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ABSTRACT

Wage Differentials and International Trade in Italy Using Individual Micro Data 1991-1996

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. Being different to 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 the individual characteristics of workers, changes in the institutions of the labour market, in skill-biased technological progress and increasing international integration.

Our results show that individual, firm and macro variables matter in explaining wage differentials. In particular, international integration, both in terms of trade in goods and in terms of international labour mobility, plays a role in determining the wage differential between skilled and unskilled workers, but the impact is in opposite directions. While, on the one hand, increasing trade in goods reduces wage differentials (through a positive impact on the wages of the unskilled workers), on the other hand immigration increases wage differentials, 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 wages of the blue collar workers and has no effect on the wages of the white collars, supporting the idea that Italy is atypical with respect to other industrialised countries and has a comparative advantage in low-skilled labour-intensive production. We have also shown that an analysis of the wage differentials hides their different effects on the white and blue collar wage dynamics of the explicative variables.

JEL Classification: J31, F4, O33

Keywords: wage differential, institutions, individual characteristics, migration, trade liberalization and skill-biased technological change

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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 product prices; in turn, changes in product prices influence factor prices by affecting relative factor demand. A lot of research has tried to evaluate the role which international trade plays in explaining the deteriorating conditions of unskilled workers with mixed results. The current consensus emerging from this empirical literature is that trade plays a positive, yet relatively small, role in this rising inequality.¹ Skill-biased technical change has been another major factor which it is claimed has been responsible for the shift in demand away from unskilled workers and for the lower wage premium.² Finally, a different line of approach in the literature, based on research done by labour economists, has stressed the role played by the labour market institutions and by an individual's characteristics in explaining the wage differentials³.

The concern about the effects of globalisation on labour market outcomes has also been raised in Italy, and has been particularly stimulated by the high rate of unemployment of unskilled workers. Among all 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 traditionally have 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 goods, as many other emerging economies. On the one hand, these features of the pattern of production and trade have raised growing concern regarding Italy's vulnerability on foreign markets, when 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 what impact international trade has in the Italian case. At the industry level, attention has been focussed on what effect trade has on manufacturing employment and wage levels. De Nardis and Malgarino (1996) find that trade has a net positive effect on manufacturing employment. Differently, Bella and Quintieri (2000) and Faini et al. (1999) find that trade has a very limited impact on the Italian labour market, 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 - influenced the employment opportunities 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 skill intensive sectors who have been most vulnerable to the effect of increasing international competition in terms

¹ See for a suitable 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).

of a 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 attention 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 between skilled workers themselves 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 firms’ export activity 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 how globalization affects the 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, that is to say, a country which is competitive with low-skill intensive products on the export markets yet suffers from the increasing import penetration of labour intensive goods.

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 changes in labour market institutions 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 international labour mobility, seems to play a role in determining 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 wages of the unskilled. In addition, in line with the research in labour economics, our findings show that the individual characteristics of workers play a role in explaining the wage differentials 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 offers some conclusions.

2. Facts and the dataset

As for the Italian case, there are not many sources to get 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 something like 30% of total employment is excluded.⁶ The only other available source are the INPS data, a social security data set which covers firms of all sizes. In our analysis this dataset is used (see the appendix for more information).

⁴ In a different context, focusing attention 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).

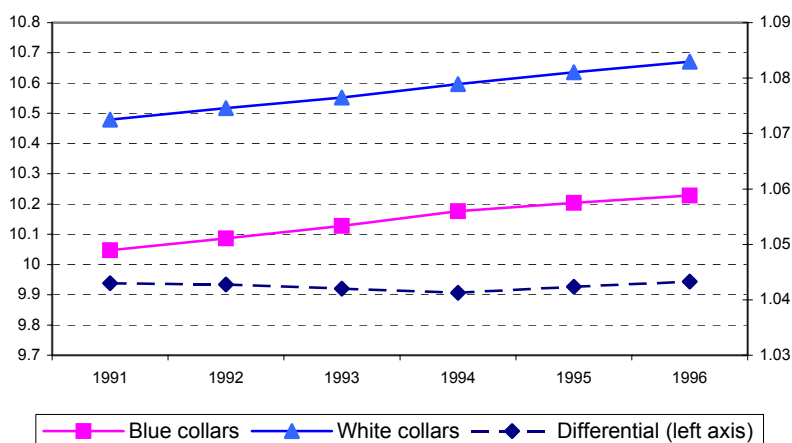
⁶ The reference period is 1983-1997.

As in previous researches (i.e. Manasse et al., 2004) only blue collars and white collar workers are considered and used as proxies of skilled and unskilled workers⁷. 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 are determined. An alternative would be to use the daily wage calculated as annual wage divided by the number of 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). Both 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 throughout the period.

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



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

There were at least at 3 important transitions in the labour market. Italy became a country of immigration. At the beginning of the period foreigners were 1.5% of total employees in the manufacturing sector and reached 3% in 1996 and 4% in 1999 (see Fig.2); women entered the labour market in large numbers, even in the manufacturing sector they were 30% of total employed in 1991 and reached 31% in 1996; finally there was a gradual aging of the labour force, the share of old workers (over 65) over the share of young workers (aged less than 25) was only 1.2 in 1991 and reached 1.6 in 1996.

All these factors have contrasting effects on wages: immigrants are mainly blue collars and are registered in low wage jobs, thus they increase the wage differential between manual and non manual workers, while women are usually in high wage jobs among blue collar workers and in low wage jobs among white collar workers, thus their growth in employment tends to reduce 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. The aging of the employees in both groups increases the wage differential. To have a clear cut idea of how important the age is for the level of wage differentials, it is only necessary to look at Fig.3 derived from the INPS data set where it can easily be seen that the log wage differential is stable for each age group and increases only through the aging of the cohort.

While the workers' characteristics changed, the role of labour market institutions changed too. In 1993 an important agreement was signed which brought to an end the nation wide wage indexation (the so-called *scala mobile*). Thus, since then wage increases were more closely related to labour productivity and to firm profit margin. Trade union membership increased from 39% in 1991 to 40% in 1992-1993 and declined to 38% in 1996. The fall in trade union membership in the latter period explains the increase in the wage differential, it was the result namely of white collar workers' wages catching up. Territorial distribution of trade union membership however shows an overall declining rate, but in Lombardy and Piedmont, for example, the trade union rate remained quite stable and these two regions are the ones where the trade union base is strongest. The territorial distribution however shows a prevailing declining rate 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 thousand per year but fell to 2.080 in 1995. In general the region of Lombardy is the most conflicting region, but for instance the region of Emilia Romagna had a peak of conflicts in 1992 with 28% of the total number of Italian hours lost because of strikes.

Both indicators are expected to have a negative effect on wage differentials, applying the underlying assumption that trade unions protect the blue collar workers more and that strikes are also more frequent among the blue collars, but this assumption is not always confirmed.

There are however many other variables which affect the wage differential as for instance the firm's size. Figure 4 shows how strong and stable the relationship between a firm's size and the wage differential is. But the figure also shows that the growth of a firm's size also changes 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 exports and imports over the value added and reveals for the period under question the strong effect of the 1992 devaluation which favoured the increase in exports and exports overtaking imports for the whole period, thus producing 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 was devalued. But of course the effect of the trade variable will be different in the various sectors depending on how open they are.

Figure 6 shows the different sectorial behaviour to trade openness during the whole period 1996-1991 and reveals large differences. The textiles and clothing sector, for instance, shows a large growth in the 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 relationship between the two variables, while on the contrary the different behaviour of the changes in wage differentials are sector specific. This lack of relationship could be imputed to territorial differences in 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 have the highest increase in wage differential for a small increase in trade openness. Again there is not a clear cut pattern, thus a more specific analysis has to be done, one which can check for all these factors.

Figure 2 - Share of foreign workers over total employment

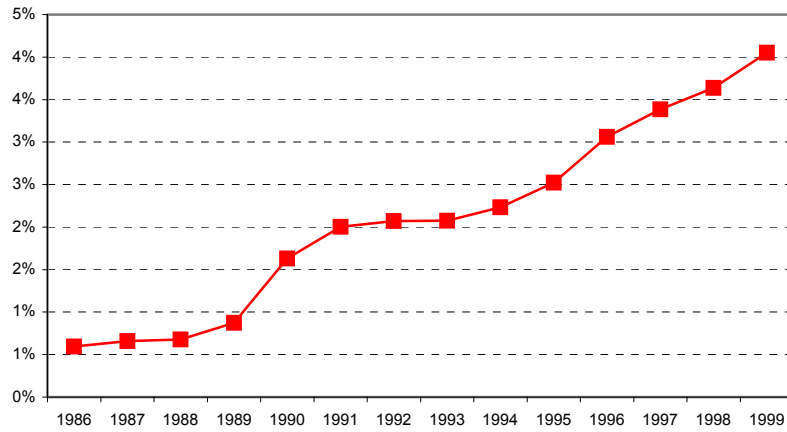


Figure 3 – Log wage differential white-blue collars by age groups

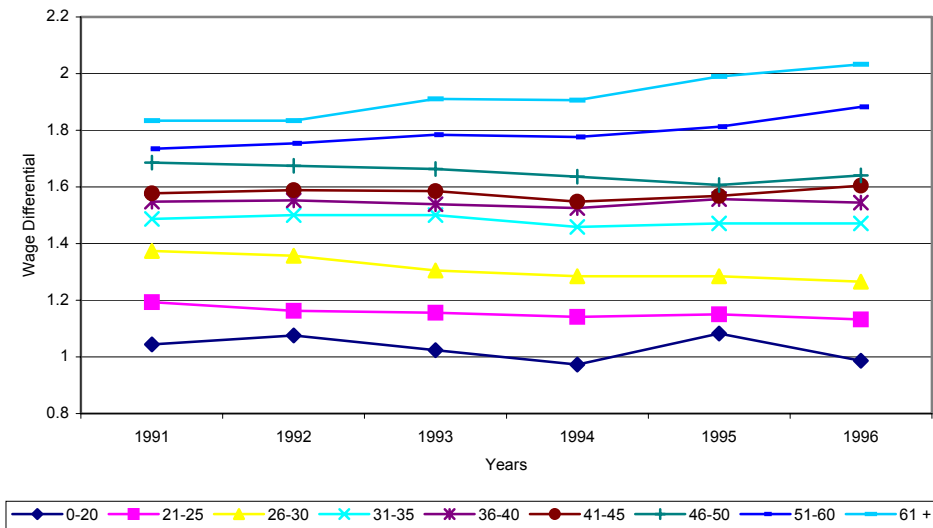


Figure 5 - Import and Export share over value added, 1991-1996

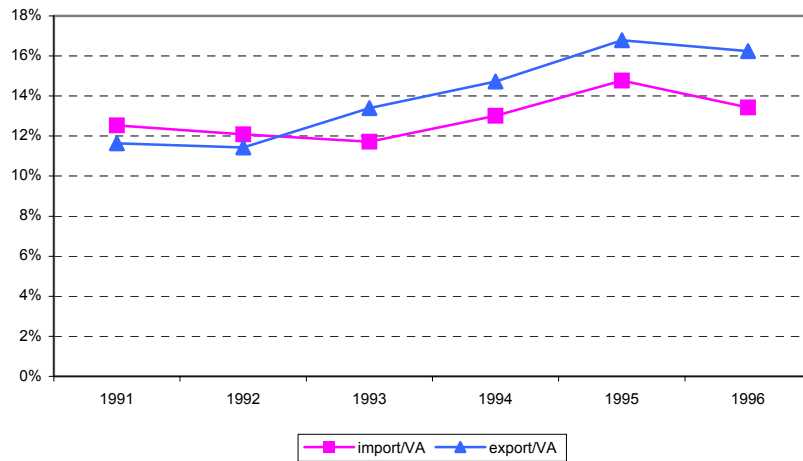


Figure 6 - Changes in W-B wage differential and in the rate of trade openness by sectors, 1991 - 1996

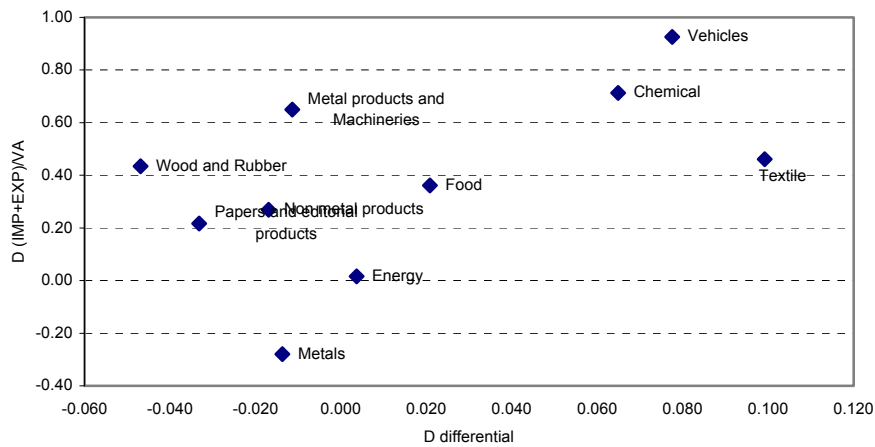
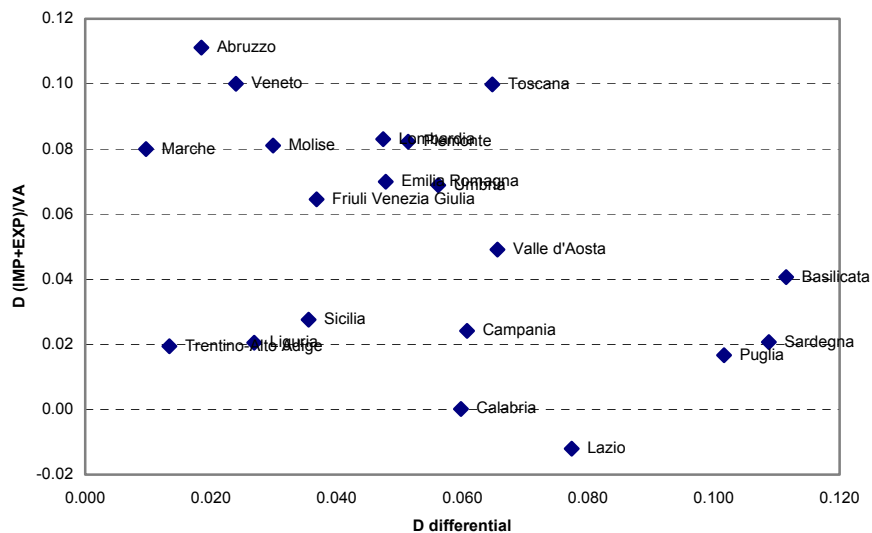


Figure 7 - Change in W-B wage differential and in the rate of trade openness by regions, 1991-1996



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 previous paragraph it would appear to be necessary to check for both 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, aggregate data are used for these variables.

3.1 Is the analysis by branch and region appropriate?

Before going on with the analysis of the wage differential by the region and branch ‘cells’ it is necessary to investigate the changes in white collar employment so as 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 white collar employment and further, 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 collar workers. Moreover, the within cell growth is dominant both for the low and high wage differentials, and for the less and more open trade sectors. It is particularly strong for the more open to trade sectors.

Thus, the analysis at the branch-region dimension seems to be appropriate if we want 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
Manufacturing	High differential *	26,9%	27,6%	0,0075	-23,9%	123,9%
Manufacturing	Low differential *	30,0%	32,6%	0,0257	-0,0028	0,0103
Manufacturing	Sectors more open to trade	32,8%	33,6%	0,0074	-37,2%	137,2%
Manufacturing	Sectors less open to trade	22,8%	24,1%	0,0126	0,0007	97,3%
					-0,0079	0,0153
					-107,5%	207,5%
					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 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 tobacco, Textile, leather, Paper 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

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

$$r=1, \dots, 20 \quad s=1, \dots, 10$$

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 belong 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),

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

With this model an attempt has been 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 has been made for the composition of supply, namely, individual characteristics; institutional factors which change the incentives in the hiring and firing of workers by simultaneously checking for macroeconomic changes and changes in the structure of production. The latter could be the result of adjusting the pattern of the production to changes in the trade pattern or to technological changes. Thus a special estimate takes this possibility into account.

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 (**Δ female**), in the average age of the employed (**Δ age**); and in the share of foreign workers (**Δ foreigner**).

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 firm⁸ (**Δ small**); in the share of medium-sized firms⁹ (**Δ med**); in the net creation rate of new firms (**Δ net firm**); in the share of employment of the cell over total employment (**Δ empl**); and in the turnover rate¹⁰ (**Δ turnover**).

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

⁸ Firms with less than 20 employees

⁹ Firms with between 20 and 100 employees

¹⁰ Annual inflow plus outflows of employment

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 exports over value added (Δexp); and in the openness of the cell¹¹ 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 widely detailed.

	Source	Desegregation	Mean value
Differential in log wage	Panel INPS	Branch and Region	0.0026
$\Delta\text{log wage blue collars}$	Panel INPS	Branch and Region	0.0012
$\Delta\text{log wage white collars}$	Panel INPS	Branch and Region	0.0014
$\Delta\text{share of female}$	Panel INPS	Branch and Region	0.0024
Δage	Panel INPS	Branch and Region	0.1564
$\Delta\text{share of foreigner}$	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
$\Delta\text{number of firms}$	Firm archive INPS	Branch and Region	-0.0040
$\Delta\text{employment}$	Firm archive INPS	Branch and Region	0.0000
$\Delta\text{turnover}$	Panel INPS	Branch and Region	-0.0078
$\Delta\text{value added}$	ISTAT national account	Branch and Region	1.0585
$\Delta\text{unemployment rate}$	ISTAT Labour force survey	Region	0.2700
$\Delta\text{strikes}$	ISTAT	Macro branch and region	0.0137
$\Delta\text{unionization}$	Unions data	Region	-0.1200
$\Delta\text{import on VA}$	ISTAT International trade account	Branch and Region	0.0156
$\Delta\text{export on VA}$	ISTAT International trade account	Branch and Region	0.0859
$\Delta\text{trade (X+M/VA)}$	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 female in the labour market reduces the wage differential because women are either in non-manual low wage jobs or in manual high wage jobs, 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.

¹¹ Imports plus Exports

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 which implies that the growth of unemployment has a negative effect on the growth of wage differentials.

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 aimed at checking for the turbulence of the cell and capturing 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 increase 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. Δ Log wage differential by branch and region						
Δ female	-0.409	-2.1	-0.407	-2.1	-0.418	-2.1
Δ age	0.022	3.5	0.021	3.5	0.022	3.6
Δ foreigner	2.132	4.1	2.142	4.1	2.157	4.1
Δ small <20	1.129	2.5	1.112	2.4	1.136	2.5
Δ medium 20-100	1.116	2.4	1.147	2.5	1.128	2.4
Δ net firm	0.188	1.8	0.191	1.8	0.172	1.6
Δ turnover	0.225	7.8	0.227	7.8	0.225	7.7
Δ employment	2.17	0.7	2.333	0.8	2.202	0.8
Δ value added	0.042	1.12	0.041	1.3	0.036	1.2
Δ unemployment	-0.012	-2.2	-0.010	-1.7	-0.013	-2.2
Δ strikes	-0.095	-0.16	-0.037	-0.28	-0.100	-0.7
Δ unionization			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 well¹². 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 at 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.

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.

**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. Δ Log wage differential by branch and region						
Δ female	-0.428	-2.2	-0.360	-1.8	-0.400	-2.0
Δ age	0.022	3.5	0.022	3.5	0.022	3.4
Δ foreigners	2.132	4.1	2.322	4.3	2.120	4.0
Δ small	1.129	2.5	1.256	2.7	1.157	2.5
Δ medium	1.116	2.4	1.160	2.4	1.208	2.5
Δ net firm	0.188	1.8			0.197	1.8
Δ turnover	0.225	7.8			0.229	7.8
Δ employment	2.169	0.7			2.460	0.8
Δ va	0.042	1.4	0.033	1.0	0.032	1.0
Δ unemployment	-0.012	-2.2	-0.014	-2.3	-0.010	-1.7
Δ strikes	-0.095	-0.7	-0.084	-0.6	-0.072	-0.5
Δ unionization						
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 (0.0001)		3.32 (0.0002)	

The three variables, changes in net firm creation, the turnover rate and the importance, in terms of size, of the cell could be affected by the changes in trade openness and also by technology. Therefore, 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 only between the change in exports and the change in net firm creation but it was very weak, while in the latter case there were no differences emerge in the results for tests with or without the relocation variables.

Different combinations of checks are also 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 changes in technology are adopted. Given that the time dummies and the time trend have no significant effect, a sector time trend (column 4) and different kind of intercepts - which are a better check for the different technological characteristics of the sector- were tried; but neither the Pavitt intercept (column 1) which orders the sector according to the

technological innovation content¹³ nor the distinction in Traditional; Scale and High tech. Sectors¹⁴ (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 obtained 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 white collar wages? To analyse the effect of all the different kinds 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 our 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 the 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 collar workers is not upgrading but is passing 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 kind of technological sectors, or simply the sectorial dummies, are never significant while the time dummies are significant and have a negative sign.

The blue collar equation gives different results. As in the case of white collar workers, 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 indifferent 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 stronger where wage growth is smaller. Imports and exports play a positive role on manual wages and, as said above, 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 the different combinations of the trend variables were never significant before, because the two components non manual and manual wage both have a negative trend.

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

¹⁴ Sectors 1 Energy, 7 Food and 8 Textiles are classified as Traditional; Sectors 2 Metals, 3 Non-metal products, 6 Vehicles 9. Newsprint and editorial products are classified as Scale sectors; Sectors 4 Chemicals and 5 Metal products and machinery as High tec; and sector 10 Wood and rubber as specialization.

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 identify the effect of imports and exports on each group of workers. Other authors who had data for individual firms (Manasse et al., 2004) do not check for changes in the composition of the workforce nor for import penetration. Further, the institutional variables were not 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. ΔLog wage differential by branch 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
Δnet firm	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
Δunemploy.	-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 ^o	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 ^o					0.0009	0.06		
Hightech specialization					-0.009	-0.51		
					-0.023	-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)

^oThe 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 Chemicals and 10, 5 Metal products and machinery 3.42, 6 Vehicles 3, 7 Food 1, 8 Textiles 1, 9.Paper and Publishing sector 3.14, 10 Wood and rubber 3.

°Sector 1 Energy, 7 Food and 8 Textiles are classified as Traditional; Sector 2 Metals, 3 Non-metal products, 6 Vehicles and 9 Papers and Publishing are classified as Scale sectors; Sector 4 Chemicals and 5 Metal products and machinery as High tech; and sector 10 Wood and rubber as specialization.

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

Variable	Param.	t Value	Param.	t Value	Param.	t Value	Param.	t Value
Dep Var. ΔLog wage differential by branch 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
Δnet firm	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			-0.001	-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 regarding workers together with industry and regional data to study the dynamics of wage differentials between skilled and unskilled workers in Italy during the period 1991-1996. Even though our analysis covers only a few years, this period was characterised by changes which had 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 rapid export growth following the devaluation of the Italian Lira.

Different to previous empirical studies, this data enable us to explore within 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 a worker's individual characteristics, changes in the institutions of the labour market, skill-biased technological progress, and increasing international integration.

First, our results show that international integration, both in terms of trade in goods and in terms of international labour mobility, plays a role in determining 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, through its effect on the wages of unskilled workers. 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 white collar wages, supporting the idea that Italy is atypical with respect to other industrialised countries and has a comparative advantage in low-skilled labour-intensive production. As for imports, the effect has the opposite sign: it is positive on the wages of the unskilled workers and negative on the wages of skilled workers.

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

These conclusions emerge more clearly when our analysis is widened to investigate not only the wage differentials, but also white and blue collar wages separately. In fact, it is shown that the analysis of the wage differential hides the different effects on the 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 pays out 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 benefits¹⁵; 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 has 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, the justice, the armed forces 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, the 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

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 "depressed" areas, etc.). Items (iv)-(vii) are broken down into 4 occupational groups (manual and non manual workers, cadre and managers, apprentices), as well as taking account of part time and other special work contracts.

the employer's details (code of economic activity, total number of employees) are then associated to the employee¹⁷.

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 economy¹⁸.

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 collar workers. Of course there are more blue collars in the manufacturing sector alone than in the dataset for the private service sector.

The textiles 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 these 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	Sectors	Manufact. %
Female		30.75%	1 Energy	3.38%
Male		69.25%	2 Metals,	2.68%
Age			3 Non-metal products	5.85%
-20		1.47%	4 Chemical	4.78%
21-25		13.41%	5 Metal products and machineries	35.12%
26-30		18.45%	6 Vehicles	5.44%
31-35		17.02%	7 Food	7.81%
36-40		13.50%	8 Textile	18.07%
41-45		12.24%	9 Papers and editorial products	4.59%
46-50		13.33%	10 Wood and rubber	12.30%
51-60		9.98%	Geo. areas	
61+		0.60%	North-West	39.86%
Firm Dimension			North-East	27.39%
1-5		8.80%	Center	17.09%
6-9		7.18%	South	15.67%
10-19		14.13%	Skill	
20-49		17.17%	Blue	72.8%
50-99		10.69%	White	27.2%
100-199		9.25%		
200-499		10.07%		
500-999		5.59%		
1000 +		17.12%		

Table 4.a Correlation between trade variables and relocation proxies

	$\Delta_{openness}$	Δ_{imp}	Δ_{exp}
Δ_{firm}	0.043	-0.011	0.099 **
N. obs	997	997	997
$\Delta_{turnover}$	0.002	-0.006	0.016
N. obs	984	984	984
Δ_{employ}	0.003	0.001	0.005
N. obs	998	998	998
** Prob > r under H0: Rho=0 <1%			