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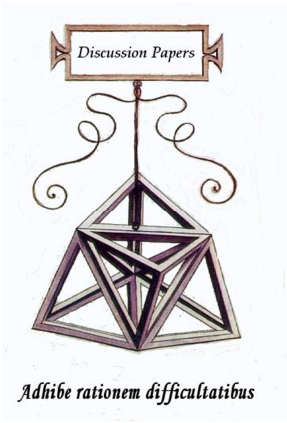

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Is there really no link between international trade and wage differentials? A cross-country analysis

Discussion Paper n. 118

2011

Discussion Paper n. 118, presentato: **Settembre 2011**

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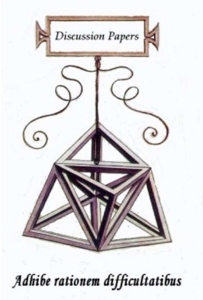

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Abstract

This paper investigates empirically the relationship between international trade (in particular with non-OECD countries) and wage differentials of workers with different skills. We examine years from 1996 and 2005 in several countries and, whereas past studies (conducted on previous years) had not detected any relevant relationship, we find a clean cut positive effect of imports from non-OECD countries on differentials. In addition, we find evidence that technological change is having a polarization effect on wages.

Classificazione JEL: D31, F16, J31.
Keywords: International Trade; Wage Differentials, Skills.

1. Introduction

There is an ongoing debate on whether international commerce, and competition from non-industrial countries in particular, is affecting the within-countries wage distribution and the wage differentials between skilled and unskilled workers. In the last decades international trade increased remarkably (the total imports plus exports of good and service rose from to 27% of world GDP in 1970 to 59% in 2008, according to World Bank data) and less developed, emerging and (ex) transition countries became part of the world trade system.

Standard economics theory predicts that an increase in competition from non-industrialized countries should produce an increase in the wage differentials between skilled and unskilled workers. This conclusion directly descends from the Stolper-Samuelson theorem: the increasing competition from less developed countries produces a downward pressure to the price of low skill intensive goods and this translate in a fall in the price of the factor used in the production process, unskilled labour in this case. Then, the increasing competition from less development countries should increase the wage of unskilled workers and increase wage differentials between skilled and unskilled workers.

While this theoretical result appears quite straightforward, it is not met by a similar conclusiveness in the empirical analyses. Several studies concluded that there is little evidence that international trade is widening wage differentials: among the most influential, Krugman (1995) finds that trade has only a quantitatively minor role in determining wage differentials while Machin and Van Reenen (1998) do not find trade to affect wage gaps. An interesting survey on these aspects is contained in Machin and Van Reenen (2007) where they concludes that there is little support for a trade based explanation for the widening of wage differentials. More recently, two influential studies have appeared further fuelling the discussion on the role of international trade. Lawrence (2008) confirms the previous feeble link between trade and wage inequalities and point to the fact that imports, even those from less developed countries, often involves technological advanced goods. On the contrary, Krugman (2008) partly overturn the previous conclusions: according to him, previous empirical analyses focused on a time span when the north-south trade involved mostly countries like Hong Kong, Singapore, South Korea and Taiwan whereas now it involves mostly Brazil, China, India and Mexico: the latter group of countries displays even lower average wage than the former and thus, international trade produces now an even fiercer competition for low skill intensive sectors.

Our study contributes to this discussion, investigating empirically the relationship between international trade and wage differentials of workers with different degree of skills in several industrial countries. We improve previous analyses in three ways: (i) using more recent data covering a period that spans from 1996-2005, capturing thus the shift in international trade that Krugman (2008) suggested; (ii) breaking

down workers into three categories of skills (low, medium and high) thus capturing different dimensions of skills; and (iii) using a measure of trade that only consider non-fuel imports from non-industrial countries. Our results show that, in the period of analysis, there is a clear positive effect of imports from non-OECD countries on wage differentials.

We have also to mention that other factors affect wage differentials. The most obvious is the relative supply of a given category of labour, which should decrease the relative wage. In addition, technological progress is another important factor and several studies (Katz and Murphy 1992 and Acemoglu 2001 for example) have found that progress is skill biased and increases the differentials between skilled and unskilled wages. A more recent strand of literature, however, argues how the technological change appears to be nuanced. Studies by Autor et al. (2003), Manning (2004), Spitz-Oener (2006) and Dustmann et al. (2009) suggest that progress actually favours non-routine jobs in the high skill sector but also in the low skill sector, whereas it is detrimental to routine jobs in the medium skill sectors. According to this view, technological change produces a polarization in the wage distribution. Finally, labour market institutions have an important role in the determination of wage differentials, though their effect is not always clean-cut: see DiNardo and Lemieux (1997), Koeniger et al. (2007) and Corsini (2011). While we do not focus on these aspects, we include them in our analysis.

The paper proceeds as follows: section 2 discuss the theoretical relationship between trade and differentials, section 3 describes the data and our empirical methodology, section 4 presents the results of our analysis and section 5 concludes.

2. The Relationship between Trade and Differentials

The basic framework to explain the relationships between trade and differentials is based on the Hecksher-Ohlin theory. According to it, traded quantities depend on the relative factor endowments. In a two-good, two-factor model where inputs are skilled and unskilled labour, the less developed countries, whose endowment in unskilled labour is relatively larger, will specialize in the unskilled labour intensive good. In this scheme, a reduction of tariffs and of transportation and communication costs produces an increase of relative demand for skilled-intensive goods from less-developed countries (who lack the production of these goods). In turn, these will have to be paid with larger exports of unskilled labour intensive goods and the increasing competition in the unskilled intensive sector would drive down the relative world price of unskilled intensive products.

The final link between relative prices and wage differentials is explained by the Stolper-Samuelson theorem. In fact, this theorem shows that a reduction in relative prices of outputs reduces the relative returns of the input used relatively intensively in the production. In our case, this implies that an increase in

trade with less developed countries should increase the wage differentials between skilled and unskilled workers in more developed countries.

3. Data Description and Empirical Methodology

Our analysis covers the years from 1996 to 2005 for a group of European countries (Austria, Belgium, Czech Republic, Denmark, Finland, Germany, Hungary, Netherland, Spain and United Kingdom) plus Japan and United States. The choice of the countries is strictly dictated by the availability of data: only for these countries and for these years, it was possible to obtain detailed data on wage differentials and international commerce.[1]

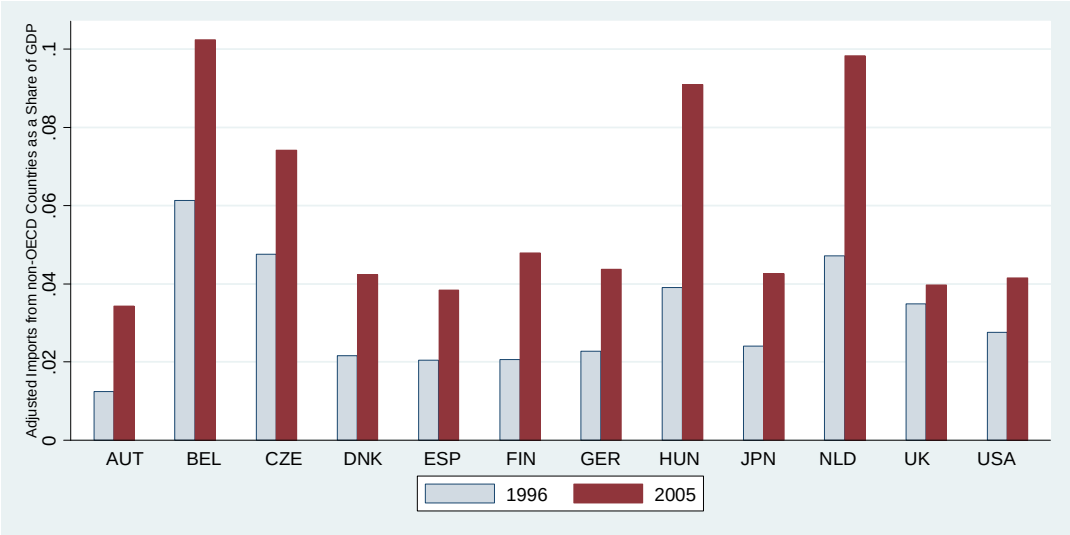
The key dataset we use for information on wages and labour supply is the 2007 release of the EU-KLEMS database. This dataset contains data on average hourly wages and total hours worked, broken down for three categories of workers: low, medium and high skilled. The distinction is made on the base on educational attainment of individuals: low skilled comprises workers up to lower secondary education, medium skilled up to higher secondary education and high skilled those above this latter threshold. This categorization is the same for most of the country with just a few country exceptions: a full description of the categories is contained in Timmer et al. (2007). We use this database to obtain the wage differentials between the different categories of workers (the hourly wage ratio between high and low skilled, the one between high and medium skilled and the one between medium and low skilled) and the relative supply (the ratio of aggregate total hours between the workers of different skills). We only use data for male of age from 30 to 49: this allows us to get rid of compositional issues (in terms of gender and age) that could affect wage differentials. In all, we have three series for wage differentials and three series for relative supplies, each one related to differences between workers of different skill level.

Data on international trade comes from the OECD International Trade by Commodity Statistics. In particular, we build a variable that we believe able to capture the exact dimension of competition from non-industrial country. For each country, we compute the value of all commodities imported from non-OECD countries subtracting then the value of imports in fuels and ores (from non-OECD countries). We normalize then this variable dividing it by the GDP. Basically, we obtain imports from non-OECD countries as a share of GDP net of the imports of inorganic raw materials: we call this variable “adjusted imports”. Given that we are investigating on whether the competition from goods produced in less industrial countries affect wages, we believe this to be the proper variable to be used in our analysis. In Figure 1 we depict the values of this variable during the first and the last year of our analysis. The figure highlights how

[1] The only exception to this is Italy, for which we had data, but whose wage differentials were completely out of scale with respect to the others: suspecting some measuring or reporting error in data source, we preferred to omit this country from the analysis.

these imports increased largely in all countries (though in the UK and USA the increase was milder). However, the size of these imports is rather small compared to overall economy being usually around 4% of GDP and only in a few cases reaching 10%.

Figure 1: Imports from non-OECD countries



In our analysis we also use a variable representing the technological change. The literature we mentioned in the introduction highlights that Research and Development expenditures over GDP should be a good proxy for technological change and therefore we adopt this very variable: data are taken from the EUROSTAT database. Finally we include also a dimension of labour market institutions and we use minimum wage (measured as a share of median wage): data are taken from OECD database.

Given these variables of interests, we want to estimate how wage differentials of workers of different skill level are affected by trade from non-industrial countries, controlling for the relative supply of workers, for the technological progress and for the minimum wage. The equation we wish to estimate is then:

$$WD_{i,t} = C + c_{i,t} + \beta_1 RS_{i,t} + \beta_2 IMP_{i,t} + \beta_3 TECH_{i,t} + \beta_4 MW_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $WD_{i,t}$ are wage differentials (i and t are country and time index, respectively), *C* is the common constant, $c_{i,t}$ is the country-specific constant, *RS* is relative supply, *IMP* represents imports, *TECH* is technology change and *MW* minimum wages. All the variables are measured in logs. In total we have three series of differentials: high over low skilled (HL), high over medium skilled (HM) and medium over low (ML). Accordingly, we have three series of relative supplies.

We estimate equation (1) separately for the three differentials using the fixed effect (FE) approach. This approach is quite common in the analysis of wage differentials and has been adopted in several works on this subject (Machin and Van Reenen 1998, Kroeninger et al 2007, Corsini 2011).

We assume panel-correlated standard errors and the parameters are estimated by Prais-Winstein FE regression. Basically we are assuming that the variance-covariance matrix of the errors is not identical and we allow for heteroskedasticity and panel specific autocorrelation. We prefer to use the Prais-Winstein over feasible general least square (FGLS) because they are much more reliable than FGLS when, as a robustness check, we allow for cross-correlation between errors of different countries (see Back and Katz 1995). In fact several other specifications were tried and our estimation proved to be robust through all of them. In particular, though we do not report the results for reason of space, we also estimated equation 1: (i) using FGLS, (ii) using Prais-Winstein regression but allowing for cross-correlated errors, (iii) using wage differentials of workers of all age and genders but inserting as independent variables some indexes describing the workforce composition. In all cases, the results were qualitatively the same and, in particular, the coefficients of imports remained almost identical.

4. Results

We present in Table 1 the results for the estimation of equation (1) for the three wage differentials. The results clearly show that imports from less development countries have a significant role in the determination of wage differentials and we can infer that the competitions from these countries is pushing downward the wages of workers with lower wage. These results are different from the conclusions of previous analyses on international trade. We believe that our findings are new and different because we are focusing on more recent time-span, where the nature of trade has changed (supporting thus the conclusions of Krugman 2008) and because we are adopting a proper measure for imports, capable of capturing the relevant dimension of the problem.

The other interesting result we find is related to technological change: it has a positive effect on the HL differentials (but its significance is not completely certain, being greater than zero at 89.1%), it has a strong positive effect on HM differentials and a clean-cut, negative, effect on the ML skilled. These results strongly suggest that technological progress is inducing polarization in wages, with medium skilled workers being strongly penalized by it, the low skilled faring relatively better and high skilled probably having the greatest advantage.

The rest of variables do not appear to be significant: the coefficient of relative supply is extremely small and hardly plays a role while minimum mage have the expected sign but a high standard error, probably implying relationships quite different across the different countries.

Finally, we try to assess to which extent trade from non-industrial countries is relevant in explaining the overall wage differentials changes between 1996 and 2005. To do this, we compute the estimated change on wage differentials produced by the observed variation in non-OECD imports and we compare it to the observed change in the wage differentials. Our findings (Table 2) show that the share of increase in differentials due to the imports from non-OECD countries is quite variable across countries and, in most cases, large. In some cases, the share is even greater than 100%, implying that some other factors offset the rise in wage differentials. Only in a few countries the share is not particularly high (though still relevant) and United States is probably the most evident case (being roughly 10%, 22% and 9% for the different categories). However this should be attributed to the relative small increase in the imports, rather than to a weak link between trade and differentials. Given that most of studies on these aspects were on United States we believe that is one of the reasons why the role of trade was underestimated in past analyses: in truth, it is not its effect to be feeble but it is its actual size that, in some countries, is rather small.

5. Concluding Remarks

We find relevant evidence that imports from non-OECD countries affects positively wage differentials between workers with different skills. Comparing this result to previous empirical analyses, we conclude that a major change has occurred in the composition of international trade and that the competition from non-OECD countries have grown fiercer and is strongly affected the low skilled sectors. In this respect, our analysis supports the conclusions of Krugman (2008). However, we also note that imports from non-OECD countries are still quantitatively small. Thus, even if the relationship between trade and differentials is clean-cut, the final effect of the former on the latter is not large. This particularly true for UK and US and it might explain why this relationship has been underestimated in previous analysis. However, given the rise in international trade that we are currently observing, we believe that international trade is going to be one of the driving forces behind wage inequalities.

While not directly related to trade, we also find interesting results on the role of technological change. In fact, we find that progress is pushing toward a polarization of income distribution: it favors high skilled workers and, to a lesser extent, low skilled while it is detrimental to medium skilled occupations.

Table 1: Fixed effect regressions for wage differentials

	(1)	(2)	(3)
	HL Wage Differentials	HM Wage Differentials	ML Wage Differentials
Relative Supply	0.0016	-0.1230	0.0225
	(0.0359)	(0.0937)	(0.0137)
Adjusted Imports	0.0733**	0.0633**	0.0348**
	(0.0231)	(0.0201)	(0.0099)
Technological Change	0.1060	0.1630**	-0.0725**
	(0.0662)	(0.0489)	(0.0210)
Minimum Wage	-0.0721	-0.0302	-0.0155
	(0.1660)	(0.1500)	(0.0315)
Observations	120	120	120
R^2	0.982	0.962	0.961

Country specific constants are not reported. Standard errors in parentheses, significance levels: ** p<0.01, * p<0.05

Table 2: The effect of change in imports on the wage differentials (1996-2005)

		HL Wage Differentials			HM Wage Differentials			ML Wage Differentials		
	Observed change in imports	Observed change in differentials	Estimated change due to imports	**% of change due to imports**	Observed change in differentials	Estimated change due to imports	**% of change due to imports**	Observed change in differentials	Estimated change due to imports	**% of change due to imports**
Austria	0.022	-0.041	0.142	**Neg.**	-0.043	0.095	**Neg.**	0.010	0.046	**4.463**
Belgium	0.041	0.240	0.071	**0.296**	0.115	0.050	**0.433**	0.061	0.022	**0.365**
Czech Republic	0.027	0.249	0.096	**0.386**	0.183	0.062	**0.337**	-0.001	0.021	**Neg.**
Denmark	0.021	0.177	0.086	**0.486**	0.054	0.061	**1.142**	0.076	0.029	**0.374**
Spain	0.018	0.157	0.103	**0.656**	0.138	0.062	**0.453**	-0.023	0.031	**Neg.**
Finland	0.027	0.077	0.103	**1.338**	0.038	0.082	**2.176**	0.024	0.032	**1.359**
Germany	0.021	0.128	0.103	**0.805**	0.173	0.067	**0.386**	-0.058	0.030	**Neg.**
Hungary	0.052	0.669	0.200	**0.299**	0.620	0.135	**0.218**	-0.039	0.038	**Neg.**
Japan	0.019	0.158	0.072	**0.456**	0.051	0.053	**1.032**	0.065	0.024	**0.362**
Netherland	0.056	0.289	0.114	**0.394**	0.147	0.068	**0.465**	0.049	0.038	**0.768**
United Kingdom	0.005	0.148	0.021	**0.142**	0.086	0.013	**0.147**	0.014	0.007	**0.458**
United States	0.014	0.770	0.075	**0.097**	0.200	0.045	**0.224**	0.253	0.021	**0.082**

Changes are calculated as the difference between the 2005 and 1996 value. When actual change in wage differential is negative is not possible to assess how much is due to the increase of imports. Those cases are recorded with "Neg.".

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