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TRAINING BY FIRMS IN ITALIAN REGIONAL LABOUR MARKETS: THE EFFECTS OF EDUCATION AND UNEMPLOYMENT

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Abstract

This paper analyses the determining reasons of the differences among the Italian regions in matter of investment in workers' training. Training incidence in Italy is not homogeneous among regions, with a lower intensity in the South. Two not alternative explanations are proposed at a theoretical level and tested by econometric estimates, referring to the complementarity between education and training and to the effects of regional unemployment. Both hypotheses, as the results show, are upheld by empirical estimates, based on the *European Community Households Panel*. In our results educational level appear to be important as it affects the choice made by the firm of *which workers* to offer an opportunity of training, whereas unemployment rate and wage compression affect the decision of *how many workers* to train. The unemployment effect found out by this paper confirms that, as it has been pointed out by most recent developments of human capital literature, the firms incentives to pay for general training depend on the level of wage compression. Notwithstanding it represents an original result as compression in this model doesn't depend on institutional factors, as usually assumed in the literature, but on the dependence of unskilled wage on regional unemployment.

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Giuseppe Croce and Emanuela Ghignoni[*]

1. Introduction

This paper analyses the determining reasons of the differences among the Italian regions in matter of investment in workers' training. In particular, training provided to employed workers is considered as distinguished from education. As we show afterwards, training incidence in Italy is not homogeneous among regions, with a lower intensity in the South. Two hypotheses are considered in this paper which can attempt to explain these differences.

The first hypothesis considers that workers' training levels depend positively on their educational levels. Complementarity between education and training is founded on the idea that knowledge obtained through education facilitates learning and helps to valorise the further skills acquired on the job (Rosen 1976, Brunello 2001, Ariga and Brunello 2002). Even

though this effect results to be relevant, it is not sufficient to explain the differentials in training among the Italian regions. Therefore further explicative factors must be considered. The second hypothesis we formulate assumes that training can depend on the regional labour market conditions as well. We verify if and in which way the structural differences among regional labour markets weigh on training investments. The mechanism we formalize in the model, assumes that the unemployment of unskilled workforce influences the wage structure, downward pressing the unskilled wage and, consequently, widening the unskilled/skilled wage differential. Through this channel, labour markets conditions impinge on the firms incentives to train. In short, unemployment can hold down the private training investments. This hypothesis is based on the most recent results of literature on training in imperfect labour markets (Acemoglu and Pischke 1998, Stevens 1994 and 1996, Booth and Bryan 2002) and constitutes an original application to the Italian case. Both hypotheses, as the results show, are upheld by empirical estimates, based on the *European Community Households Panel*. The results demonstrate that both the workforce characteristics and the conditions of regional labour markets – in addition to other likely factors, as industrial and technological structure of the economy - are relevant in determining training investments. The differences in the regional training policies should be considered as well, however, given the common institutional framework, we may think that they have less weight in a cross-region analysis than in a cross-country one.

In the second paragraph the model is presented, while in the third one we show some empirical evidences on training activities, education and

unemployment levels in Italian regions. In the fourth paragraph the results of econometric estimates results are reported and discussed. At last some implications are pointed out in the fifth paragraph.

2. A model of training incidence in regional labour markets with different educational levels and unemployment rates

The model presented in this section shows a mechanism which determines different training incidence rates in regions with not homogeneous workforce and unemployment rates. It analyses training offered by firms and the choice they make of *how many* and *which* workers to train. Recent studies on human capital prove that firms pay for general training (see Acemoglu and Pischke 1998, Stevens 1996 and the review in Croce 2004) because of labour market competitive imperfections broadly due to institutional factors. So scholars have compared countries with different labour market and training institutions. Institutional explanations can have a not negligible role also in a cross-region analysis in Italy. However, given the common institutional framework, we need to inquire into further explanatory economic factors. In particular, this paper considers the role of the workforce educational levels and that of the regional unemployment rates. A higher level of education provides polyvalent knowledge requested to foster learning abilities and a better exploitation of skills gained by training. Scholars have already pointed out complementarity between education and training. Brunello (2001) and Ariga and Brunello (2002) observe that there is technical complementarity between them when a higher level of education increases training

productivity. In this paper we introduce a simple specification of worker's productivity in which this condition is satisfied and demonstrate that the individual educational level is a major indicator adopted by firms in order to select the workforce to whom offer training. A worker is defined *skilled (unskilled)* when he has been trained (or not) in a firm when in employment, apart from his educational level. Unemployment rates are assumed to be different across regions and heavily concentrated on *unskilled* workers. Both these hypotheses, as shown in the following paragraph, are realistic if compared with the Italian situation. In this model the regional unemployment level, weighing upon unskilled workers' wages, determines the unskilled/skilled wage differential, on which the willingness of firms to invest in training depends. Therefore, while in the original theory of human capital unemployment depresses workers' investments in general training, in this model unskilled workers' unemployment is relevant for firms investments. De Paola and Scoppa (2001) as well consider the firms choice in matter of training depending on the unemployment level. They do have a different perspective, however, as they consider the case of skilled workers' unemployment and analyse its effects on the choice between internal training and external recruitment of skilled workers. Whereas we assume that unemployment of skilled workforce (that is workers with professional background and expertise), contrary to the unskilled workforce unemployment, is a relatively limited phenomenon. Empirical evidence suggests the existence in Italy of wide skill shortages. This is moreover coherent with the analyses on the effects of the technological change. These argue that the diffusion of new technologies has increased the demand of

skilled labour causing, as a consequence, a widening of the wage differentials in the US economy and an increase of unskilled unemployment in the continental European countries, characterized by a lesser wage elasticity. In such a situation it is not an easy task for firms to recruit skilled workers because of the relative lack of them in the labour market. In these conditions the firm can hire unskilled workers and has to choose whether employ them as they are or train them.

2.1. Model set up

The firm can employ both unskilled and skilled workers. They are substitutes but the skilled workers are more productive than unskilled ones. For the sake of simplicity, we assume that there are constant returns to scale. Firms are assumed to be identical. Two periods are considered omitting time discounting to simplify.

Hypothesis 1. We do not consider, in this model, the chance of recruiting skilled workers, so that the firm can hire only unskilled workers. At the beginning of the first period every firm hires the same number *N* of employees. Labour supply is inelastic. The company can offer each worker either a job without or with training: therefore the firm must decide how many and whom offer a job with training. The worker may accept or refuse the firm offer. In case of refusal the firm is ready to employ him as unskilled.

Hypothesis 2. The human capital acquired by training is of a general kind and it is indivisible, so that it always values 1 in case of training or 0 without it. Following Acemoglu and Pischke (1998), we assume that direct costs for training are borne by firms because of a credit constraint that

prevents employees to overburden them. However the worker bears indirect costs, corresponding to the lost wage in the training period. Training per capita direct cost is constant, equal to $c > 0$.

Hypothesis 3. Workers' productivity depends not only on their endowment of human capital – acquired through training and education – but also on the technological characteristics of the jobs. Unskilled workers are employed in unqualified jobs where knowledge acquired through education is useless, so that their productivity equals $a(0)$, independent from education and constant over the two periods.

Hypothesis 4. On the contrary, in case of employment with training, the first period is for training (without output and wage), while in the second one the skilled worker is employed for production purposes. His productivity is equal to $a(1)h_i > a(0)$, where η_i measures the pre-training productivity of the i-*th* worker, positively dependent on his educational level. We assume $h \in \left[h^-; h^+\right]$ with η^- e η^+ respectively equals to the minimum and maximum values of η, that is distributed as the distribution function $F(h)$, where $F(H) = prob(h < H)$. As η directly depends on the educational level, it is perfectly observed by firms. With identical firms recruiting in the regional labour market, the distribution of the workforce pre-training productivity levels is the same in every one of them.

Hypothesis 5. Unskilled wage is determined in labour market as a negative function of the unemployment rate. The labour market imperfections cause an equilibrium unemployment u of unskilled labour,

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with their wage given by $\hat{w}(u)$, with $\hat{w}' < 0$ and $\hat{w}'' > 0$ (Blanchflower and Oswald 1994)[1].

Hypothesis 6. The wage paid to the skilled worker in the second period is $w_i(1) > \hat{w}(u)$. Moreover, as in Acemoglu and Pischke (1998) we make the hypothesis that $\boldsymbol{a}(1)\boldsymbol{h}_i > w_i(1)$ from which descends that the firm realizes a surplus when it employs a skilled worker. This represents a necessary but not a sufficient condition for the firm to invest in workers' general training.

Hypothesis 7. At the beginning of the second period the skilled workers quit the firm according to an exogenous turnover rate q. The wage that a skilled worker can gain in an external firm is $v(1)\boldsymbol{h}_i$, with $\hat{w}(u) < v(1)\boldsymbol{h}_i < w_i(1)$.

2.2. The skilled worker's wage

At the beginning of the second period the skilled workers who don't quit the company can one by one bargain the second period wage $w_i(1)$, as their employment gives rise to the surplus $\boldsymbol{a}(1)\boldsymbol{h}_i - w_i(1) > 0$. Bargaining follows, given risk neutrality of the players, the Nash scheme. The firm payoff deriving from the employment of a skilled worker is $\boldsymbol{a}(1)\boldsymbol{h}_i - w_i(1) - \boldsymbol{p}(0) > 0$, where $\boldsymbol{p}(0)$ represents the second period profit if the bargaining fails. As to the worker his payoff is $w_i(1) - v(1)\boldsymbol{h}_i$. The bargained wage results from the first order condition for the maximization of the product

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[1] Even in presence of centralized bargaining institutions, the existence of regional wage differentials in Italy and their sensitivity to regional unemployment cannot be excluded and are objects of debate (see for instance Casavola et al., 1995, and Contini et al., 2000).

$$[\boldsymbol{a}(1)\boldsymbol{h}_i - w_i(1)]^{(1-\boldsymbol{b})}[w_i(1) - v(1)\boldsymbol{h}_i]^{\boldsymbol{b}} \tag{1}$$

where β measures the worker's bargaining power $(0 \leq \boldsymbol{b} \leq 1)$ and $\boldsymbol{p}(0) = 0$ to simplify[2]. The bargained wage is therefore equal to:

$$w_i(1) = v(1)\boldsymbol{h}_i + \boldsymbol{b}[\boldsymbol{a}(1) - v(1)]\boldsymbol{h}_i \tag{2}$$

In this expression training cost is not considered because bargaining occurs when the cost has been already borne. The wage $w_i(1)$ is known by the players since the beginning of the first period and it is also the only credible wage for workers. In fact, if a wage rate above that level would be announced by the firm at the beginning of the first period in order to attract more high-productive workers, they would consider it unreliable as they anticipate that the firm would be able to refuse to pay a wage exceeding [2] in the second period.

2.3. The firm

At the beginning of the first period the firm must decide which employment offer to each worker, comparing his expected gain in case of training with the one without training. Therefore the following condition can be derived

$$2[\boldsymbol{a}(0) - \hat{w}(u)] \leq (1 - q)[\boldsymbol{a}(1)\boldsymbol{h}_i - w_i(1)] - c \tag{3}$$

where the term on the left of the inequality represents the two periods profit without training while that on the right represents the expected profit with training. [3] represents the necessary and sufficient condition that must be satisfied for investment in general training to be profitable for the firm

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[2] We exclude from the analysis the case of workers' collusion, which would imply a higher workers' bargaining power and different values of the parameters in the bargaining solution.

while, as mentioned previously, $\boldsymbol{a}(1)\boldsymbol{h}_i - w_i(1) > 0$ is only a necessary condition. By substituting [2] in [3] we obtain:

$$\boldsymbol{h}_i \geq \frac{2\boldsymbol{a}(0) - 2\hat{w}(u) + c}{(1-q)(1-\boldsymbol{b})[\boldsymbol{a}(1) - v(1)]} \equiv R \qquad [4]$$

2.4 The worker

Given [4], a worker with a 'low' level of pre-training productivity, that is $\boldsymbol{h}_i < R$, can receive only job offers without training. If he refuses such an offer, he can be hired by another firm in the same period with probability equal to $1 - u$ but, as firms are identical, he would receive a similar offer by whatever external firm, given his level η_i. So the expected gain for the two periods in case of refusal is $2(1-u)\hat{w}(u)$, with zero income in case of unemployment to simplify. Consequently the worker chooses to accept a job without training (even if he would prefer one with training).

When the firm offers a job with training the worker decides whether to accept or not, comparing the expected earnings from a job with or without training, and considering that in case of refusal he could be employed in the same firm as unskilled. So the following condition must be satisfied in order that the worker accepts:

$$2\hat{w}(u) \leq (1-q)w_i(1) + qv(1)\boldsymbol{h}_i \qquad [5]$$

where the term on the left represents the earnings of the unskilled worker, while that on the right represents the expected earnings by the skilled worker, equal to the sum of the internal and external wages weighted by the respective probabilities. By substituting [2] in [5] we obtain:

$$\boldsymbol{h}_i \geq \frac{2\hat{w}(u)}{v(1) + (1-q)\boldsymbol{b}[\boldsymbol{a}(1) - v(1)]} \equiv S \qquad [6]$$

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2.5 How many and which workers are trained

Condition [4] shows that firms offer an employment with training to every worker satisfying the condition $h_i \geq R$ and only to them. Whereas the condition [6] establishes that the workers who accept this offer are all and the only ones for whom the condition $h_i \geq S$ is verified. The percentage of workers who receive an offer of training is therefore given by

$$1 - F(R) = prob(h_i \geq R). \qquad [7]$$

This shows that firms make selective offers of training, choosing people whose pre-training productivity is at least equal to the threshold R. That is the firms prefer highly educated workers to train. As to the workers, the percentage of them aiming at receiving training is equal to

$$1 - F(S) = prob(h_i \geq S) \qquad [8]$$

that includes sufficiently highly educated workers whose pre-training productivity is at least equal to the threshold S.

Finally, the following "global" condition for training can be established, reflecting the fact that the firm must offer training and the worker must accept it in order that it takes place

$$h_i \geq h^* = Max(R, S) \qquad [9]$$

which implies that training incidence rate equates $1 - F(h^*)$.

2.6 Educational levels, unemployment and training by the firms.

The obtained results imply that an increase of workforce educational levels, which means a more concentrated distribution $F(h)$ towards relatively high levels of η, determines, ceteris paribus, a higher value of both $1 - F(R)$ and $1 - F(S)$, that is a greater propensity of firms and

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workers to training. The "global" condition [9] also implies that in all cases in which R ≠ S we have a rationing of training that hits firms or workers depending on the sign of the inequality. From [4] and [6] it is possible to determine the unskilled unemployment rate u^* such that R=S. However, since the unemployment rate is exogenous in this model, this only occurs at random, while $u \neq u^*$ has to be expected. Therefore we may distinguish two cases. In the first we have $u<u^*$ and, consequently, R<S which implies that firms turn out to be rationed in the chance of carrying out their training plans[3]. In the second, we have $u>u^*$ and R>S that implies, on the contrary, a workers' training propensity greater than the firms' one. These two cases of training rationing can usefully stylise the divergence between different regional areas in Italy. The first case, that could be labelled as "North East pattern", shows the situation of many local labour markets of the north-eastern regions, where, in presence of low unemployment rates, the firms find difficult to fill all the positions open to apprentices, because young people consider them scarcely gainful (Frey and others 2003). The second, on the contrary, with high unemployment rates and a lower training activity promoted by firms, could be labelled as "South pattern", as it resembles the situation of southern labour markets.

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[3] A possible implication of the case R<S not developed in this paper, but that is worth to mention, is the following. In this case, if the hypothesis that the bargaining wage is the only credible is removed, the firms could be motivated to increase the skilled wage over the bargained level in order to make training attractive for a greater number of workers. The wage would be determined by the maximization of profits, considering that a higher wage corresponds to a greater number of skilled workers, but also to a lower profit margin for each one of them (an analogous situation is analysed, for instance, by Stevens 1996). The increase of skilled wage, reducing firms incentive to train and increasing the workers' one, would continue up to the level that equalizes R and S so to make their choices coinciding.

On the basis of the obtained results the unemployment effect (u) is not univocal. In fact, [4] shows that a higher u reduces the unskilled wage and makes training relatively less profitable for firms. On the other side, an increase of u and the subsequent reduction of unskilled wage make the training more gainful for workers, as from [6]. So the sign of the net effect of an increase of u on the share of workforce entering training depends on the sign of the inequality between R and S. As long as $R<S$ an increase (reduction) of u reduces (increases) S and causes, ceteris paribus, an increase (reduction) of the regional training incidence rate $1-F(\boldsymbol{h}^{*})$. While with $R>S$ an increase (reduction) of u, reduces (increases) the training incidence through the effect on R.

The unemployment effect found out by this model determines results similar to those by Acemoglu and Pischke (1998), as it confirms that the incentive for firms to pay for general training arises and increases with regard to the level of wage compression. Notwithstanding it represents an original result as compression in this model doesn't depend on institutional factors, as usually assumed in literature, but on the dependence of unskilled wage on regional unemployment.

3. Training, education and unemployment levels: some empirical evidences

The available information shows differences in the quantity of training provided across regions. From the CVTS2 survey, that considers only firms with at least 10 employees, the percentage of training-firms in the South is 15,4%, below the national average of 23,9% (tab. 1). The training gap is wider in services sector, with 13,3% for the South and 24,8% for Italy. In the North-East the training-firms reach the percentage of 27,5% (30,2% in services). The territorial gap in training activities is relevant in all firms sizes, while vanishes only when over 500 employees. Excelsior data confirm this picture, even if on a different scale, due to a larger survey sample (including all firms with at least one employee) and to the more limited kinds of training activities considered (more innovative and less formal activities are excluded). The percentage of training-firms in the South is 9,4% (tab. 2), while the one in North-East reaches 13,2%. The percentages of trained workers on total dependents in all firms reveals similar contrasts between regions.

Table 3 shows education levels in different areas. The relative numbers of upper secondary and tertiary degree on total labour force in the South are below the levels of the Centre, on the same levels of the North-west and above those of the North-east. This evidence suggests that the hypothesis of complementarity between education and training cannot explain the training gap between regions, as North-east and South exhibit similar levels of education and large differences in training incidence rates.

Tab. 1 - Percentage of firms offering continuous training, Italy – 1999

	North West	North East	Centre	South	Italy
Industry	26.1	25.1	19.3	17.0	23.3
Constructions	18.3	31.0	31.4	16.9	23.7
Services	27.6	30.2	23.5	13.3	24.8
10-19 employees	16.2	19.5	16.2	11.2	16.3
20-49 employees	33.5	35.0	25.6	19.9	30.1
50-249 employees	51.8	50.0	50.6	28.8	47.8
250-499 employees	82.4	80.1	76.9	53.9	77.8
500-999 employees	77.9	87.8	79.5	86.1	81.4
More than 1000	95.4	94.0	84.5	90.5	92.7
Total	*25.9*	*27.5*	*22.4*	*15.4*	*23.9*

Source: Eurostat-CVTS2. Various training methods considered, excluded employment-training contracts and apprenticeship.

Tab. 2 - Percentage of firms offering continuous training and percentage of trained workers on total dependents in all firms, Excelsior, Italy – 2000

	North West	North East	Centre	South	Italy
% of firms					
1-9 dependents	10.7	11.3	10.4	8.4	10.3
10-49 dependents	19.8	20.2	15.8	15.0	18.3
50-249 dependents	37.9	38.6	31.7	24.3	34.9
250 dependents and more	85.8	90.7	85.5	91.7	87.8
Total	*12.6*	*13.2*	*11.5*	*9.4*	*11.9*
% of dependents					
1-9 dependents	3.4	3.7	3.4	3.2	3.4
10-49 dependents	5.4	5.3	4.3	5.0	5.1
50-249 dependents	9.5	9.0	8.9	7.3	8.9
250 dependents and more	23.3	25.8	24.0	27.2	24.6
Total	*11.2*	*10.7*	*10.4*	*9.7*	*10.6*

Source: Unioncamere-Excelsior. Excluded employment-training contracts and apprenticeship.

Table 3, in order to draw the attention to the huge differences in labour market conditions, reports the employment and unemployment rates per area. The unemployment rate of the South (27,9 %) results to be more than five times the one of the North-East (4,6%).

Tab. 3 – Educational levels and regional labour markets, Italy - 1999

	North West	North East	Centre	South
Upper second. lev./ labour	30.1%	27.2%	34.1%	30.0%
Tertiary level/labour forces	9.7%	8.1%	11.1%	9.6%
Employment rate	57.8%	58.7%	55.6%	40.3%
Unemployment rate	6.7%	4.6%	9.7%	27.9%

Source: Labour Force Survey, ISTAT, average 1999

Tab. 4 – Unemployment rates by work experience and educational qualifications, Italy, Istat - 1999

Educational qualification	Unemployed				Total
	first job seekers	with work experience	Age £40 years	Age>40 years	
Italy					
Tertiary educ. and more	6.4	2.3	15.3	1.2	*8.7*
Upper secondary education	8.4	5.0	18.1	3.2	*13.4*
Compulsory education	6.2	9.1	21.1	8.4	*15.4*
Total	*7.1*	*6.7*	*19.2*	*5.9*	*13.8*
North-Centre					
Tertiary educ. and more	4.5	2.2	11.3	1.3	*6.7*
Upper secondary education	3.6	3.9	9.9	2.2	*7.5*
Compulsory education	2.1	5.7	10.9	4.5	*7.9*
Total	*3.0*	*4.6*	*10.5*	*3.4*	*7.6*
South-Islands					
Tertiary educ. and more	10.5	2.7	25.9	1.2	*13.2*
Upper secondary education	20.1	7.7	38.1	5.6	*27.7*
Compulsory education	13.5	15.1	38.5	15.9	*28.6*
Total	*15.4*	*11.2*	*37.2*	*11.1*	*26.7*

Source: Labour Force Survey, ISTAT, average 1999

Table 4 shows the prevalent presence of unskilled workers in unemployment in both macro-area. Despite the increase number of temporary contracts, the largest part of unemployed is constituted of first job seekers (7,1% as compared to the 6,7% of unemployed with work experience). As regards the age, which can be considered as a proxy of

experience and expertise, the unemployment rate of people over the age of forty is equal to 5,9 %, compared to 19,2% of those people less than forty, and this difference exists at any educational level.

4. Synthesis of the *probit* estimates results

Data used for the empirical evidence have been drawn from the sixth wave (concerning 1999) of the ECHP Eurostat Survey, dealing with Italy, and from Labour Forces ISTAT survey for the same period. Trying to understand what determines the worker's probability of training *on the job*, a probit model for the training incidence has been estimates as follows:

$$\Pr ob[T = 1] = \boldsymbol{F}(\mathbf{Z'}\hat{\mathbf{a}})$$

where the binary independent variable assumes the following values:

$T = 1$ if the worker have done training on the job

$T = 0$ otherwise;

and where the independent variables $\mathbf{Z}$ explain the worker's personal characteristics, the job position, and the labour market situation in the macro-area where he works[4], $\mathbf{b}$ is a vector of parameters and ϕ is the standard distribution. In order to avoid bias in the estimates, the sample provided by Eurostat has been selected so to consider only workers from 16 to 60 years old, whom, in the considered period, have worked from 15 to 60 hours per week (see Brunello, 2001). The descriptive statistics of the used variables are shown in tab. 5, while probit estimates results are synthesized in schedules 6.a and 6.b.

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[4] See Appendix for the variables description.

Tab. 5 upholds the strong gap among labour markets situation in northern and central region (especially in North East regions) and in southern regions previously shown. Beyond an employment rate 18 terms in percentage higher in North East in comparison with the southern regions (tab. 3), the data of the sample show a different distribution of workers by kind of firm, productive sector and type of employment contract. In particular in the North East there is a lower percentage of workers in firms with over 500 employees (big firm), in the services sector and in the public sector, as well as a higher percentage of individuals with permanent employment.

The lower precariousness of employment in the labour markets of the North East, in comparison with those of the South, is confirmed by the different percentages of unemployed/long term unemployed before current job, while the greater difficulties of southern young people to enter the labour market would be confirmed by the lower general experience, by the higher percentage of employees at their first job and by the smaller percentage of employees with "recent" certificate of education[5].

In the North East regions there is a better occupational condition and higher wage levels, both monthly and hourly, than in the South. Moreover the northern wage distribution is more homogeneous, like is pointed out by the Kaitz index and by the other indicators of wage dispersion[6].

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[5] . For the definition of "recent" certificate of education, see Appendix.

[6] See Appendix for the detail of the used indicators of dispersion. It is useful however to notice that the difference between the median of the incomes distribution of "skilled" and "unskilled" on macro-area level, confirms that investments in human capital could signify for people living in the South a comparatively more efficient means, in comparison with the other regions, to improve their monetary and non monetary work conditions, as already shown by Rossetti, Tanda, 2001 and Ghignoni 2002.

With regard to human capital and training in the two compared macro-areas we see that the average number of years spent in education is lower than the national average both in North East and in South/Islands. This datum, with the other ones described in tab. 3, from which we notice that the percentage of individuals among the workforce with at least an upper secondary degree (or a tertiary degree) is lower in the North East than in Southern Italy, (respectively: 27.2% against 30% for the upper secondary degree and 8.1% against 9.6% for the tertiary degree), confirming that the level of the basic human capital investment is not particularly high in the North-East nor in the South. Although, individuals in the North-East hoard a lower basic human capital, we notice however, that the percentage of employed people who have been in training on the job is definitely higher in the North-East rather than in the rest of Italy and, in particular, in the southern regions (22% against 5.4%).

This fact seems not to be in line with the hypothesis of the complementarity between education and training, now an acquired result by most of the empirical and theoretical literature on this matter (see, among the others, Montanino, 2001; Carillo 2001; Brunello, 2001; Peraita, 2001; Ariga, and Brunello, 2002), at least as to the western developed countries. In this matter, the hypothesis which we try to verify empirically in the following pages is that the training activity supplied by the firms is actually addressed to those most provided with basic human capital individuals, so agreeing with the hypothesis of the complementarity between education and training. But also that, as we shown in the previous theoretical model, the unemployment rates, the wage levels and the different levels of inequality in

the wage distribution have an important role in determining both the firms'
supply and the workers' *training on the job* demand. A summary of the
results of the estimate of the various probit models is quoted in schedules
6.a and 6.b.1-6.b.2.

Tab. 5 – Descriptive statistics (mean or percentage) of sample data

Variables	Macro-areas			
	North West	**North East**	**Centre**	**South-Islands**
Age	36.88	36.41	38.03	39.76
Males	54.7%	54.9%	58.2%	65.3%
Married	62.0%	60.3%	64.7%	71.0%
Generic experience	16.75	17.57	17.37	16.58
Employed at their first job	25.5%	22.3%	22.8%	34.1%
Specific experience	9.35	9.65	9.50	10.71
Unemployed before current job	27.5%	26.2%	33.0%	39.5%
Unempl. for one year/more before current job	14.3%	8.3%	18.3%	28.7%
Years of education	12.24	11.83	12.05	11.93
"Recent" certificate of education	31.7%	30.3%	26.9%	22.4%
Good health conditions	72.5%	74.4%	72.7%	72.8%
Have been in training	15.7%	22.0%	11.1%	5.4%
Monthly wage (thousand of Liras)	2036.22	1948.70	1930.47	1795.50
Hours worked per week	37.95	37.48	38.07	37.14
Hourly wage	13.62	13.28	12.91	12.70
Kaitz Index	0.26	0.40	0.24	0.19
Differential between the median (log) wages of skilled and unskilled workers	0.1790	0.1272	0.1713	0.2472
Difference between 90th and 10th percentile	0.8134	0.7658	0.8049	1.0918
Individuals with permanent employment	88.2%	91.5%	86.8%	76.4%
Employed in firms with more than 500 dependents	11.9%	8.1%	9.9%	9.5%
Employed in the industrial sector	39.0%	35.3%	33.4%	24.1%
Employed in the services sector	57.8%	59.8%	59.9%	64.8%
Employed in the public sector	28.6%	29.8%	29.6%	41.6%
N	*1096*	*614*	*1181*	*1903*

Source: Eurostat 1999. For a wider description of variables see Appendix

To balance the numbers of the explanatory variables with the
numerousness of the reference sample (4794 individuals of which 579 have
already done training) we preferred to limit the number of variables

introduced in the estimates, choosing the   most important ones to test the hypothesis of the shown theoretical model[7].

The education/training complementarity hypothesis seems to be confirmed, since getting training on the job is more likely for the individuals with an upper secondary or a tertiary degree compared to those who have a lower education (see models (a), (e), (f), (g) and (h)). The models (b), (c) and (d), instead of the dummies per degree, consider the average studying years of the individuals and seem to confirm that the probability of receiving training on the job is directly proportional to the basic human capital owned by an individual. Among the variables that describe the personal characteristics of the individual, the dummy "bad health conditions" seems to have a very negative effect on the probability of receiving training. Likely the firms prefer to invest in more "reliable" working people, with less probability of absenteeism. In this way the health is included in the individual "human capital" in a wider sense.

Some of the estimated models show, as Brunello (2001) underlined, that sometimes training on the job could be a "recovery" of the basic human capital depreciation. Actually it seems that the probability of being in training is lower, if not for people who have a recent degree (see model (b)), at least for people at their first working experience (see model (c))[8]. It is interesting to notice how the dummy "first employment" loses significance

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[7] By the way in all the estimated models (see tab. 6) the coefficient of the constant is significant but not so high to make us think to excessive problems of relevant variables' omission.

[8] Actually it is very likely that first job workers are the same who have more recent degrees. In fact when the two variables are included at the same time in the estimates (see models (a) and (d)) they seem to get significance away each other. For this reason in the models (b) and (c) these two variables have been included one by one.

when another dummy that considers the type of employment contract ("permanent employment") is put in the estimate. In fact, from previous empirical researches (see Brunello, 2001) it results that the firms are inclined to privilege the training of permanent workers and that most of the hiring of the individuals at their first labour experience happens with different contractual ways.

Even accepting the hypothesis of complementarity, we should notice how the probability of being trained on the job is really higher for the workers in the North East regions (an area in which the individual basic human capital is not very high) compared with the other Italian regions, especially compared with the Southern ones and the islands (see models (a), (b), (c) and (d)). A similar result is not new in literature. Brunello (2001) maintains that a clear and univocal relationship between the percentage of people in training and the share of people who have high degrees does not exist[9]. Obviously there are other variables that interact with the basic educational level in determining the individuals' and firms' training choice. Trying to clarify, some variables, which describe the local labour markets' situation, have been added in the following models.

The model (e) shows how the introduction of such variables in the estimate causes to the territorial dummies the loss of most of their significance, and let us suppose that they are "screen" variables, which hide the acting of different mechanisms. Then, in the estimate of the models (f),

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[9] For instance, Denmark has a percentage of trained workers at least double in regard to Belgium, as if with a very similar percentage of third level educated individuals. On the other side in Greece a very low workers' share is interested in training, even if the workforce as to education is very similar to the United Kingdom, where the trained workers' percentage is much higher.

(g) and (h) the territorial dummies have been removed and we have considered only the effect on the training probability of the individuals' basic human capital and of the variables that characterize the labour markets at a single macro-area level. Once again, the results confirm the hypothesis of complementarity between education and training, but they stress a very negative influence of the unemployment rate on the training probability and a very positive effect of a lower wage inequality. The variables that summarise the training expense at a local level seem to be of little significance.

The sign of the estimated coefficient for the Kaitz index (see model (e)), agrees with the forecasts of the training models in the imperfect labour markets by Acemoglu-Pischke (1998): according to them the wage compression should increase the firms' convenience to finance training activities for their own workers.

Actually, in spite of the theoretical expectations, the empirical studies on this matter have not reached a univocal result yet.

Among the others, Peraita (2001) refuses that such a relationship is good for Spain[10], while Brunello (2002) and Bassanini, Brunello (2003) maintain that there is a positive relationship between wage compression and training for the European countries.

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[10] But in this case the empirical test results should be upheld further on. It is assumed that, even if in Spain the difference between the 90th and the 10th percentile of logarithmic distribution of the workers' monthly net wage is much lower than the other European countries' one, the most of workers who get training is concentrated in the highest deciles of the wage distribution. It looks like to mean simply that training is concentrated among workers with higher wage levels (and probably training helps to increase the level of skilled workers' wages), and it does not necessarily deny a link between wage structure compression and training incidence.

Tab. 6.a – Probit Estimates (dummies variables in bold)

Variables	Model (a)		Model (b)		Model (c)		Model (d)	
	Coeff. β	t-ratio	Coeff. β.	t-ratio	Coeff. β	t-ratio	Coeff. β	t-ratio
Constant	-0.80424	-3.724**	-1.6107	-18.861**	-1.6376	-18.896**	-1.6397	-18.861**
Individuals characteristics and kind of occupation								
M_Areas								
N-W	-0.28923	-3.893**	-0.29881	-4.058**	-0.29806	-4.048**	-0.29864	-4.056**
Centre	-0.47829	-6.302**	-0.49684	-6.597**	-0.49606	-6.588**	-0.49916	-6.624**
S-I	-0.90900	-11.835**	-0.93043	-12.344**	-0.93129	-12.355**	-0.94120	-12.417**
Male	-0.88E-01	-1.627						
Married	0.152E-01	0.250						
Age	-0.70E-02	-1.651						
Years_Ed			0.740E-01	13.859**	0.718E-01	14.008**	0.733E-01	13.592**
EDU								
E2	10.396	12.304**						
E3	0.62619	10.083**						
Recent	-0.55E-01	-0.684	-0.77E-01	-1.366			-0.54E-01	-0.868
G_Exp	-0.97E-05	-0.094						
S_exp.	0.828E-04	0.719						
Health	-0.16E-02	-3.135**	-0.16E-02	-3.204**	-0.16E-02	-3.200**	-0.17E-02	-3.212**
Hours	-0.32E-02	-0.941						
Public	-0.88E-04	-0.262						
Industry	0.177E-03	0.759						
Big firm	-0.54E-04	-0.173						
Per_emp	-0.40E-04	-0.280					-0.16E-03	-1.201
First job	-0.11E-03	-0.588			-0.11E-03	-1.988*	-0.96E-04	-1.627
Unempl	-0.27E-03	-1.135						
Unemp_1	0.194E-03	1.186						
**: significant at 1%; *: significant at 5%								

Source: Eurostat, Istat, e Isfol 1999, variables description in Appendix

The result obtained by including the Kaitz Index in the estimates is also confirmed by using as regressors 1) the difference between the median of the logarithm distribution of the skilled people hourly wage and the one of the unskilled people (see model (g)) and 2) the difference between the 90° and the 10° percentile of the regional logarithm distribution of the hourly wage (see model (h)).

Moreover, the models (g) and (h) point out how the percentage of the labour force with a secondary school degree in the local labour markets, could influence negatively the training probability. The complementarity

between education and training, should exist at an individual level but, as to the complexity of the involved variables, it could not be valid at an aggregate level.

Tab. 6.b.1 – Probit Estimates, (dummies variables in bold)

Variables	Model (e)		Model (f)	
	Coeff. β	t-ratio	Coeff. β	t-ratio
Constant	-1,1641	-1,878	-1,7465	-4,873**
Individuals characteristics and kind of occupation				
M_Areas				
N-W	0,23315E-01	0,195		
Centre	-0,16281	-1,191		
S-I	-0,62513	-3,696**		
Male				
Married				
Age				
Years_Ed				
EDU				
E2	10,173	12,687**	10,347	12,992**
E3	0,69961	11,479**	0,64318	10,533**
Recent	-0,31259E-01	-0,514	0,31382E-01	0,523
G_Exp				
S_exp.				
Health	-0,85813E-03	-1,851	-0,14419E-02	-2,748*
Hours				
Public	-0,48596E-03	-1,476	-0,21384E-03	-0,655
Industry	0,57808E-03	2,369*	0,22296E-03	1,004
Big firm	0,51843E-04	0,158	0,48773E-05	0,016
Per_emp				
First job	-0,11982E-03	-2,064*	-0,13102E-03	-2,233*
Unempl				
Unemp_1				
Local labour markets				
% E2	-0,51693E-02	-0,366	-0,13198E-01	-1,330
U_rate	-0,97357E-04	-0,015	-0,20655E-01	-4,010**
Kaitz	-1,1856	-1,560	1,6481	3,405**
MedS_medU				
90th_ 10th				
T_exp/empl	-0,67849E-01	-0,246	-0,23887	-0,903
n°_T/empl	0,46383E-02	1,634	0,81527E-02	2,279*
**: significant at 1%; *: significant at 5%				

Source: Eurostat, Istat, e Isfol 1999, variables description in Appendix

However, our estimates seem to confirm the previous theoretical hypothesis.

Tab. 6.b.2 – Probit Estimates, (dummies variables in bold)

Variables	Model (e)		Model (f)	
	Coeff. β	t-ratio	Coeff. β	t-ratio
Constant	-1,7077	-4,909**	0,20122	0,449
Individuals characteristics and kind of occupation				
M_Areas				
N-W				
Centre				
S-I				
Male				
Married				
Age				
Years_Ed				
EDU				
E2	10,251	12,847**	1,041	13,045**
E3	0,64038	10,464**	0,64279	10,523**
Recent	0,33186E-01	0,552	2,66E-02	0,444
G_Exp				
S_exp.				
Health	-0,14799E-02	-2,838*	-1,46E-03	-2,791*
Hours				
Public	-0,20565E-03	-0,638	-1,72E-04	-0,526
Industry	0,22736E-03	1,030	2,22E-04	1,001
Big firm	-0,10992E-04	-0,036	-5,40E-05	-0,174
Per_emp				
First job	-0,13597E-03	-2,317*	-1,43E-04	-2,432*
Unempl				
Unemp_1				
Local labour markets				
% E2	0,26860E-01	2,012*	-2,98E-02	-2,865*
U_rate	-0,35786E-01	-7,334**	-1,67E-02	-2,988*
Kaitz				
MedS_medU	-26,351	-4,570**		
90th_10th			-0,95016	-4,241**
T_exp/empl	-0,22045	-0,889	-0,11926	-0,461
n°_T/empl	0,76186E-02	2,793*	3,17E-03	1,086
**: significative at 1%; *: significative at 5%				

Source: Eurostat, Istat, e Isfol 1999, variables description in Appendix

According to them, with low unemployment rates, the firms could consider convenient to support the training costs even for the individuals with a low basic human capital. In this case, the firm could increase the productivity of the individuals with a lower basic education to whom, because of the positive employment situation, the firm should be obliged to pay quite high wages. Such an incentive would not exist in some areas

where the high unemployment (especially among the workers with a low human capital) contributes to keep the wages low. In this case, the wage inequality between the skilled and the unskilled workers, can make not convenient for the firm trying to increase the productivity of low educated people by the training on the job.

5. Conclusions

In this paper we investigated the uneven distribution of workers' training among Italian regions. Two not alternative explanations have been proposed at a theoretical level and tested by econometric estimates, referring to the complementarity between education and training and to the effects of unemployment. Some authors have already argued that education and training are complements in the sense that knowledge acquired by education facilitates learning and helps to valorise the further skills gained on the job. Nonetheless, the evidence shows that regions with a similar educational level can have a very different percentage of trained workers. Therefore it seems to be clear that complementarity is not sufficient to explain the complex mechanism that causes training incidence. The second explanation regards the effect of regional unemployment on firms' and workers' choices of training investments. The hypothesis is that as regional unemployment rate affects the unskilled/skilled wage differential and, consequently, the incentives to training. If unemployment is low, even for the unskilled workers, the unskilled wage tends to be high and the differential between skilled and unskilled wage quite low. In that case, the firms is boosted to provide training even to the relatively less educated workers. The contrary is

expected to happen in regions with high unemployment. The examined data and *Probit* estimates confirm the complementarity effect, as workers with an higher basic human capital has more probability to enter training. At the same time they show a strong influence of both the unemployment rate and the wage compression indicators on the training incidence. In a few words, educational level appear to be more important in deciding *to which workers* the firm has to offer an opportunity of training, whereas unemployment rate and wage compression affect the decision of *how many workers* making this offer. The unemployment effect found out by this paper confirms that, as it has been pointed out by most recent developments of human capital literature, the incentive for firms to pay for general training depends on the level of wage compression. Notwithstanding, it represents an original result, as compression in this model doesn't depend on institutional factors, as usually assumed in the literature, but on the dependence of unskilled wage on regional unemployment. The reached results suggest some interesting policy implications. First, the existence of complementarity between education and training give us the idea of how an increase of people's average educational level could set in motion a "virtuous circle" able to increase the workforce's total human capital, with strong benefits both at individual and at local economic system level. This can be really important both in the perspective of *lifelong learning* and in a context of policies aimed at reducing *social exclusion*. Secondly, we can maintain that the relationship between training and regional unemployment makes urgent, overall in the South of Italy, a deeper coordination of training policies and local development structural policies. Thirdly, our results put in evidence

that it is possible that labour policies based on wage flexibility could depress training investments, threatening to lower the skill requirements of the economy with a negative impact on the problem of employment quality.

Appendix - Data and variables description

T: the dependent variable in the *probit estimate* was built giving value 1 to all the individuals who answered to question PT002 of the Eurostat questioner (*Have you been in education or training since January last year? And, if yes, which kind of course(s) was it?*) that they have done *Vocational* and/or *Training* and/or *Language courses*, and value 0 otherwise. Obviously, being about training courses, we are considering only the "formal" training activity. Another limit of the available data source is that it does not allowed us to find the financing source of the *training*. The question PT017 (*Was the vocational education course "paid for" or "organised by" the employer*) was considered ambiguous and difficult to use even from others authors (Bassanini, Brunello 2003).

Macro-area (M_areas): series of *dummies variables* built on the basis of the question HG015 by grouping the 11 regions considered by Eurostat in 4 "macro-areas": North West, North East (dummies reference), Centre, South/Islands.

Generic Experience (G_exp): variable built on the basis of the questions PD003 (*Age*) and PE039 (*How old were you when you began your working life?*) in that way: $Generic\ Experience = PD003 - PE039$

Specific Experience (S_exp): variable built on the basis of the question PE011 (*year of start of current job*): $Specific\ Experience = year\ of\ the\ interview - PE011$

Years of education (Years_ed): variable built on the basis of question PT022, giving to every certificate of education the number of years necessary to get it, that is 20 years for ISCED 5-7; 13 years for ISCED 3; 8 years for ISCED 0-2.

Certificate of education (EDU): *dummies variables* built on the basis of question PT022 (*Highest level of general or higher education completed*). E2 (upper secondary level = ISCED 3), E3 (tertiary level = ISCED 5-7), dummy reference: not more than compulsory level;

"Recent" certificate of education (Recent): *dummy variable* built on the basis of questions PD003 (*Age*) and PT023 (*Age when the highest level of general or higher education was completed*) as follows: $"Seniority"\ of\ the\ certificate\ of\ education = PD003 - PT023$

Afterwards we computed the quartiles of the distribution of the "Seniority" variable and we considered "Recent" the qualifications got since a number of years lower or equal to the first quartile of such distribution (11 years).

Bad health conditions (Health): *dummy variable* built on the basis of the question PH001 (*How is your health in general?*) giving value 0 if the individual has answered: *very good*, *good*, *fair* and value 1 if the individual has answered *bad*, *very bad*.

Unemployed before present job (Unempl): *dummy variable* built on the basis of question PE014 (*Existence of an unemployment period before current job?*).

Unemployed for one year or more before the present job (Unemp_1): *dummy variable* built on the basis of question PE015 (*Number of months of continuous unemployment before current job*).

Monthly wage: variable built on the basis of the question PI211M (*Current wage and salary earnings- net, monthly*).

Hours working per week (Hours): variable built on the basis of the question PE005 (*Total number of hours working per week*).

Hourly wage: $Hourly\ wage = \dfrac{Monthly\ net\ wage}{4\times\ Hours\ working\ per\ week}$

Kaitz index: variable calculated on hourly wages (considering the presence of eventual *outliers*), in a disaggregate way for the 11 Eurostat regions,

$Kaitz\ index = \dfrac{minimum\ wage}{average\ wage}$

If the minimum wage is very far from the average (and therefore the wage distribution is very unequal) the index has a low value. If the wage distribution is equal and the minimum wage is equal to the average wage, the index reaches its maximum value, equal to 1.

Differential between the median (log) wages of skilled and unskilled workers (MedS_medU): the variable has been built calculating the difference, for each Eurostat region, between the median of the distribution of the logarithm of hourly skilled wages and the median of the distribution of the logarithm of hourly unskilled wages. The higher is the value of this index, the higher is wage inequality between skilled and unskilled workers.

Difference between 90th and 10th percentile (90th_10th): the variable has been built for each Eurostat region, calculating the difference between 90th and 10th percentile of the regional distribution of the logarithm of hourly wages. The higher is this difference, the higher is local wage inequality.

Permanent employment (Per_emp): *dummy variable* built on the basis of the question PE024 (*What type of employment contract do you have in your main job*).

% E2 = percentage of upper secondary level of education in labour force at local level.

Unemployment rate at local level (U_rate), Istat 1999.

Training expenditure/employment at local level (T_exp/empl), Isfol 1999.

Number of workers in training/employment at local level (n°_T/empl), Isfol 1999.

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