = 0 = \int_{0}^{z_1} E_3 dz - \int_{z_2}^{1} E_1 dz = mz_1 (R_3 + T_{23}) - m(1 - z_2)(R_1 + T_{21}). \tag{20}$$

Solving (20) for $R_1 + T_{21}$ and using it in (18), summing (19) and (20) using $T = T_{21} + T_{23}$, and rearranging terms, yields:

$$R_1 = \frac{z_1}{1 - z_2} R_3, \quad R_2 = \frac{z_2 - z_1}{1 - z_2} R_3 - \frac{(1 - m) T}{m (1 + z_1 - z_2)}, \tag{21}$$

$$T_{21} = \frac{R_1}{R_1 + R_3} T = \frac{z_1}{1 + z_1 - z_2} T, \; T_{23} = \frac{R_3}{R_1 + R_3} T = \frac{1 - z_2}{1 + z_1 - z_2} T. \tag{22}$$

Note, from (22), that the share of bilateral transfers T_{21} and T_{23} in the total transfer T is proportional to the relative size of trading partners. This suggests that, in a multi-country setup, a transfer to the rest of the world may be equivalent to a transfer to a fictitious country representative of the rest of the world in a two-country setup.

Next, using (21) in (17), and choosing L_3 as the numeraire, yields an expression for the wage of low skill workers in the three countries:

$$w_{L,1} = \frac{z_1 (2 - z_1) L_3}{(1 - z_2)^2 L_1}, \quad w_{L,3} = 1, \tag{23}$$

$$w_{L,2} = \frac{(2 - z_1 - z_2)}{L_2} \left(\frac{(z_2 - z_1) L_3}{(1 - z_2)^2} - \frac{(1 - m) T}{2m (1 + z_1 - z_2)} \right). \tag{24}$$

[30] The endogeneity of T_{21} and T_{23} also implies that the total trade imbalance of countries 1 and 3 is endogenous to T as well. However, if there are many countries, the impact of T on the total trade imbalance of the other countries is generally small.

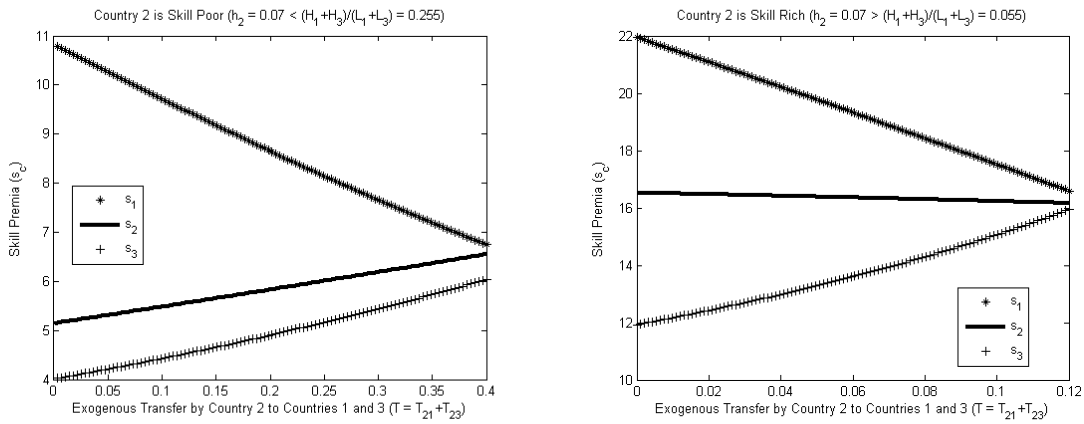


Figure 7: Trade Imbalances and Skill Premia in a Three-Country World

Using (16) and (23)-(24) to eliminate factor prices from the equilibrium conditions $C_{12}(z_1) = 1$ and $C_{23}(z_2) = 1$ yields a two-equation system in z_1 and z_2. Although the system is too involved to allow for a full analytical characterization of the general equilibrium, and we must therefore rely on numerical simulations, some of the model's properties are easily understood. Note first, from (16), that skill premia do not directly depend on T. Similarly, by (23) and (24), $w_{L,1}$ and $w_{L,3}$ do not directly depend on T, whereas $w_{L,2}$ is directly decreasing in T. It follows that a rise in T shifts the curve $C_{12}(z)$ upwards and the curve $C_{23}(z)$ downwards, thereby leading to a reduction in z_1 and an increase in z_2. Note also, from (15) and (16), that Z_1 and s_1 only depend on z_1 and are monotonically increasing, whereas Z_3 and s_3 only depend on z_2 and are monotonically increasing. Thus, a transfer from country 2 to the rest of the world, by reducing z_1 and increasing z_2, reduces the average skill intensity of exports and the skill premium in the skill-poor country while increasing the average skill intensity of exports and the skill premium in the skill-rich country. Hence the baseline model's predictions extend straightforwardly to countries with "extreme" endowments.

Consider now the "intermediate" country 2. Here matters are more involved because, by (15) and (16), Z_2 and s_2 are monotonically increasing in $z_1 + z_2$ and therefore the impact of T is potentially ambiguous. Numerical simulations persistently show, however, that whenever parameter values are such that country 2 is skill poor relative to the rest of the world, Z_2 and s_2 are increasing in T, whereas the opposite is true for parameter values implying that country 2 is skill rich relative to the rest of the world. Figure 7 illustrates two such numerical examples, in which equilibrium skill premia are computed for different values of T in a range consistent with FPD. Parameter values imply that country 2 is (extremely) skill poor relative to the rest of the world in the left-hand graph, and (slightly) skill rich in the right-hand graph.[31] Note that s_2 is strongly increasing in T in the former case, and slightly decreasing in the latter. Moreover, as expected, in both cases s_1 is decreasing and s_3 increasing. These results suggest that, in a frictionless multi-country world, what matters for the general equilibrium impact of a given imbalance T on wage inequality is how a country is endowed relative to the rest of the world, rather than how T is distributed across its heterogeneous trading partners.[32]

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[31] Specifically, we set $L_1 = 1$, $L_2 = 0.5$, $L_3 = 1$, $h_1 = 0.01$, $h_2 = 0.07$, $h_3 = 0.5$ and $m = 0.2$. In the right-hand graph, L_3 is reduced to 0.1.

[32] Instead of treating T as exogenous, we may have fixed the value, e.g., of T_{23} and let T and T_{21} adjust endogenously. In this case, unreported numerical simulations show that, consistent with the results in Figure 7, an exogenous transfer by country 2 to its skill-rich partner ($T_{23} > 0$) reduces s_2 when country 2 is skill rich relative to the rest of the world, and increases s_2 otherwise.

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Table 1 - 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***	-0.103***
	(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						0.026
						(0.017)
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 1977-07. *T* is the manufacturing trade surplus over GDP; *h* is the average number of years of schooling in the workforce; *LP* is labor productivity (manufacturing value added per worker); *L* is 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 - Robustness Checks: Skill Intensities and Skill Ratios

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

	Excl. Industries with Extreme Changes in Skill Intensities				Excl. Countries with Extreme Changes in Skill Ratios				Excl. Industries and Countries with Extreme Changes in Skill Intensities and Skill Ratios				Excl. Early Years		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	1%	5%	10%	15%	1%	5%	10%	15%	1%	5%	10%	15%	No 1977-84	No 1977-89	No 1977-94
$\Delta T_{c,t}$	-0.017	-0.025	-0.011	-0.010	-0.012	-0.018	-0.008	-0.015	-0.018	-0.035	-0.007	-0.007	-0.038	-0.056	-0.074
	(0.053)	(0.054)	(0.059)	(0.052)	(0.051)	(0.054)	(0.046)	(0.050)	(0.055)	(0.059)	(0.057)	(0.053)	(0.054)	(0.058)	(0.068)
$\Delta T_{c,t} * h_c$	-0.095***	-0.086***	-0.078**	-0.089**	-0.105***	-0.111***	-0.103***	-0.114***	-0.098***	-0.094***	-0.078**	-0.095**	-0.110***	-0.112***	-0.128**
	(0.028)	(0.034)	(0.034)	(0.037)	(0.029)	(0.031)	(0.032)	(0.035)	(0.029)	(0.037)	(0.038)	(0.044)	(0.030)	(0.034)	(0.050)
$\Delta h_{c,t}$	0.052**	0.031	0.035	0.032	0.059**	0.053**	0.054**	0.033	0.055**	0.023	0.026	0.002	0.055	0.015	-0.015
	(0.025)	(0.026)	(0.026)	(0.024)	(0.026)	(0.027)	(0.027)	(0.034)	(0.026)	(0.028)	(0.030)	(0.022)	(0.034)	(0.042)	(0.048)
$\Delta LP_{c,t}$	0.022	0.014	0.027	0.025	0.027	0.025	0.036*	0.041*	0.023	0.012	0.037*	0.046*	0.022	0.019	0.027
	(0.018)	(0.016)	(0.016)	(0.017)	(0.019)	(0.020)	(0.021)	(0.023)	(0.019)	(0.017)	(0.021)	(0.024)	(0.022)	(0.030)	(0.042)
$\Delta LP_{c,t} * h_c$	-0.050**	-0.028	-0.024	-0.026	-0.052**	-0.052**	-0.050**	-0.061**	-0.052**	-0.029	-0.018	-0.024	-0.073***	-0.073***	-0.114**
	(0.020)	(0.018)	(0.017)	(0.019)	(0.022)	(0.022)	(0.023)	(0.025)	(0.021)	(0.019)	(0.018)	(0.022)	(0.026)	(0.027)	(0.052)
Observations	3,127	3,127	3,127	3,127	3,083	2,859	2,622	2,214	3,083	2,859	2,622	2,214	2,438	1,917	1,384
R-squared	0.032	0.030	0.030	0.030	0.034	0.038	0.040	0.045	0.033	0.036	0.037	0.039	0.040	0.036	0.042
Year FE	yes	yes	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	yes	yes

Columns (1)-(4) reconstruct the dependent variable after excluding industries for which the change in the ranking of skill intensities between 1977 and 2005 falls in the top and bottom *q* percent of the distribution (with *q* indicated in the columns' headings). Columns (5)-(8) exclude countries for which the change in the ranking of skill ratios between 1977 and 2005 falls in the same four percentiles of the distribution. Columns (9)-(12) combine the two approaches. Columns (13)-(15) exclude data for the periods 1977-84, 1977-89 and 1977-94, respectively. 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 3 - Robustness Checks: Alternative Samples and Specifications

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Excl. Small Countries	Excl. US, China, Japan and Germany	Excl. Oil Exporters	Capital Stock per Worker		Per Capita GDP		Civil Liberties		Political Rights	
$\Delta T_{c,t}$	-0.013	-0.011	-0.010	0.051	0.042	0.056	0.056	-0.029	-0.030	-0.034	-0.029
	(0.059)	(0.050)	(0.052)	(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***		-0.087***		-0.095**		-0.094***		-0.103***
	(0.040)	(0.028)	(0.028)		(0.031)		(0.042)		(0.036)		(0.035)
$\Delta T_{c,t}$ * k_c				-0.057***	0.003						
				(0.022)	(0.034)						
$\Delta T_{c,t}$ * y_c						-0.055***	0.008				
						(0.021)	(0.033)				
$\Delta T_{c,t}$ * 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*	0.048*	0.047*	0.062**	0.061**	0.054**	0.054**	0.055**	0.055**
	(0.029)	(0.026)	(0.028)	(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	0.031	0.028	0.035	0.034	0.020	0.025	0.020	0.026
	(0.021)	(0.019)	(0.022)	(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**	-0.031*	-0.033*	-0.039*	-0.040*	-0.050**	-0.050**	-0.050**	-0.050**
	(0.025)	(0.021)	(0.022)	(0.018)	(0.018)	(0.021)	(0.021)	(0.022)	(0.021)	(0.022)	(0.021)
Observations	2,351	3,007	2,638	3,073	3,073	3,113	3,113	3,072	3,072	3,072	3,072
R-squared	0.046	0.034	0.036	0.029	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
Country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

k_c, y_c and IQ_c denote, respectively, capital stock per worker, per capita GDP and two indexes of institutional quality (civil liberties and political rights), all measured in the year 1995. In column (1), small countries are those with less than 5 million inhabitants in 2007. 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 - Robustness Checks: 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	-0.009	-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 the columns' headings. The resulting variables are included both linearly and interacted with h. Column (11) includes a full set of country-specific linear 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 5 - Robustness Checks: 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
$\Delta T_{c,t}$	0.002	-0.015	-0.019	-0.009	-0.024	-0.008	-0.011	0.006	-0.011	-0.033	-0.021	0.006
	(0.045)	(0.043)	(0.047)	(0.049)	(0.040)	(0.048)	(0.052)	(0.043)	(0.047)	(0.048)	(0.047)	(0.043)
$\Delta T_{c,t} * h_c$	-0.092***	-0.110***	-0.108***	-0.101***	-0.097***	-0.090***	-0.109***	-0.110***	-0.111***	-0.097***	-0.103***	-0.091***
	(0.022)	(0.034)	(0.028)	(0.029)	(0.025)	(0.026)	(0.029)	(0.030)	(0.028)	(0.028)	(0.028)	(0.027)
$\Delta h_{c,t}$	0.062**	0.071***	0.062**	0.053***	0.048*	0.054**	0.059**	0.057**	0.048*	0.060**	0.056**	0.049*
	(0.025)	(0.028)	(0.029)	(0.018)	(0.028)	(0.025)	(0.023)	(0.024)	(0.027)	(0.025)	(0.025)	(0.027)
$\Delta LP_{c,t}$	0.014	0.025	0.031	0.036**	0.022	0.024	0.023	0.014	0.029	0.032**	0.028	0.032
	(0.022)	(0.015)	(0.020)	(0.018)	(0.019)	(0.021)	(0.020)	(0.020)	(0.020)	(0.016)	(0.020)	(0.021)
$\Delta LP_{c,t} * h_c$	-0.048**	-0.053**	-0.032	-0.047**	-0.031	-0.049**	-0.041**	-0.043*	-0.051**	-0.043**	-0.054**	-0.042*
	(0.021)	(0.022)	(0.023)	(0.020)	(0.022)	(0.021)	(0.019)	(0.025)	(0.021)	(0.022)	(0.021)	(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
R-squared	0.125	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
Country FE	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 1977-07) in the characteristics indicated in the 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. 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 - Competing Explanations

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

	(1) Trade Openness	(2) Inward FDI	(3) Imported Inputs	(4) Technical Change	(5) Nontraded Share of Expenditure	(6) Government Consumption	(7) Oil Prices	(8) All Controls
$\Delta T_{c,t}$	-0.004	-0.011	-0.000	-0.024	-0.009	-0.008	0.010	0.003
	(0.048)	(0.049)	(0.051)	(0.039)	(0.049)	(0.053)	(0.061)	(0.051)
$\Delta T_{c,t} * h_c$	-0.093***	-0.100***	-0.106***	-0.080***	-0.121***	-0.113***	-0.119***	-0.143***
	(0.028)	(0.027)	(0.034)	(0.029)	(0.029)	(0.028)	(0.034)	(0.052)
$\Delta OPEN_{c,t}$	0.070							0.043
	(0.068)							(0.054)
$\Delta OPEN_{c,t} * h_c$	0.057**							0.076**
	(0.029)							(0.039)
$\Delta FDI_{c,t}$		0.034						0.061
		(0.060)						(0.095)
$\Delta FDI_{c,t} * h_c$		-0.029						-0.032
		(0.034)						(0.037)
$\Delta II_{c,t}$			0.026					-0.023
			(0.035)					(0.054)
$\Delta II_{c,t} * h_c$			-0.009					-0.103*
			(0.032)					(0.057)
$\Delta SBTC_{c,t}$				0.291***				0.257***
				(0.096)				(0.083)
$\Delta SBTC_{c,t} * h_c$				-0.062				-0.109
				(0.061)				(0.079)
$\Delta NT_{c,t}$					-0.001			0.025
					(0.028)			(0.025)
$\Delta NT_{c,t} * h_c$					0.014			0.027
					(0.016)			(0.020)
$\Delta GVT_{c,t}$						-0.006		-0.020
						(0.022)		(0.024)
$\Delta GVT_{c,t} * h_c$						-0.028		-0.056***
						(0.022)		(0.019)
$\Delta OIL_{c,t}$							0.012	0.073***
							(0.024)	(0.020)
$\Delta OIL_{c,t} * h_c$							-0.018	-0.000
							(0.026)	(0.021)
$\Delta h_{c,t}$	0.060**	0.049*	0.057**	0.028*	0.053**	0.027	0.044	-0.008
	(0.024)	(0.026)	(0.025)	(0.015)	(0.026)	(0.030)	(0.028)	(0.030)
$\Delta LP_{c,t}$	0.037**	0.027	0.028	0.021	0.027	0.024	0.040*	0.046**
	(0.017)	(0.019)	(0.018)	(0.024)	(0.019)	(0.018)	(0.024)	(0.023)
$\Delta LP_{c,t} * h_c$	-0.043**	-0.048**	-0.050**	-0.039	-0.054**	-0.058***	-0.061**	-0.059*
	(0.021)	(0.020)	(0.021)	(0.025)	(0.022)	(0.022)	(0.027)	(0.033)
Observations	3,127	3,127	3,127	3,127	3,070	2,978	2,477	2,354
R-squared	0.039	0.035	0.034	0.136	0.034	0.038	0.039	0.139
Year FE	yes	yes	yes	yes	yes	yes	yes	yes
Country FE	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. *NT* is value added in nontraded sectors over apparent consumption (i.e., GDP + imports - exports). *GVT* is lagged government consumption over GDP. *Δ OIL* is the product of the yearly percentage change in oil prices and the average net fuel exports as a share of GDP over 1970-76. 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 A1 - Descriptive Statistics

	Mean	Std. Dev.	Obs.
Average Skill Intensity of Exports (%)	0.51	0.14	3355
Trade Surplus (% of GDP)	-0.04	0.12	3248
Manufacturing Value Added per Worker (US $)	1689.3	2458.0	3376
Population (Thousands)	45451.0	143114.6	3379
Trade Openness (% of GDP)	0.37	0.27	3248
Inward FDI Stock (% of GDP)	0.22	0.41	3273
Imported Inputs (% of GDP)	0.14	0.10	3251
Average Export Share Weighted by Industries' Ranking in Terms of TFP Growth (%)	0.56	0.11	3355
Nontraded Share of Expenditure (%)	0.57	0.13	3197
Government Consumption (% of GDP)	0.20	0.16	3234
Change in Oil Prices * Average Net Fuel Exports over GDP	0.001	0.037	2520
Average Number of Years of Schooling (1995)	7.0	2.6	109
Capital Stock per Worker (1995, US $)	44073.4	43813.2	107
Per Capita GDP (1995, US $)	8116.9	10842.9	109
Civil Liberties (1995)	0.41	0.29	107
Political Rights (1995)	0.51	0.35	107