Wage differentials and international trade in Italy

using individual micro data 1991-1996

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Abstract:

In this paper we use individual micro data on workers combined with industry and regional data to study the dynamics of the wage differential between skilled and unskilled workers in Italy in the period 1991-1996. Differently from previous empirical studies, our data allow us to explore in a unique framework the role of all the factors indicated in the literature as possible causes of the widening of the wage gap between skilled and unskilled workers: changes in individual characteristics of workers, changes in the institutions of the labour market, skill-biased technological progress, increasing international integration.
Our results show that individual, firm and macro variables matters in explaining the wage differential. In particular, international integration, both in terms of trade in goods and in terms of labour international mobility, plays a role on the wage differential between skilled and unskilled workers, but the impact goes in opposite directions. While, on the one hand, increasing trade in goods reduces the wage differential (through a positive impact on the wages of the unskilled workers), on the other hand immigration increases the wage differential, affecting the wage of the unskilled. As for the role of trade in goods, it is interesting to note that export growth has a positive impact on the wage of the blue collar workers and has no effect on the wage of the white collar, supporting the idea that Italy is atypical with respect to other industrialised countries and has a comparative advantage in low-skilled labour-intensive productions. We have also shown that the analysis of the wage differential hides different effects on white and blue collar wage dynamic of the explicative variables.

1. Introduction

The impact of increasing international integration on the labour market, particularly on the wage differentials between skilled and unskilled labour, is a hotly debated issue. In the advanced countries, the growing import flows of low-skill intensive goods from LDCs have been blamed for the declining relative demand for unskilled workers and the fall in their wages. This claim stems largely from the well known Stolper-Samuelson theorem. According to this theorem, international trade affects the prices of products; in turn, changes in product prices influence factor prices by affecting relative factor demands. A large amount of research has tried to evaluate the role which international trade plays in explaining the deteriorating conditions of unskilled workers and has achieved mixed results. The current consensus emerging from this empirical literature is that trade accounts for a positive, yet relatively small, share of the rising inequality.[1] Skill-biased technical change has been another major factor argued to be responsible for the shift in demand away from unskilled workers and for the lower wage premium.[2] Finally, a different strand of the literature, based on labour economists' research, has stressed the role played by the labour market institutions and by the individual characteristics in explaining the wage differentials[3].

The concern about the effects of globalisation on labour market outcomes has also involved Italy, particularly stimulated by the high rate of unemployment of unskilled workers. Among the industrialised countries, Italy represents an interesting case due to the quite peculiar pattern of international specialisation. Italy's position in traditional sectors and in some specialised supplier industries is very strong, while it is weak in sectors based on economies of scale and, especially, in high tech industries, where capital and skill abundant countries have traditionally their comparative advantages. Overall, both the observed pattern of trade and the characteristics of the manufacturing sector seem to suggest that Italy has a comparative advantage in labour-intensive productions, as many emerging economies. On the one hand, these features of the pattern of production and trade have raised growing concern regarding the vulnerability of Italy's position on foreign markets, facing the competitive pressures of products from low-wage countries. On the other hand, given this distinct pattern of comparative advantage in low-skill, high-labour intensive production, "Italy should be placed among those countries whose labour force is likely to gain from the operating of the Stolper-Samuelson effect" (Faini et al., 1999, 129).

A number of studies have tried to investigate the impact of international trade in the Italian case. At the industry level, attention has been focussed on the effect of trade on manufacturing employment and wage levels. De Nardis and Malgarino (1996) find a net positive effect of trade on manufacturing employment. Differently, Bella and Quintieri (2000) and Faini et al. (1999) find that the impact of trade on the Italian labour market is very limited, in line with the results found for other advanced countries.

All these studies do not distinguish the effect of trade between skilled and unskilled workers, a major issue to be investigated in the context of the Italian labour market. This line of research has been followed by Brenton and Pinna (2001), in their analysis of the factors which explain skill upgrading (that is the increase in the skill intensity of production) in the Italian manufacturing industry. They find that trade – specifically, imports from low-wage labour abundant countries - has influenced the employment possibilities of unskilled workers in Italy in the 1980s and in the 1990s. In particular, Brenton and Pinna show that "it is blue-collar workers in the skilled intensive sectors who have been most vulnerable to the effect of increasing international competition in terms of a

[1] See for a survey, among others, Slaughter (1999), Haskel (2000), Feenstra and Hanson (2001).

[2] See, among others, Machin and Van Reenen (1998) and Berman et al. (1994).

[3] See Bazen, Gregory and Salverda (2000), Dell'Aringa and Lucifora (1994), Erikson and Ichino (1995), Lucifora (2000), Baccaro (2000), Cappellari (2000), Cipollone (2001).

decline in their use relative to that of skilled labour. .. On the other hand, in the low-skill sectors the impact of trade is weak and not significant" (Brenton and Pinna, 2001, 17).[4]
Other studies have investigated the role of trade on skill upgrading focussing on the export activity of firms. Quintieri and Rosati (1995) and Ferragina and Quintieri (2000) study the relationship between export activity, productivity and performance at the firm level. Manasse et al. (2004), using a sample of metal-mechanical firms, find that skill-biased technical change is the main determinant of skill upgrading, increasing wage inequality within skilled workers more than between manual and non-manual workers.[5] The export status of firms is found to play a key role as exporters account for most of the demand-related and the technology-related shifts. In all these studies, the trade variable being analysed is the export activity of firms and, due to the nature of the data, the impact of increasing foreign competition is not investigated.

In this paper, using individual micro data on workers combined with industry and regional data, we explore the relationship between globalization and wage differentials between skilled and unskilled workers. Different to previous studies, we take into account both the role of growing activities of Italian firms in international markets and the impact of increased exposure to foreign competition. In this way, it is possible to try to investigate the effects of the two sides of the atypical pattern of Italian international specialisation, being competitive with low-skill intensive products on the export markets but suffering the increasing import penetration of labour intensive goods too.
In addition, and most important, the data used in this paper makes it possible to take into account the role played by the changes in the individual characteristics of workers and in the institutions of the labour market in explaining the wage differential between skilled and unskilled workers.
Our results show that international integration, both in terms of trade in goods and in terms of labour international mobility, seems to play a role on the wage differential between skilled and unskilled workers. Specifically, on the one hand trade openness reduces the wage differential (through a positive impact on the wages of the unskilled workers), while on the other hand labour openness increases the wage differential, affecting the wage of the unskilled. In addition, in line with the research in labour economics, our findings show that individual characteristics of workers play a role in explaining the wage differential between skilled and unskilled workers.
The paper is organised as follows: section 2 presents the data used in the paper and discusses the main stylised facts. In section 3, the model and the empirical variables used are analysed. Section 4 presents the estimation results and section 5 concludes.

2. Facts and the dataset

As for the Italian case, there are not many sources to get a clear cut information on the white/blue collar wage differential. The ISTAT series "Economic accounts of the manufacturing firms" do not cover the firms with less than 20 employees, thus disregard something like 30% of total employment. [6] The only other available source are the INPS data, a social security data set which cover firms of all size. In our analysis we will use this dataset (see the appendix for more information).

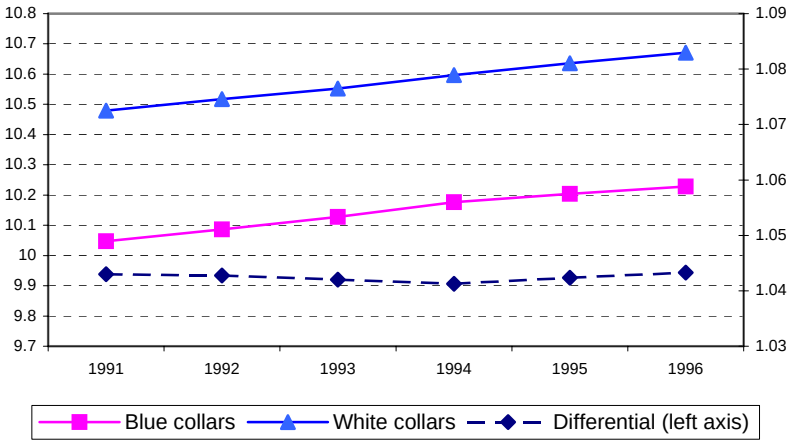
[4] In a different context, focusing on the role of international fragmentation of production, Helg and Tajoli (2003) find that the increase in the skilled-to-unskilled labour ratio in Italy is positively and significantly related to an index of international fragmentation of production. The same result is obtained when the dependent variable is the skilled labour share of the total wage bill.
[5] The result that skill-biased technical change is the main explanation of the increase in the relative demand for skilled workers is confirmed in Manasse and Stanca (2003).
[6] The reference period is 1983-1997.

As in previous researches (i.e Manasse et al., 2004) only blue collars and white collar workers were considered and used as proxies of skilled and unskilled workers[7]. White collar employees include the cadres and they correspond to the executive category in MTS.

The wage variable used in our analysis is the annual wage based on the total amount of the monthly earnings paid to the worker (basic wage, cost-of-living allowance, residual fees, overtime), plus the total amount of the non-monthly wages (back pay, bonuses, supplements holiday pay, sick pay), expressed in thousands of Italian lira. At a fiscal level it represents the basis on which payroll taxes can be determined. An alternative would be to use the daily wage obtained as annual wage divided by the paid working days. The reason why the former is adopted is that paid working days could be underreported by the firms to adjust the total wage bill to the minimum wage requirements. Further, such underreporting does not seem to be distributed uniformly in the country, but it appears to be very frequent in the South and among the blue collars (Contini et al.2000).

Fig.1 shows, for the years 1991 to 1996, the blue and white collar wage trends and the wage differential (all in log). Either white and blue collar wages increase, with the former increasing more than the latter. As a result, the total wage differential rises a bit after 1993. This is not the result of a variation in the dispersion within the groups because the variance within each group remains stable in all the period.

Figure 1 - Log blue collar wage, log white collar wage and log wage differential



Many changes however took place in this period which could explain this trend.

We assisted at least at 3 important transitions in the labour market. Italy become a country of immigration, the foreigners were 1.5% of total employees in the manufacturing sector and reached 3% in 1996 and 4% in 1999 (see Fig.2); women penetrated massively the labour market, even in the manufacturing sector they were 30% of total employed in 1991 and reached 31% in 1996; finally we assisted to a gradual aging of the labour force, the share of the old workers (over 65) on the share of the young workers (aged less than 25) were only 1.2 in 1991 and reached 1.6 in 1996.
All these components have contrasting effects on the wages: immigrants are mainly blue collars and are registered in low wage positions, thus they increase the wage differential between manual and non manual workers, while female are usually in high wage positions among blue collar workers and in low wage positions among white collar workers thus their growth in employment tend to reduce the wage differential. The aging of the employees in both groups increase the wage

[7] Managers who are registered in the INPS dataset are not representative of the entire category because most managers belong to a different social security fund.

differential. To have a clear cut impression of how it is important the age for the level of wage differential just give a look to Fig.3 derived from the INPS data set where it is easily seen that the log wage differential is stable for each ages bracket and increase only by the aging of the cohort.

While the workers characteristics changed, also the role of labour market institutions changed. In 1993 was signed the important agreement which ended the nation wide wage indexation (the so-called *scala mobile*), thus since than the wage increases were more related to labour productivity and to firm profit margin. The trade union membership increased from 39% in 1991 to 40% in 1992-1993 and declined to 38% in 1996. The trade union declines in the last period explains the increase in the wage differential, namely the caching up of the wages of the white collars. The territorial distribution however shows a prevailing declining rate but in Lombardia and Piemonte for example the trade union rate remained quite stable and these two regions are the one with the highest trade union base. The strike pattern is again very uneven. The number of hours lost for strikes were stable at about 9 or 10 thousands per year but declined to 2.080 in 1995. In general the region Lombardia is the more conflicting region, but for instance the region Emilia Romagna had a peak of conflicts in 1992 with 28% of total Italian hours lost for strike.
Both indicators are supposed to have a negative relation on wage differentials applying the underline assumption that trade unions protect more the blue collar workers and that strikes as well are more frequent among the blue ones, but this assumption is not always confirmed.

There are however many other variables which affect the wage differential as for instance the firm dimension. A look at figure 4 shows how strong is the relationship between firm dimension and wage differential and how stable it is. But the figure also shows that the growth of firm's size changes also the average wage differential.

In addition to the workers and firms characteristics and the role played by the trade unions, an important recent cause of the variation in the (log) wage differential can be imputed to the changes in the trade patterns. Figure 5 shows the variation in the share of export and imports on the value added and reveals for the period at hand the strong effect of the depreciation of 1992 which favoured the increase in export and the over jumping of the export over the import for all the period, thus a surplus in the balance of payment. Trade should affect the white-blue collar wage differential, and could be an important explanatory variable for the growth of the wage differential a year after the lira depreciation. But of course the effect of the trade variable will be different in the various sectors according to their openness.

Figure 6 shows the different sectorial behaviour to trade openness in the total period 1996-1991 and reveals large differences. The textile and cloth sector for instance shows a large growth of wage differential and a medium openness to trade, while the wood and rubber sector shows a very small increase of the wage differential for a similar moderate change in trade openness. There is not a very clear relation ship between the two variables, while on the contrary different behaviour of the changes in wage differentials are sector specific. This lack of relationship could be imputed to territorial differences of the openness to trade which is very large as Figure 7 shows. Abruzzo is the region with the largest increase in openness but also one with the smallest increase in wage differential, while Basilicata, Sardegna and Puglia has the highest increase in wage differential for a small increase in trade openness. Again not a clear cut pattern emerges, thus a more specific analyses has to be done which controls for all these components.

Figure 2 - Share of foreign workers on total employment

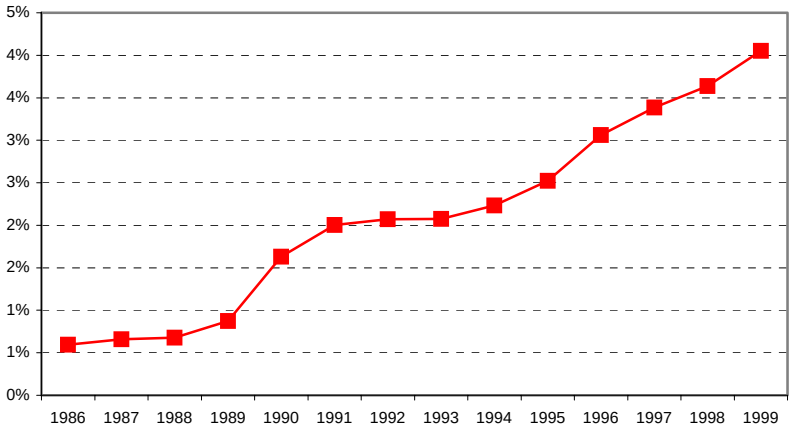


Figure 3 – Log wage differential white-blue collars by age groups

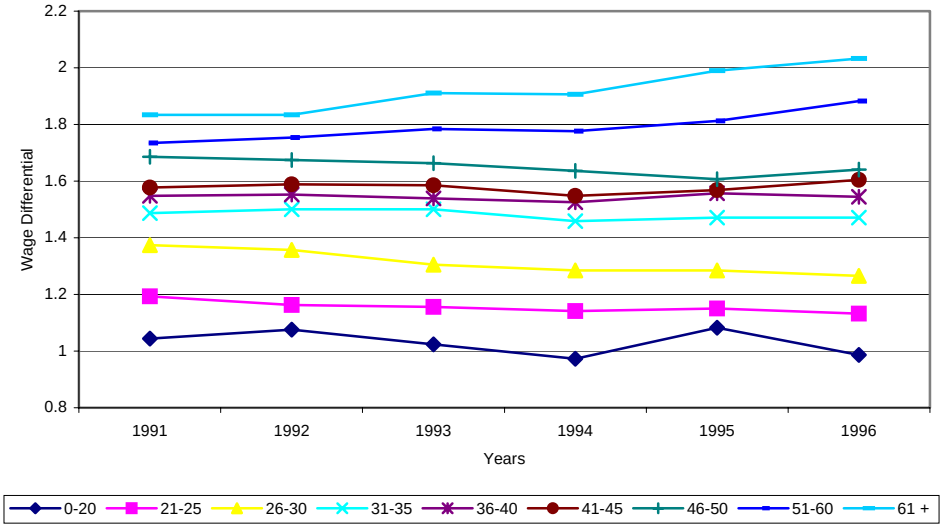


Figure 4 – Log wage differential white-blue collars by firm size

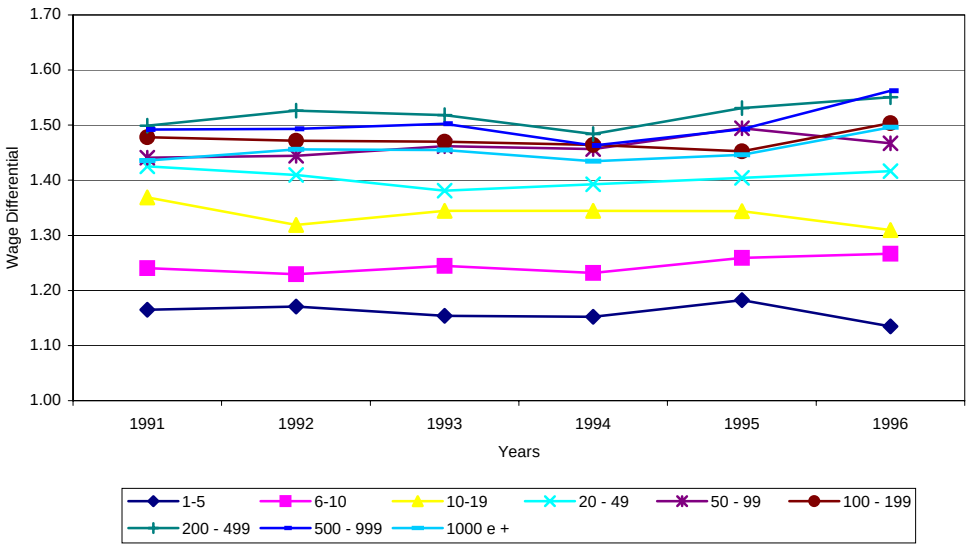


Figure 5 - Import and Export share on value added, 1991-1996

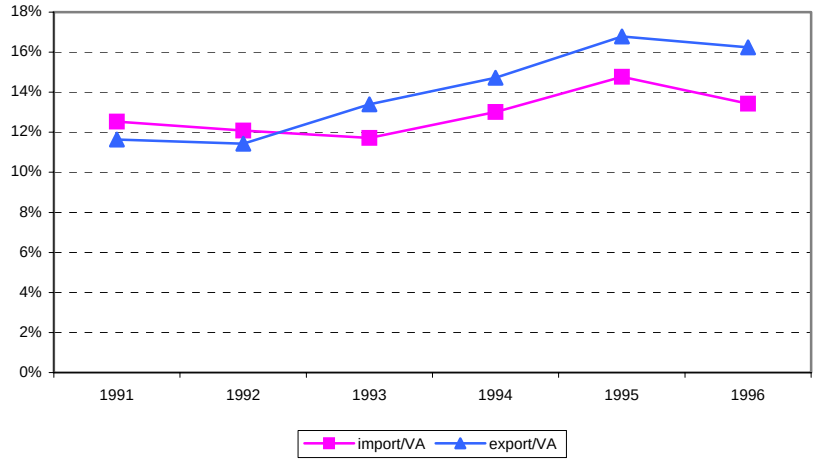


Figure 6 - Changes in W-B wage differential and in the rate of trade openness by sectors, 1991 - 1996

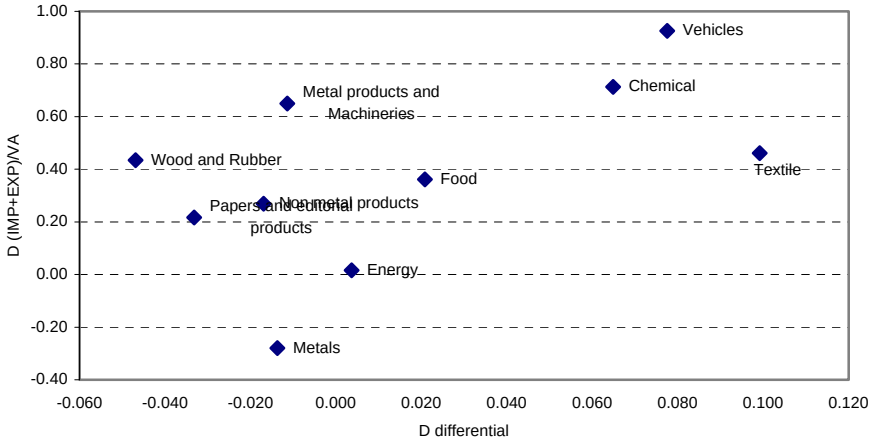
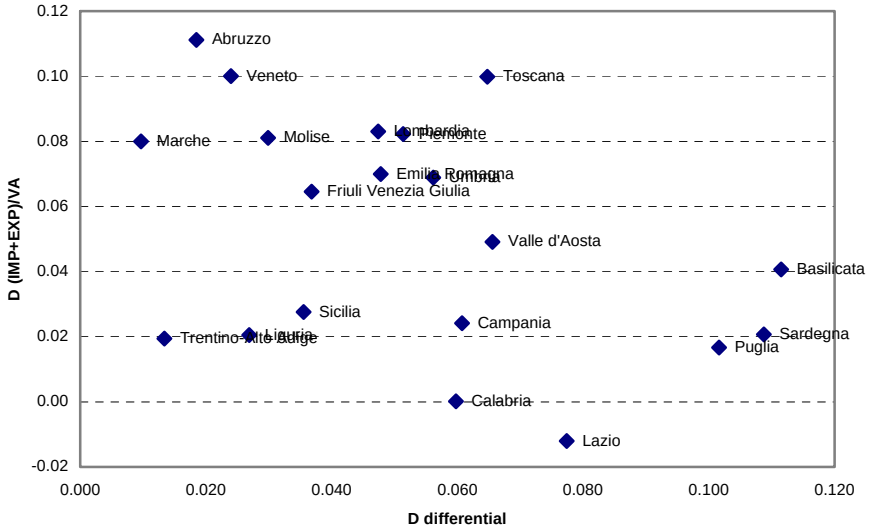


Figure 7 - Change in W-B wage differential and in the rate of trade openness by regions, 1991-1996



3 The model

The dependent variable, the growth of the log wage differential between non- manual and manual workers cannot be computed at an individual level but at a group level thus the analysis should be made at a higher level of aggregation. From the discussion presented in the paragraph before seems necessary to control both for the region and sector dimension. Thus, the *joint region and branch dimension* has been chosen. Further, given that the aim of this research is to study the causal relationship between changes in the log wage differential and variables such as trade and technology and institutions, for these variables only aggregate data are available.

3.1 Is the analysis by branch and region appropriate?

Before going on with the analysis of the wage differential by the cell region and branch it is necessary to inquire into the changes in white collar employment to be sure that the subsequent analyses of the wage differential capture the areas where the phenomenon is relevant. Using the break-up of the share of white collars first used by Berman et al. (1994) and Machin (1996), white collar growth is split up into two components.
The component *between* which shows by how much the change in white collar employment is due to employment movement to "cells" which already have a higher share of white collar employment; and the component *within* which shows by how much the change in white collar employment takes place within each "cell"

$$\Delta S_w = \sum_i \Delta S_i S_{wi} + \sum_i \Delta S_{wi} S_i$$

Between Within

S_w= share of white collars
S_i= share of employed in the cell i= region and sector
S_{wi}= share of white collars in the cell

Table 3.1 shows a general growth in the white collars employment and in addition in the manufacturing sector the growth is all within the sector and the between component is negative which means that the movement is in the opposite direction namely towards the sectors and region with fewer white collars. Further, the within growth is dominant both for the low and high wage differentials, and for the less and more open to trade sectors and is particularly strong for the more open to trade sectors.
Thus the analysis at the branch-region dimension seems to be appropriate to understand the dynamic relationship between white collars and blue collars wages.

Table.3.1 Change in the share of white collars by regions and sectors Between and Within component 1991-1996

		I			II	
		share white collars		Δ share white	between	within
		1991	1996			
Manufacturing		**27,7%**	**28,8%**	**0,0112**	**-0,0027**	**0,0139**
					-23,9%	**123,9%**
Manufacturing	**High differential ***	**26,9%**	**27,6%**	**0,0075**	**-0,0028**	**0,0103**
					-37,2%	**137,2%**
Manufacturing	**Low differential ***	**30,0%**	**32,6%**	**0,0257**	**0,0007**	**0,0250**
					2,7%	**97,3%**
Manufacturing	**Sectors more open to trade**	**32.8%**	**33.6%**	**0.0074**	**-0.0079**	**0.0153**
					-107.5%	**207.5%**
Manufacturing	**Sectors less open to trade**	**22.8%**	**24.1%**	**0.0126**	**0.0001**	**0.0125**
					0.8%	**99.2%**

**High differential* are Chemical products, , Metal products and machineries, Food, beverage and tobacco, Textile, leather ; Wood and rubber.
**Low Differential*:, Energy products Minerali e metalli, Minerals and metal products, Vehicles, Paper and and printing.

More open are: Minerals and metal products, Chemical products , Metal products and machineries, Vehicles
Less open are: Energy products, Non-metal products, Food, beverage and tobaco, Textile, leather, Paper and and printing, Wood and rubber

3.2. The model

For each cell given by the joint region (r) and branch (s) of the Manufacturing sector, the non-manual (1) manual (2) wage differential is defined as below

$$\delta_{s,r} = (\ln(W_{1\,s,r}) - \ln(W_{2\,s,r})) \qquad [1]$$

$$r=1,\ldots,20 \qquad s=1,\ldots,10$$

The change between t and t' of the wage differential ($\delta_{s,r}$) is explained by a series of variables at the same level of aggregation but belonging to different areas: change of (X) average characteristics of the employed workers, change of the structure of production (F), changes of the macro economic or the institutional variables (Y),

$$\Delta \delta_{s,r} = \beta \Delta X_{s,r} + \gamma \Delta F_{s,r} + \lambda \Delta Y_{s,r} + \theta \Delta T_{s,r} + \varphi K_s + \varepsilon_{s,r} \qquad [2]$$

With this model an attempt is made to capture all the possible causes of the wage differential: in addition to the more trendy trade variables and changes in technological innovation, allowance is made for the composition of supply, namely, individual characteristics; institutional factors which change the incentives in hire or fire workers by simultaneously checking for macroeconomic changes and changes in the structure of production. The latter could be result of adjusting the structure of the production to changes in the trade pattern or to technological changes. Thus a special estimate will allow for this possibility.

3.3 The variables

The individual variables X used account for all the changes from t and t', by branch and region in the share of women **(Δfemale),** in the average age of the employed **(Δage);** in the share of foreign workers **(Δforeigner).**
The variables employed to check the **structure of production F** are the changes between t and t', by branch and region, in the share of small firm[8] **(Δsmall);** in the share of medium firm[9] **(Δmed**); in the net creation rate of new firms **(Δfirms);** in the share of employment of the cell on total employment **(Δempl**); in the turnover rate[10] **(Δturnover).**

The **institutional and macro variables Y representing** changes between t and t' in the value added **(Δva**) by branch and region; in the unemployment rate **(Δunemployment**) by region; in the hours lost because of strikes **(Δstrikes)** by "3 branches" and region; and in the unionization rate **(Δunionization)** by region.

The **Trade Variables T** measure the change between t and t', by branch and region, in the share of imports over value added **(Δimp);** in the share of export over value added **(Δexp);** and in the openness of the cell[11] over value added **(Δtrade).**

Checks for **fixed effects** related to geographical areas, macro-areas or regions, sectors and over time are also included.

Proxies which can capture **technological change (K)** are also introduced as a pavitt index of technological innovation, alone or interacted with time dummies, intercept which is able to distinguish between sectors with different propensities to the innovation, and sector dummies interacted with a time trend.

All the variables presented are at the **region joint branch** level with the exception of the variables for the unemployment rate and the unionization rate and the number of strikes. In these cases there is only the regional dimension or the sector dimension is not largely detailed.

	Source	**Desegregation**	**Mean value**
Differential in log wage	Panel INPS	Branch and Region	0.0026
Δlog wage blue collars	Panel INPS	Branch and Region	0.0012
Δlog wage white collars	Panel INPS	Branch and Region	0.0014
Δshare of female	Panel INPS	Branch and Region	0.0024
Δage	Panel INPS	Branch and Region	0.1564
Δshare of foreigner	Panel INPS	Branch and Region	0.0017
Δsmall	Firm archive INPS	Branch and Region	-0.0015
Δmed	Firm archive INPS	Branch and Region	0.0009
Δlarge	Firm archive INPS	Branch and Region	-0.0003
Δnumber of firms	Firm archive INPS	Branch and Region	-0.0040
Δemployment	Firm archive INPS	Branch and Region	0.0000
Δturnover	Panel INPS	Branch and Region	-0.0078
Δvalue added	ISTAT national account	Branch and Region	1.0585

[8] Firms with less than 20 employees
[9] Firms with between 20 and 100 employees
[10] Annual inflow plus outflows of employment
[11] Imports plus Exports

Δunemployment rate	ISTAT Labour force survey	Region	0.2700
Δstrikes	ISTAT	Macro branch and region	0.0137
Δunionization	Unions data	Region	-0.1200
Δimport on VA	ISTAT International trade account	Branch and Region	0.0156
Δexport on VA	ISTAT International trade account	Branch and Region	0.0859
Δtrade (X+M/VA)	ISTAT International trade account	Branch and Region	0.1015

4. Results

The results shown in Table 4.1 stress the importance of the use of an appropriate model. The individual variables are always significant; the growth of females in the labour market reduces the wage differential because women are either in non-manual low wage positions or in manual high wage positions, the ageing of the employees increases the wage differential because the initial gap continues through a life time and the increase of foreigners in employment increases the wage gap because immigrants are mainly in blue collar jobs and at the lowest rungs of the blue collar ladder.
Manual workers are worse off in small firms, thus the firm size variable plays a positive role on the wage differential.
The institutional variables - strikes and trade union membership - are not significant, while the macro variables, changes in value added and changes in the unemployment rate are. The former are not significant even if there is the expected sign and the latter are significant with a negative sign that implies that the growth of unemployment has a negative effect on the growth of wage differential.
A series of variables, namely, changes in net firm creation, changes in the turnover rate and changes in the importance of the cell in terms of employment, has been included. They are supposed to check for the turbulence of the cell and capture sectorial relocation, if present in the data. Among all these variables only the turnover rate is always significant with a positive sign and net firm creation is almost significant indicating that new firms are increasing the wage differential.

Table.4. 1 Log Wage Differentials White and Blue Collars 1991-1996

Variabiles	Param.	t Value	Param.	t Value	Param.	t Value
Dep Var. Log wage differential by branch and region						
Δfemale	**-0.409**	**-2.1**	**-0.407**	**-2.1**	**-0.418**	**-2.1**
Δage	**0.022**	**3.5**	**0.021**	**3.5**	**0.022**	**3.6**
Δforeigner	**2.132**	**4.1**	**2.142**	**4.1**	**2.157**	**4.1**
Δsmall <20	**1.129**	**2.5**	**1.112**	**2.4**	**1.136**	**2.5**
Δmedium 20-100	**1.116**	**2.4**	**1.147**	**2.5**	**1.128**	**2.4**
Δimpr	**0.188**	**1.8**	**0.191**	**1.8**	**0.172**	**1.6**
Δturnover	**0.225**	**7.8**	**0.227**	**7.8**	**0.225**	**7.7**
Δemployment	**2.17**	**0.7**	**2.333**	**0.8**	**2.202**	**0.8**
Δvalue added	**0.042**	**1.12**	**0.041**	**1.3**	**0.036**	**1.2**
Δunemployment	**-0.012**	**-2.2**	**-0.010**	**-1.7**	**-0.013**	**-2.2**
Δstrikes	**-0.095**	**-0.16**	**-0.037**	**-0.28**	**-0.100**	**-0.7**
Δunionization			**0.011**	**1.49**		
Δ_imp	**-0.017**	**-3.3**	**-0.016**	**-3.5**		
Δ_exp	**-0.0109**	**-0.3**	**-0.006**	**-0.29**		
Δ_openess					**-0.013**	**-2.9**
Area dummies	**Yes**	**n.s**	**Yes**	**n.s**	**Yes**	**n.s**

Time dummies	**Yes**	**n.s**	**Yes**	**n.s**	**Yes**	**n.s**
Rsq	**0.11**		**0.11**		**0.12**	
N.obs	**936**		**936**		**936**	
F-value	**6.57**	**(0.0001)**	**6.38**	**(0.0001)**	**6.77**	**(0.0001)**

Turning to the trade variables: surprisingly export penetration does not play any role in determining the wage differential, while import penetration reduces wage differences between white and blue collar workers and thus the degree of change in trade openness (imports plus exports over value added) has a negative significant role as well[12]. Area and time dummies are also included.

Tables 4.2 and 4.3 continue this analysis. In Table 4.2 a closer look is taken of the role played by the firm or cell specific variables and in Table 4.3 the possible proxies used to capture technological progress are analysed.

Table 4.2 Log Wage Differentials White and Blue Collars 1991-1996
With and without relocation proxies and sector dummies

Variables	**Param.**	**t Value**	**Param.**	**t Value**	**Param.**	**t Value**
Dep Var. Log wage differential by branch and region						
Δfemale	**-0.428**	**-2.2**	**-0.360**	**-1.8**	**-0.400**	**-2.0**
Δage	**0.022**	**3.5**	**0.022**	**3.5**	**0.022**	**3.4**
Δforeigners	**2.132**	**4.1**	**2.322**	**4.3**	**2.120**	**4.0**
Δsmall	**1.129**	**2.5**	**1.256**	**2.7**	**1.157**	**2.5**
Δmedium	**1.116**	**2.4**	**1.160**	**2.4**	**1.208**	**2.5**
Δfirms	**0.188**	**1.8**			**0.197**	**1.8**
Δturnover	**0.225**	**7.8**			**0.229**	**7.8**
Δemployment	**2.169**	**0.7**			**2.460**	**0.8**
Δva	**0.042**	**1.4**	**0.033**	**1.0**	**0.032**	**1.0**
Δunemployment	**-0.012**	**-2.2**	**-0.014**	**-2.3**	**-0.010**	**-1.7**
Δstrikes	**-0.095**	**-0.7**	**-0.084**	**-0.6**	**-0.072**	**-0.5**
Δunionization						
Δ_imp	**-0.017**	**-3.5**	**-0.016**	**-3.2**	**-0.017**	**-3.5**
Δ_exp	**0.014**	**0.9**	**0.010**	**0.7**	**0.024**	**1.6**
Area dummies	**Yes**	**Non sig**	**Yes**	**Non sig**	**No**	
Time dummies	**Yes**	**Non sig**	**Yes**	**Non sig**	**Yes**	**Non sig**
Regional dummies	**No**		**No**		**Yes**	**Non sig**
Sectorial dummies	**No**		**No**		**Yes**	**Non sig**
N.obs	**936**		**936**		**936**	
F-value	**6.64**	**(0.0001)**	**4.58**		**3.32**	

[12] A simple test on the orthogonality of the individual variables is obtained by testing the log wage differential without the individual variables. The results show that the trade variables become less significant.

The three variables, changes in net firm creation, the turnover rate and the importance, in quantity terms, of the cell could be affected by the changes in trade openness and also by technology, for this reason it was decided to check for possible endogeneity in the variables in two ways; first by calculating a Pearson correlation test (see Table 4a, in the appendix) and secondly by eliminating them from the equation, columns 2 of Table 4.2. In the former case the Pearson correlation test shows a significant and positive correlation in one case, between the change in exports and the change in net firm creation but very weak, while in the latter case no differences emerge in the results with or without the relocation variables.
Also different combinations of checks are used, area dummies and time dummies in column 1, time dummies and sector dummies in column 3, time, region and sector dummies in columns 4 and 5 but none is significantly different from 0.

In Table 4.3 different proxies for the changes in technology are adopted. Given that the time dummies and the time trend have no significant effect, a sector time trend in column 4, different type of intercept which is a better check for the different technological characteristics of the sector was tried, but neither the Pavitt intercept (column 1) which orders the sector according to the technological innovation content[13] nor the distinction in Traditional; Scale and High tech. Sectors[14] (column 3) is significant. Further, a combination of the Pavitt intercept (column 2) with the time trend was implemented with no better results. Fundamentally the log wage differential does not respond to any time variables, probably because the time span used is too short for such a proxy.

Even though the results shown up to now are very interesting there are still a lot of questions to be answered. The technological effect does not seem to be relevant while the trade effect seems to be important but it is not very clear how it works. Do imports favour manual wage increases in an active manual refining process or do imports of high non-manual content reduce the growth of the white collar wages? To analyse the effect of all the type of variables, individual, firm, institutional, macro and tradable better it was decided to run the wage growth regression for manual and non-manual workers separately.

Table 4.4 provides some very interesting results and answers some of the questions. The two separate estimates also use specific individual variables for the two groups namely sex and age and also turnover rate. First, looking at the white collar equation, the increase in female employment reduces non-manual wage growth while the ageing of the workers has a positive effect on wage growth. Foreigners, who are mostly manual workers, do not play any role in the wage equation, and nor do changes in the size of the firm. Contrary to what was expected the turnover rate has a significant but negative sign, meaning that labour mobility for white collars is not upgrading but is going into precarious job positions. Finally, value added is significant and has the expected positive sign, while changes in unemployment, strikes and unionization are not significant. Considering the trade and technology variables, changes in the share of imports over value added are always significant with a negative sign, while changes in the share of exports over value added is not significant even though it has a positive sign. The dummies which try to capture the type of technological sectors, or simply the sectorial dummies, are never significant while the time dummies are significant with a negative sign.

[13] To Sector 1 Energy has been given the value *1*, Sector 2 Metals the value *2.94* , 3 Non-metal products *2.77* , Sector 4 Chemical *10,* 5 Metal products and machinery *3.42* , 6 Vehicles *3* , 7 Food *1* , 8 Textile *1,* 9.Papers and editorial products sector *3.14,* 10 Wood and rubber *3.*

[14] Sector 1 Energy, 7 Food and 8 Textile are classified as Traditional; Sector 2 Metals, 3 Non-metal products, 6 Vehicles 9.Papers and editorial products are classified as Scale sectors; Sector 4 Chemical and 5 Metal products and machinery as High tec; and sector 10 Wood and rubber as specialization.

The blue collar equation gives different results. As in the case of white collars, changes in the share of female workers reduce the wage increases of manual workers while their ageing increases their wage. Foreigners, being manual workers and being among the less skilled manual workers, reduce manual average wages. While it is the same for white collar workers, blue collars are better off in large companies. A high turnover rate reduces the growth of manual wages. Turning to macro variables, value added has the expected positive and significant sign, as is also the case for the growth of the unemployment rate, indicating a trade off between wage and employment for manual workers. Strikes are not significant but the unionization variable is significant and has a negative sign, suggesting that the trade unions are larger where wage growth is smaller. Imports and exports play a positive role on manual wages and, as before, the sector dummies and the type of technological sector are not significant, while the time dummies are very significant and have a negative sign.

These results explain previous results regarding the wage differential equation: all the trend variables and different combinations of the trend variables were never significant before, because the two components non manual and manual wage both have a negative trend.
A clear and different effect of trade is revealed. If export growth is positive for blue collars and irrelevant for white collars, import penetration is again positive for blue collars, while it seems to have a negative effect on white collar wages.
These results are unusual for the Italian empirical literature where given the different nature of the dataset it is not possible to distinguish the effect of import and export on each group of workers. Other authors who had individual firm observations (Manasse et al., 2004) do not check for the change in the composition of the workforce nor for import penetration. Further, the institutional variables have not been included.

Table.4. 3 Log Wage Differentials White and Blue Collars 1991-1996 and proxies for the Technological progress

Variable	Param.	t value	Param.	t value	Param.	t value	Param.	t value
Dep Var. Log wage differential by brach and region								
Intercept							-0.042	-1
Δfemale	-0.428	-2.2	-0.41	-2.1	-0.41	-2.18	-0.42	-2.1
Δage	0.022	3.5	0.022	3.7	0.02	3.35	0.022	3.6
Δforeigner	2.132	4.1	2.11	4.1	2.15	4.2	2.14	4.1
Δsmall <20	1.14	2.56	1.11	2.45	1.14	2.56	1.17	2.5
Δmedium 20-100	1.135	2.49	1.19	2.57	1.134	2.5	1.21	2.6
Δimpr	0.189	1.8	0.19	1.82	0.191	1.8	0.20	1.9
Δturnover	0.225	7.9	0.23	7.9	0.2266	7.9	0.22	7.8
Δemployment	2.06	0.7	2.67	0.9	2.19	0.76	2.16	0.73
Δvalue added	0.043	1.38	0.015	0.96	0.043	1.38	0.040	1.28
Δunemployment	-0.011	-1.89	-0.011	-1.9	-0.0109	-1.88	-0.01	-1.37
Δstrikes	-0.035	-0.26	-0.037	-0.3	-0.027	-0.21	-0.011	-0.09
Δunionization	0.009	1.27	0.013	1.77	0.01	1.28	0.011	1.65
Δ_imp	-0.0164	-3.46	-0.017	-3.5	-0.016	-3.46	-0.017	-3.4
Δ_exp	-0.0043	-0.15	-0.014	-0.51	-0.0018	-0.06	-0.008	-0.29
Pavitt◦	0.00006	0.03						
Pavitt92			-0.00128	-0.29				
Pavitt93			-0.006	-1.33				
Pavitt94			0.006	1.33				
Pavitt95			-0.0019	-0.45				
Pavitt96			0.0004	0.09				
Scale▫					0.0009	0.06		

Hightech specialization					**-0.009** **-0.023**	**-0.51** **-1**		
trend-sect1							**0.0027**	**0.46**
trend-sect2							**0.0036**	**0.58**
trend-sect3							**0.0004**	**0.08**
trend-sect4							**0.0038**	**0.63**
trend-sect6							**-0.0029**	**-0.46**
trend-sect7							**0.0017**	**0.28**
trend-sect8							**0.0036**	**0.59**
trend-sect9							**0.004**	**0.69**
trend-sect10							**-0.002**	**-0.43**
Area dummies	**Yes**	**n.s**	**Yes**	**n.s**	**Yes**	**n.s**	**Yes**	**n.s**
Time dummies	**Yes**	**n.s**			**Yes**	**n.s**		
N.obs	**934**		**936**		**936**		**935**	
F-value	**6.24**	**(0.0001)**	**6.42**	**(0.0001)**	**5.8**	**(0.0001)**	**5.35**	**(0.0001)**

°The pavit dummy is obtained giving to each sector an ordering value, to Sector 1 Energy the value *1*, Sector 2 Metals value *2.94* , 3 Non-metal products *2.77* , Sector 4 Chemical and *10,* 5 Metal products and machineries *3.42* , 6 Vehicles *3* , 7 Food *1* , 8 Textile *1,* 9.Papers and editorial products sector *3.14,* 10 Wood and rubber *3.*

▫Sector 1 Energy, 7 Food and 8 Textile are classified as Traditional; Sector 2 Metals, 3 Non-metal products, 6 Vehicles and 9.Papers and editorial products are classified as Scale sectors; Sector 4 Chemical and 5 Metal products and machineries as High tec; and sector 10 Wood and rubber as specialization.

Table.4. 4 Log Wage White and Blue Collars 1991-1996

Variabile	**Param.**	**t Value**	**Param.**	**t Value**	**Param.**	**t Value**	**Param.**	**t Value**
Dep Var. Log wage differential by brach and region								
	WHITE COLLARS				**BLUE COLLARS**			
Δfemale w,b	**-0.35**	**-7**	**-0.35**	**-7**	**-0.26**	**-3.7**	**-0.26**	**-3.6**
Δage w,b	**0.032**	**16**	**0.032**	**16**	**0.012**	**6.03**	**0.011**	**6.17**
Δforeigner	**0.07**	**0.2**	**0.055**	**0.15**	**-0.5**	**-2.73**	**-0.5**	**-2.8**
Δsmall <20	**0.12**	**0.4**	**0.12**	**0.4**	**-0.57**	**-3.47**	**-0.58**	**-3.58**
Δmedium 20-100	**0.015**	**0.18**	**0.067**	**0.21**	**-0.51**	**-3.1**	**-0.52**	**-3.13**
Δimpr	**0.11**	**1.5**	**0.11**	**1.5**	**0.004**	**0.12**	**0.004**	**0.12**
Δturnover w,b	**-0.19**	**-14**	**-0.19**	**-14**	**-0.18**	**-22**	**-0.18**	**-22**
Δemployment	**2.22**	**1**	**2.6**	**1.25**	**0.11**	**0.11**	**0.37**	**0.35**
Δvalue added	**0.04**	**2.19**	**0.04**	**2.2**	**0.034**	**3.34**	**0.039**	**3.41**
Δunemployment	**-0.003**	**-0.7**	**-0.003**	**-0.7**	**0.004**	**2.14**	**0.004**	**2.16**
Δstrikes	**-0.004**	**-0.04**	**-0.009**	**-0.10**	**0.053**	**1.1**	**0.043**	**0.87**
Δunionization	**-0.0007**	**-0.13**	**-0.00056**	**-0.10**	**-0.006**	**-2**	**-0.005**	**-1.87**
Δ_imp	**-0.006**	**-1.89**	**-0.006**	**-1.9**	**0.003**	**1.68**	**0.003**	**1.72**
Δ_exp	**0.019**	**0.97**	**0.02**	**1.05**	**0.030**	**2.95**	**0.030**	**2.88**
Scale	**-0.0098**	**-0.89**			**-0.004**	**-0.68**		
Hightech	**-0.0041**	**-0.32**			**0.004**	**0.63**		
Specialization	**-0.006**	**-0.39**			**-.001**	**-0.14**		
trend-sect1			**0.01**	**0.54**			**-0.0049**	**-0.48**
trend-sect2			**0.005**	**0.25**			**-0.008**	**-0.77**
trend-sect3			**0.00159**	**0.08**			**0.0054**	**0.51**
trend-sect4			**0.027**	**1.38**			**0.017**	**1.63**
trend-sect6			**-0.001**	**-0.05**			**0.0019**	**0.18**
trend-sect7			**0.015**	**0.76**			**0.007**	**0.73**
trend-sect8			**0.027**	**1.37**			**0.010**	**0.97**
trend-sect9			**0.027**	**1.33**			**0.002**	**0.22**
trend-sect10			**0.011**	**0.58**			**0.003**	**0.31**
Area dummies	**Yes**	**n.s**	**Yes**	**ns**	**Yes**	**n.s**	**yes**	**1 sig**
Time dummies	**Yes**	**sig**	**Yes**	**sig**	**Yes**	**sig**	**yes**	**sig**

RsqAd	**0.44**	**0.46**	**0.45**	**0.43**
N.obs	**936**	**936**	**936**	**934**
F-value	**30**	**24**	**29**	**24**

5. Conclusions

In this paper we use individual micro data on workers combined with industry and regional data to study the dynamics of the wage differential between skilled and unskilled workers in Italy in the period 1991-1996. Even though our analysis covers only few years, this period has been characterised by changes with important effects on the Italian economy: specifically, the end of the nation wide wage indexation (the so-called *scala mobile*) with the agreement signed in 1993 and the export growth following the devaluation of the Italian Lira.

Differently from previous empirical studies, our data allow us to explore in a unique framework the role of all the factors indicated in the literature as possible causes of the widening of the wage gap between skilled and unskilled workers: changes in individual characteristics of workers, changes in the institutions of the labour market, skill-biased technological progress, increasing international integration.

First, our results show that international integration, both in terms of trade in goods and in terms of labour international mobility, plays a role on the wage differential between skilled and unskilled workers, but the impact goes in opposite directions. While, on the one hand, increasing trade in goods reduces the wage differential (through a positive impact on the wages of the unskilled workers), on the other hand immigration increases the wage differential, affecting the wage of the unskilled. As for the role of trade in goods, it is interesting to note that export growth has a positive impact on the wage of the blue collar workers and has no effect on the wage of the white collar, supporting the idea that Italy is atypical with respect to other industrialised countries and has a comparative advantage in low-skilled labour-intensive productions. As for imports, the effect has opposite sign: positive on the wage of the unskilled workers and negative on the wage of the skilled.

Second, in line with the research in labour economics, our findings show that individual characteristics of workers matter in explaining the wage differential between skilled and unskilled workers. More specifically, the growth of female in the labour market reduces the wage differential, while the ageing of the employees increases the wage gap.

These conclusions clearly emerge widening our analysis to investigate not only the wage differentials, but also white and blue collar wages separately. In fact, we have shown that the analysis of the wage differential hides different effects on white and blue collar wage dynamics of the explicative variables.

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Appedix - More on the dataset

The data set used is derived from the Social Security archives (INPS). Social security contributions (and payments to the National Health Service) are collected from firms and individual workers by INPS, which delivers retirement benefits and various wage supplements. The data used in the present paper are derived from two different archives: the first (O1M) which has yearly data on individual employees filled in by the employers to certify an employee's rights to pension benefits[15]; and the second (DM10M), monthly data on firms with employees filled in by the employer (payments of social security contributions)[16].
The former archive is organized by individual worker and year (roughly 12.5 million records per year). A worker may appear with more than one record in a given year, whenever (s)he had worked for two or more employers during the year. The latter archive, roughly 1.2 million records (firms), is updated each month, corresponding to the number of active firms with at least one employee.

The archive includes all private firms in the industrial and service sectors with at least one employee; services and other activities connected with agriculture are not included. Central administration employees are entirely absent from the archive; i.e. mail services, state school teachers, administration of justice, army and all government agencies are not included.
Whenever a *firm is recorded in the archive, all its employees are observed* (with the exclusion of family and self-employed workers).

For each calendar year 1985-96, Social Security forms ("moduli O1M") of employees born on the 10th of March, June, September and December of any year were selected. In this way, a sequence of random (roughly, 1:90) samples of the population of employees of private firms is formed. Each yearly sample includes approximately 100,000 workers.

Using available identifiers (fiscal and social security codes), individual longitudinal data are generated for each sampled worker. The firm's longitudinal records are then accessed for each worker in the sample and

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[15] For each employee, calendar year and employer the following data are available:
- employee identification (social security number, fiscal code, date of birth, sex, etc.);
- employer identification, linking the worker to the relevant firm;
- place of work ("provincia");
- list of months for which wages or salaries were paid;
- number of "paid" weeks and days;
- date of closure of the relationship with the current employer;
- yearly salary or wage subject to social security contributions;
- yearly wage supplements due and paid by the employer;
- occupation (apprentice, manual worker, non-manual worker, manager);
- type of labor relationship (full time, part time, limited or unlimited duration);
- code of contractual agreement and position in the contractual ladder.
- wage supplements paid by the employer on behalf of INPS (starting from 1989).

[16] Firms pay compulsory social security contributions and national health insurance on a monthly basis. Forms used for the payment specify:
i firm's identifiers: social security and fiscal code, company name, address;
ii economic activity (code),
iii dates of registration and termination (if applicable);
and, for each reference month
iv number of employees to whom some salary or wage was paid by the employer;
v before tax wage (or salary) bill paid by the employer;
vi social security contributions paid by the employer;
vii total number of days for which some wage (or salary) was paid by the employer;
viii wage supplements paid by the employer on behalf on the Social Security Institute; rebates on contributions (for young and female workers, firms located in "underdeveloped" areas, etc.). Items (iv)-(vii) are broken down into 4 occupational groups (manual and non manual workers, cadre and managers, apprentices), as well as on part time and other special work contracts.

the employer's details (code of economic activity, total number of employees) are then associated to the employee[17].
If a worker is not in the archive, and hence in the panel of employees of private firms, it means that (s)he is in a different category: self-employment, unemployment, public sector, retirement, black economy[18].

This is the best dataset available for the purpose of our research because those not covered by this dataset – i.e. public sectors, self employment - are not relevant for an analysis on the effect of trade flows and technology. In addition of this dataset we will use only the section more exposed to the international trade namely the manufacturing sector. The main characteristics of the employees are shown in Table A1

Males prevail in all the dataset, but in the manufacturing sector the male group reaches about 70% of total employees, 47% are employed in firms with less than 50 employees , 72.8% are blue collars and the remainder white. Of course there are more blue collars in the manufacturing sector alone than in the dataset which includes also the private service sector.
The textile and the Metal products and Machineries sectors are by large the most important and the North West is by large the most important area and the North alone accounts for 67% of total employees.

[17] For each employee, employer and year and, the following data are available:
- the content of the employees' archive
- the code of economic activity of the relevant firm (employer);
- firm's location, dates of enrolment and cancellation;
- monthly number of employees in the firm, by occupation;
- annual wage bill, by occupation.

[18] There is no attrition in this archives, if we exclude updating problems, i.e. delays in the acquisition of information from the firms. It is compulsory to provide records on employees and firms to the social security administration, if the worker and the firm belong to one of the mentioned categories.

Table A1 Characteristics of the Employees in the INPS panel 1996

Gender ONLY	Manufacturing
Female	30.75%
Male	69.25%
Age	
-20	1.47%
21-25	13.41%
26-30	18.45%
31-35	17.02%
36-40	13.50%
41-45	12.24%
46-50	13.33%
51-60	9.98%
61+	0.60%
Firm Dimension	
1-5	8.80%
6-9	7.18%
10-19	14.13%
20-49	17.17%
50-99	10.69%
100-199	9.25%
200-499	10.07%
500-999	5.59%
1000 +	17.12%

Sectors	Manufact. %
1 Energy	3.38%
2 Metals,	2.68%
3 Non-metal products	5.85%
4 Chemical	4.78%
5 Metal products and machineries	35.12%
6 Vehicles	5.44%
7 Food	7.81%
8 Textile	18.07%
9 Papers and editorial products	4.59%
10 Wood and rubber	12.30%
Geo. areas	
North-West	39.86%
North-East	27.39%
Center	17.09%
South	15.67%
Skill	
Blue	72.8%
White	27.2%

Table 4.a Correlation between trade variables and relocation proxies

	Δ_openess	Δ_imp	Δ_exp
Δfirm	0.043	-0.011	0.099 **
N. obs	997	997	997
Δturnover	0.002	-0.006	0.016
N. obs	984	984	984
Δemploy	0.003	0.001	0.005
N. obs	998	998	998
** Prob > |r| under H0: Rho=0 <1%			