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

Abstract

In this paper we use individual micro data on workers combined with industry and regional data to study the dynamics of the wage differentials 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 many of 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, increasing international integration and skill-biased technological progress.

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 (white collar) and unskilled (blue collar) 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. In addition, in line with the research in labour economics, our findings show that the individual characteristics of workers matter in explaining wage differentials: the growth of women participation in the labour market reduces the wage gap, while the ageing of the employees increases it.

JEL Classification: J31, F16

Keywords: Wage differential, individual characteristics, international trade, international migration.

1. Introduction

The impact of increasing international integration on the labour market, particularly on the wage differentials between skilled and unskilled workers, 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 rising wage 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 their lower wages.[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 individual characteristics in explaining the wage differentials.[3]

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 productions, "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.

[1] See for a survey, among others, Haskel (2000), and Feenstra and Hanson (2001).
[2] See, among others, Machin and Van Reenen (1998) and Berman et al. (1994).
[3] See Dell'Aringa and Lucifora (1994), Erikson and Ichino (1995), Lucifora (2000), Baccaro (2000), Cappellari (2000), Cipollone (2001).

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 (white collar) and unskilled (blue collar) 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 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 the 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, plays a role in determining the wage differential between skilled and unskilled

[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) using a large panel of manufacturing firms.

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, immigration 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 matter in explaining the wage gap between skilled and unskilled workers: the growth of women participation in the labour market reduces the wage gap, while the ageing of the employees increases it.

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 empirical model and the variables used are analysed. Section 4 presents the estimation results and section 5 offers some conclusions.

2. Data and stylised facts

The information on skilled (white collar) and unskilled (blue collar) workers that we are using in this paper has been derived from the INPS (Italian Social Security Institute) Archives. The Archives include data both on employees (individual characteristics and employment information) and on firms (see the Appendix for a detailed description). As for the Italian case, the INPS Archives are one of the few sources to get clear cut information on the white/blue collar wage differential and have the important advantage of covering firms of all sizes. In fact, the only other data set available comes from the ISTAT (Italian Statistical Institute) series "Economic accounts of the manufacturing firms" covering firms with more than 20 employees, thus excluding something like 30% of total employment in Italian manufacturing industry. As in previous researches (i.e Manasse et al., 2004), in this paper only blue collar and white collar workers are considered and used as proxies of skilled and unskilled workers.[6] 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 wage (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).

Figure 1 shows, for the years 1991 to 1996, the blue and white collar wage trends and the wage differential (all in logs). Both white and blue collar wages increase, with the former increasing more than the

[6] The INPS Archives include also the category of the managers. However, 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.

latter. As a result, the total wage differential rises a bit after 1994. 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.

Many changes however took place during this period which could help to explain this trend. There were at least three important transitions in the labour market. Firstly, Italy becomes 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 Figure 2). Secondly, 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 tend to increase the wage differential between skilled and unskilled workers; 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 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 Figure 3 where it can be seen that the wage differential is quite 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. As for trade union membership, it 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 may help to explain 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 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 Lombardy is the most conflicting region, but other regions experienced peaks of conflicts in the period under analysis. Both indicators - trade union membership and strike pattern - are expected to have a negative effect on wage differentials: trade unions are assumed to protect the unskilled workers more and strikes are more frequent among the blue collars. However this assumption is not always confirmed.

There are many other variables which might affect the wage differential as for instance firms' characteristics in terms of size, industry and so on. Figure 4 shows how strong and stable the relationship between a firm's size and the wage differential is. But the figure also suggests that the growth of a firm's size changes the average wage differential.

In addition to the workers' and firms' characteristics and the role played by labour market institutions, increasing international integration has been pointed out as a possible source of the widening wage gap between skilled and unskilled workers. Under this respect, the period covered by our analysis is particularly interesting being characterised by the growth of trade flows following the devaluation of the Italian Lira in 1992 (Figure 5). Thus, in the Italian case, trade could be an explanatory variable for the growth of the wage differential a year after the Lira depreciation. But of course the possible effect of the trade variable will be different in the various sectors according to their openness. As preliminary evidence, Figure 6 shows the changes in an industry's degree of openness (measured as exports plus imports over value added) and the corresponding changes in the white-blue collar wage differentials. A clear relationship does not emerge; however for a number of sectors it seems that a high degree of openness is associated to a large increase in the wage gap. Even more heterogeneous it seems the picture presented in Figure 7, where the changes in the degree of openness at the territorial level (regions) are related to the corresponding changes in the wage differentials. The analysis at the territorial level is justified by the well known 'dualistic nature' of the Italian economy, with regions in the North historically more developed than regions in the South. Again there is not a clear cut pattern between trade openness and wage differentials between skilled and unskilled workers, thus a more specific analysis has to be done, one which can check for all these factors together.

3. The empirical model

The aim of this paper is to investigate whether the growth of the wage differential between skilled and unskilled workers is explained by changes in the individual characteristics of the workers, changes in the labour market institutions and increasing international integration, both in terms of trade in goods and of labour mobility.

The dependent variable of our empirical model - the growth of the wage differential between white and blue collar workers - cannot be computed at an individual level, but only at a group level. Thus the analysis should be made at a higher level of aggregation. From the discussion presented in the previous section it would appear to be appropriate to check for both region and industry dimension. Therefore, the *joint region and branch dimension* has been chosen and all the variables used in the empirical analysis have been aggregated at the corresponding level.

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 the white collar share of total 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 collar employment over total employment first used by Berman et al. (1994) and Machin (1996), white collar growth is split up into two components. The *between* component which shows by how much the

change in the white collar employment share is due to shifts in employment shares between 'cells' with different proportions of white collar employment; and the *within* component which shows by how much the change in white collar employment share takes place within each 'cell':

$$\Delta S_w = \underbrace{\sum_i \Delta S_i \overline{S_{wi}}}_{\text{Between}} + \underbrace{\sum_i \Delta S_{wi} \overline{S_i}}_{\text{Within}}$$

i = region and branch 'cell'

S_w= white collars share of total employment

S_i= share of employment in the 'cell' i[7]

S_{wi}= white collars share of employment in the 'cell' i

Table 1 shows a general growth in the white collar employment share. In particular, the growth is all *within*, while the *between* component is negative. This means that the growth is due to changes in the proportion of white collar workers within each 'cell', rather than to the reallocation of the workforce towards 'cells' with different skill-intensity. Moreover, also grouping the sectors according different characteristics of interest, we find that the within 'cell' component is dominant both for the low and high wage differential sectors, and for the less and more open to trade sectors. Interestingly enough, the within component is particularly strong for the sectors more open to trade. Thus, the analysis at the branch-region dimension seems to be appropriate if we want to understand the relationship between white collars and blue collars wages.

3.2 The model and the variables

For each 'cell' given by the joint region (r) and branch (s) of the manufacturing sector, the white collar (1) - blue collar (2) wage differential is defined as below

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

r =1,…,20 s =1,…,10

[7] A bar over a term denotes a mean over time.

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: changes of average characteristics of the workers (X), changes of the structure of production (F), changes of the macro economic or the institutional variables (Y), changes of the degree of openness to trade (T), and proxies for the technological progress.

The baseline equation estimated in our analysis is the following:

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

With this model an attempt has been made to capture in a unique framework the role of many of the factors indicated in the literature as possible causes of the widening of the wage gap between skilled and unskilled workers. In addition to the more trendy trade variables and changes in technological progress, allowance has been made for the composition of supply. Individual characteristics and institutional factors which change the incentives in the hiring and firing of workers are taken into account. At the same time we check for macroeconomic changes and changes in the structure of production. The latter could be the result of adjusting the pattern of production to changes in the trade pattern or to technological changes. Thus a special estimate takes this possibility into account.

Table 2 summarizes the variables used in the empirical analysis. The individual variables, X, in equation (2) 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*), and 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 firms[8] (*Δsmall*); in the share of medium-sized firms[9] (*Δmedium*); in the net creation rate of new firms (*Δnet firm*); in the share of employment of the cell over total employment (*Δemployment*); and in the turnover rate[10] (*Δturnover*). The institutional and macro variables, Y, represent the changes between t and t' in the value added by branch and region (*Δvalue added*); in the unemployment rate by region (*Δunemployment*); in the hours lost because of strikes by "3 branches" and by region (*Δstrikes*); and in the unionization rate by region (*Δunionization*). The trade variables, T, measure the change between t and t', by branch and region, in the share of imports over value added (*Δ_imp*); in the share of exports over value added (*Δ_exp*); and in the openness of the cell over value added (*Δ_openness*). [11] 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 introduced, as a Pavitt index of technological change, alone or interacted with time dummies, an intercept which

[8] Firms with less than 20 employees.
[9] Firms with employees between 20 to 100.
[10] Annual inflow plus outflow of employment.
[11] Imports plus exports over value added.

is able to distinguish between sectors with different propensities to innovate. Finally, sector dummies interacted with a time trend are used.

4. Results

Table 3 shows our first results. The individual variables have the expected sign and are always significant; the growth of female in the labour market reduces the wage differential because women are either in skilled low wage jobs or in unskilled 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.

As for the variables controlling for the structure of the production system, blue collar 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. The macro variables - changes in value added and changes in the unemployment rate – are, in the former case, not significant even if there is the expected sign; in the latter case, they 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 in our regression. 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; net firm creation is almost significant indicating that new firms increase the wage differential.

Turning to the trade variables, Table 3 shows that export growth 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 change in the degree of trade openness (imports plus exports over value added) has a negative significant role as well[12]. Area and time dummies are also included, but they are not significant.

Tables 4 and 5 continue our analysis. In Table 4 a closer look is taken at the role played by the firm or 'cell' specific variables and in Table 5 the proxies used to capture technological progress are analysed.

The three variables - changes in net firm creation, 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 A2 in the Appendix), and secondly by eliminating them from the equation, columns 2 of Table 4. In the former case the Pearson correlation test shows a significant and positive correlation only between the change in exports over value added and the change in net firm creation, but it was very weak, while in the latter case no

[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.

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 columns 1 and 2; time, region and sector dummies in columns 3), but none is significantly different from zero.

In Table 5 different proxies for changes in technology are adopted. Given that the time dummies 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 sectors - were tried. Neither the Pavitt intercept (column 1), which orders the sectors 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 with the time trend was implemented with no better results (column 2). Fundamentally the log wage differential does not seem to 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 blue collar wage increases in an active manual refining process or do imports of high skilled content reduce the growth of white collar wages? To better analyse the effect of all the different kinds of variables - individual, firm, institutional, macro and international -, it was decided to run the wage growth regression for blue collar and white collar workers separately.

Table 6 provides some very interesting results and answers of our questions.[15] First, looking at the white collar equation, the increase in the female employment reduces white collar 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 firms. 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 slightly significant with a negative sign, while changes in the share of exports over value added are not significant even though they have a positive sign. The dummies which try to capture the technological characteristics of sectors 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 wage, changes in the share of female workers reduce the wage increases of blue collar workers while their ageing increases their wage.

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

[14] Sectors 1 'Energy', 7 'Food' and 8 'Textiles' are classified as Traditional; sectors 2 'Metals', 3 'Non-metal products', 6 'Vehicles' and 9 'Paper and editorial products' are classified as Scale Intensive sectors; sectors 4 'Chemicals' and 5 'Metal products and machinery' as High Tech; and sector 10 'Wood and rubber' as Specialization.

Foreigners, being manual workers and being among the less skilled manual workers, reduce blue collar 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 blue collar 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 blue collar 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 blue collar wages and, as said above, the dummies capturing the technological characteristics of sectors are not significant, while the time dummies are very significant and have a negative sign.

These results shed light on previous findings 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 white collar and blue collar wages both have a negative trend.

A clear and different effect of trade is revealed: 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 (however, in both cases the effect is very small). These results are unusual for the Italian empirical literature where, given the different nature of the data used, it is not possible to identify the effect of imports and exports on each group of workers.

5. Conclusions

In this paper we use individual micro data on 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 the rapid export growth following the devaluation of the Italian Lira.

Different to previous empirical studies, our data enable us to explore within a unique framework the role of many of the factors indicated in the literature as possible causes of the widening of the wage gap between skilled (white collar) and unskilled (blue collar) workers: changes in a workers' individual characteristics, changes in the institutions of the labour market, skill-biased technological progress, and increasing international integration.

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

[15] The two separate estimates also use specific individual variables for the two groups, namely sex and age, and also turnover rate.

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. 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 gap hides the different effects on the white and blue collar wage dynamics of the explicative variables. 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 is positive on the wages of the unskilled workers and negative on the wages of skilled workers (however, in both cases the effect is very small)..

Finally, in line with the research in labour economics, our findings show that workers' 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.

Data Appendix

The data set used in this paper is derived from the INPS (Italian Social Security Institute) Social Security Archives. 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 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[16]; and the second (DM10M), monthly data on firms with employees filled in by the employer (payments of social security contributions)[17]. 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 the employer's details (code of economic activity, total number of employees) are then associated to the employee[18].

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[16] 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 labour 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).

[17] 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.

[18] 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);

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[19].

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 so relevant for an analysis on the effect of trade flows and technology. In addition, of this dataset we use only the section more exposed to 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.

- firm's location, dates of enrolment and cancellation;
- monthly number of employees in the firm, by occupation;
- annual wage bill, by occupation.

[19] 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	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 Size	
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	Manufacturing %
1 Energy	3.38%
2 Metals,	2.68%
3 Non-metal products	5.85%
4 Chemicals	4.78%
5 Metal products and machineries	35.12%
6 Vehicles	5.44%
7 Food	7.81%
8 Textiles	18.07%
9 Papers and editorial products	4.59%
10 Wood and rubber	12.30%
Geographical areas	
North-West	39.86%
North-East	27.39%
Centre	17.09%
South	15.67%
Skill	
Blue collar	72.8%
White collar	27.2%

Table A2 - Correlation between trade variables and relocation proxies

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

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Table 1 - Change in the share of white collar employment by regions and sectors Between and Within components (1991-1996)

		I			II	
		share white collars		Δ share white collars	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 sectors are: Chemicals, Metal products and machineries, Food, Textiles, Wood and rubber.
*Low differential sectors are: Energy, Metals, Non-metal products, Vehicles, Paper and printings.
°More open to trade sectors are: Metals, Chemicals, Metal products and machineries, Vehicles.
°Less open to trade sectors are: Energy, Non-metal products, Food, Textiles, Paper and printings, Wood and rubber

Table 2 – The variables

Variables	**Source**	**Level of aggregation**	**Mean value**
Δlog wage differential	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
Δfemale	Panel INPS	Branch and Region	0.0024
Δage	Panel INPS	Branch and Region	0.1564
Δforeigner	Panel INPS	Branch and Region	0.0017
Δsmall	Firm archive INPS	Branch and Region	-0.0015
Δmedium	Firm archive INPS	Branch and Region	0.0009
Δlarge	Firm archive INPS	Branch and Region	-0.0003
Δ net firm	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 accounts	Branch and Region	1.0585
Δunemployment	ISTAT Labour force survey	Region	0.2700
Δstrikes	ISTAT	Macro branch and region	0.0137
Δunionization	Unions data	Region	-0.1200
Δ_imp	ISTAT International trade accounts	Branch and Region	0.0156
Δ_exp	ISTAT International trade accounts	Branch and Region	0.0859
Δ_openness	ISTAT International trade accounts	Branch and Region	0.1015

Table 3 – Log Wage Differentials White and Blue Collars, 1991-1996

Dep. Var.: ΔLog wage differential by branch and region						
Variables	Param.	t Value	Param.	t Value	Param.	t Value
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	1.129	2.5	1.112	2.4	1.136	2.5
Δmedium	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
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_openness					-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	
No. obs.	936		936		936	
F-value	6.57	(0.0001)	6.38	(0.0001)	6.77	(0.0001)

Table 4 - Log Wage Differentials White and Blue Collars, 1991-1996
With and without relocation proxies and sector dummies

Dep. Var.: Δ Log wage differential by branch and region						
Variables	Param.	t Value	Param.	t Value	Param.	t Value
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
Δnet firm	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
Δvalue added	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
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	n.s.	Yes	n.s.	No	
Time dummies	Yes	n.s.	Yes	n.s.	Yes	n.s.
Regional dummies	No		No		Yes	n.s.
Sectorial dummies	No		No		Yes	n.s.
N.obs	936		936		936	
F-value	6.64	(0.0001)	4.58	(0.0001)	3.32	(0.0002)

Table 5 - Log Wage Differentials White and Blue Collars 1991-1996
With proxies for the technological progress

Dep. Var.: ΔLog wage differential by branch and region								
Variable	Param.	t value	Param.	t value	Param.	t value	Param.	t value
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	1.14	2.56	1.11	2.45	1.14	2.56	1.17	2.5
Δmedium	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
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		
High Tech					-0.009	-0.51		
Specialization					-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)

◦The Pavitt dummy is obtained giving to each sector an ordering value. Sector 1 'Energy' has been given the value 1, sector 2 'Metals' the value 2.94, sector 3 'Non-metal products' the value 2.77, sector 4 'Chemicals' the value 10, sector 5 'Metal products and machinery' the value 3.42 , sector 6 'Vehicles' the value 3, sector 7 'Food' the value 1, sector 8 'Textiles' the value 1, sector 9 'Papers and editorial products' the value 3.14, sector 10 'Wood and rubber ' the value 3.

▫Sectors 1 'Energy', 7 'Food' and 8 'Textiles' are classified as Traditional; sectors 2 'Metals', 3 'Non-metal products', 6 'Vehicles' and 9 'Paper and editorial products' are classified as Scale Intensive sectors; sectors 4 'Chemicals' and 5 'Metal products and machinery' as High Tech; and sector 10 'Wood and rubber' as Specialization.

Table 6 - Log Wage White and Blue Collars, 1991-1996

Dep. Var.: Δ Log wage by branch and region								
Variable	Param.	t Value	Param.	t Value	Param.	t Value	Param.	t Value
	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	0.12	0.4	0.12	0.4	-0.57	-3.47	-0.58	-3.58
Δmedium	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		
High Tech	-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	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	

Figure 1 - Blue collar wage, white collar wage and wage differential in Italy (in logs)

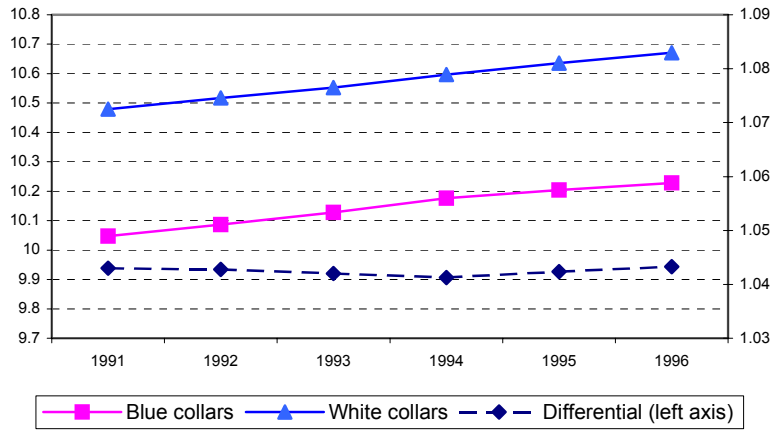


Figure 2 - Share of foreign workers over total employment

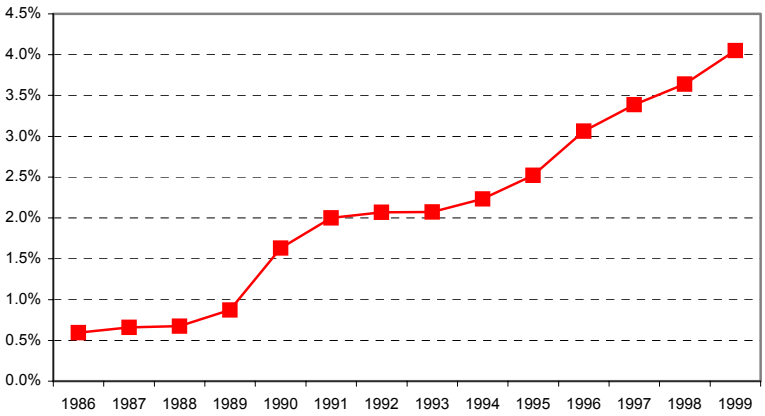


Figure 3 – Wage differential white-blue collars by age groups (in logs)

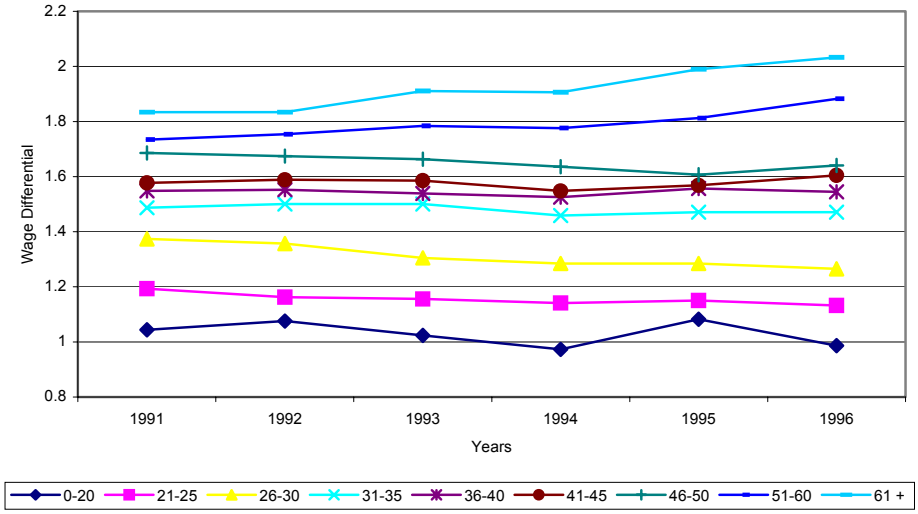


Figure 4 - Wage differential white-blue collars by firm size (in logs)

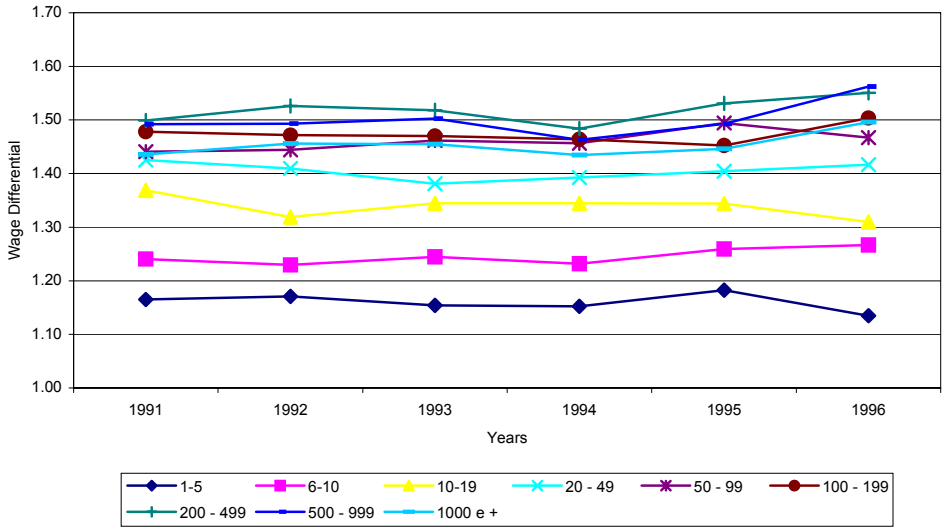


Figure 5 - Import and Export Flows over Value Added (% shares)

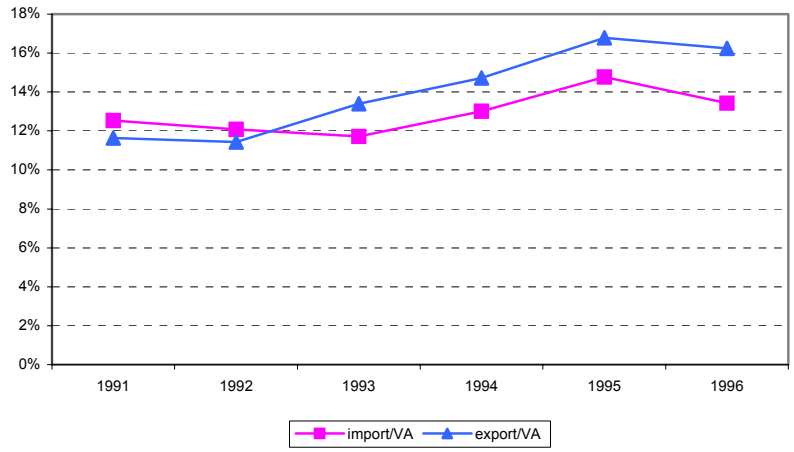


Figure 6
Changes in White-Blue Wage Differential and in the Degree of Trade Openness by Industry, 1991 - 1996

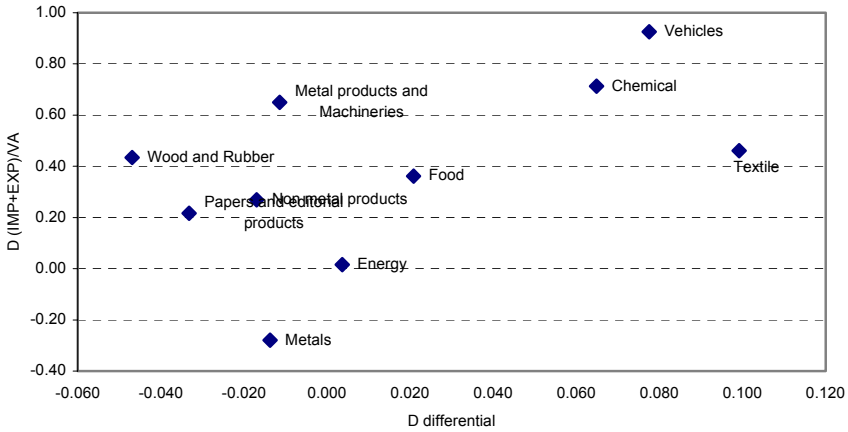
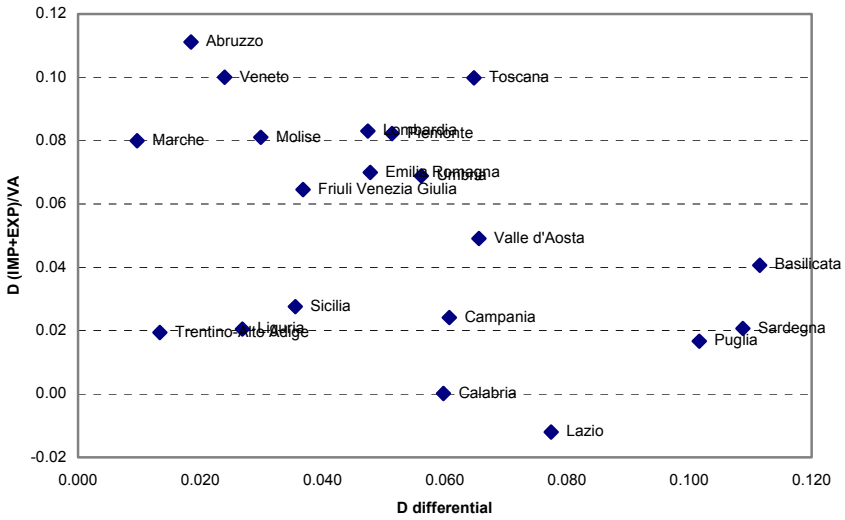


Figure 7
Changes in White-Blue Wage Differential and in the Degree of Trade Openness by Regions, 1991-1996



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