

Is firm training associated with a lower use of atypical contracts? Evidence from Italian firms

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Abstract

In this paper, using an innovative dataset constructed by linking the 2010 and 2015 waves of *Rilevazione Imprese e Lavoro* (RIL), a survey drawn by INAPP, with administrative databases relating to both firms and workers (ASIA firms, ASIA employment and *Comunicazioni Obbligatorie* - SISCO), we study the relationship between training provided by firms and their use of contractual flexibility controlling for numerous workers and firm's characteristics, including the presence of unions and innovative activities. Taking advantage of the potential of each database, flexibility at firm level is measured by the share of days worked in a given year with different types of contract at a firm. The OLS estimates suggest that the training activity carried out at time $t-1$ is positively associated with the degree of stability of the work relationships of firm at time t , and that this relationship persists for medium-large firms. Moreover, the unconditional quantile regression estimates, performed by RIF regression method, show that the positive relationship between training on-the-job and contractual stability characterizes firms located up to the median of the distribution of the number of days worked with permanent employment contracts.

Keywords: On-the-job training; contractual flexibility; sample and administrative data; Italy

Jel Classification: J21, J50

1. Introduction

During the last decade, both in the political and academic field, a wide debate has developed about the role that the updating of skills and the lifelong learning of workers have in facing the growing pressure induced by globalization and technological changes on the labor market (European Commission, 2007; Percival et al., 2013). The results of a recent European survey on skills and employment suggest that to prevent unemployment due to technological progress, a fair mix of some key elements is needed, including training for personal and professional development (Cedefop, 2017). The literature on Social

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Investment State points out that investing in human capital means generating and regenerating the productive factor; being able to count on a productive, trained and constantly updated workforce is in fact a fundamental competitive asset for long-term economic growth (Esping-Andersen, 2007; Brettschneider, 2008). Also the Europe 2020 Strategy recognizes investment in on-the-job training as a fundamental lever for fostering smart, sustainable and inclusive growth.

In the economic literature many studies analyse the role of on-the-job training identifying it as one of the tools to allow a gain in terms of productivity (Blundell et al., 1999; Bartel, 2000; Collier et al., 2008). The crucial issue concerns the convenience of investment in training and who should bear the costs. The choice essentially depends on a cost-benefit analysis: for a firm the benefits are measured in terms of higher productivity, for a worker benefits are represented by an improvement of skills and an increase in their productivity resulting in an increase in the wage they will receive at the end of the training period. Regarding to costs, Becker (1964) introduces the distinction between general and specific training explaining that, in a perfectly competitive labor market, firm is not willing to pay the full costs of general training because it is meeting the risk of hold up: once the investment in training is made, the worker, accumulating new skills and knowledge that can also be spent in other firms, can leave the firm and negotiate a higher wage elsewhere frustrating the investment made by the employer. Therefore in this context, costs should be borne by the worker by accepting a lower wage than productivity during training period (Becker, 1964; Cahuc et al., 2014). Otherwise, if the training is firm-specific, firm will pay for it because only part of the worker's skills may be appropriate from the latter, while the remainder can only be spent on the firm that offered the training. Contrary to the previous situation, in a market with imperfect competition the workers' outside option is reduced and a compressed wage structure is generated in which the wage grows less than the productivity as the training given to workers increases. In this way, even in the case of general training, firms have an incentive to sustain the costs (Acemoglu, 1997; Acemoglu and Pischke, 1999a).

Up to this point we have addressed the issue of investment in training only from firm's point of view, but we have to keep in mind that also workers can apply for on-the-job training, for example by making use of trade unions.

In an imperfect labor market, where imperfections are due to information asymmetries, an important aspect to take into consideration when studying the role of training is the link between the employer's decision to form his workers, and then the amount to invest, and the length of the employment contracts that the firm itself offers (Cantor, 1990; Hermalin, 2002). The theory of contracts, and more specifically the models that deal with incomplete contracts, suggests that, since at the time of the stipulation of the labor contract the type of training that firm will provide to the counterpart cannot be specified in detail, the parties may agree to make the duration of employment long enough so that the company is able to recover its investment in training thanks to the worker's increased productivity.¹ If the employment contract has a duration that is too short, the company has an incentive to provide an insufficient and inefficient level of training, particularly of a general nature; instead, as the duration of the contract increases, the company obtains a gradually increasing percentage of the benefits deriving from the investment (Cantor, 1990). At the same time, however, it is possible that companies, using temporary contracts in entry-level jobs, are interested in providing training so that workers hired on fixed-term contracts can quickly obtain the skills necessary to perform their work correctly and be more flexible in performing tasks requiring frequent updates (Alba 1998; Guell and Petrongolo 2007). It is obvious that if this were the case we would have to assist, in the long-run, either to contractual changes

¹ We are implicitly assuming that the wage paid to the worker grows less than productivity.

or to stabilization in favor of trained workers. Firms and workers generally try to establish mechanisms to reduce the probability of end of employment after making an investment in training. In this sense, the use of fixed-term contracts, if aimed at the mere replacement of workers, could hinder investments in training, thus damaging the long-term growth prospects of firm (Blanchard and Landier 2002).

This paper is part of this literature analyzing the relationship between training provided by firm and the use of contractual flexibility. In particular, making use of an innovative dataset reconstructed by linking 2010 and 2015 waves of *Rilevazione Imprese e Lavoro* (RIL), a survey drawn by INAPP, with administrative databases relating to both firms and workers (*ASIA Imprese*, *ASIA Employment* and *Comunicazioni Obbligatorie* - SISCO, see Section 3 for more detail), flexibility will be measured, at firm level, by the share of overall working days in a year in a firm distinguishing according to the type of contract (temporary, permanent, apprenticeship and parasubordinate). In particular, as dependent variable we will consider the share of days worked with standard forms of contract, while as main independent variables we will use some information - reported in the RIL survey - related to the quality and quantity of the training provided by the firm. The wealth of our dataset allows to check for numerous firm characteristics that can influence the relationship between the use of flexibility and training.

Therefore, within the economic literature, this paper innovates on the effects of training provided by firm, looking at the relationship between training choices and contractual choices, a relationship to which, based on our knowledge, the economic literature has paid little attention. The second element of novelty of our analysis lies in the richness of the dataset used, which was built, as mentioned, linking different datasets of administrative and sample source, and in the extreme detail with which this dataset allows to measure the use of the different contractual forms.

Finally, the paper is structured as follows. Section 2 briefly presents the related literature; section 3 clarifies the way in which the database we used is build and shows the main descriptive statistics relating to the sample of firms used in the analysis; in section 4 the main results are presented. Section 5 concludes.

2. Related Literature

A skilled and educated workforce is one of the key factors for increasing the productivity of firms and for the economic development of a country (Romer, 1987, 1996, Lucas, 1988; Mankiw et al., 1992; Acemoglu and Pischke, 1998). Most empirical studies, analysing the effect of human capital on wages and labor productivity, tend to focus on formal education achieved during the course of study. However, the process of forming human capital does not end with leaving the educational institution. If this were the case, the stock of capital incorporated in each worker would be given and would tend to decrease with the aging of the subject and/or with the obsolescence of the acquired knowledge, and a decreasing trend of individual wage would be observed during the labor career. A significant amount of human capital is instead accumulated after an individual has entered the labor market thanks to the training provided by firm. Therefore, this training integrates the education acquired by the individual, generating possible multiplicative effects on labor productivity (OECD, 2010; McGowan and Andrews, 2015).

According to the human capital theory, agents will invest in training if the discounted net present value of the benefits of training exceeds the costs. For an individual (the worker), the decision to take part in

the training program is taken on the basis of cost expectations, namely zero or low wages during the training period, and on the benefits in terms of higher future wages. For the employer, the choice is made on the base of expectations about benefits, measured in terms of increased productivity, and costs, linked to direct expenses for training activities and the loss of productivity during the training period. Starting from the paper of Becker (1964), more recent studies show that, in contexts of imperfect competition, both firms and workers can have an incentive to invest in general training. Acemoglu (1997) and Acemoglu and Pischke (1999a) point out that when wages are lower than labor productivity, firms may have greater incentives to pay for such training. This happens because the labor market's imperfections, such as information asymmetries, create a gap between the marginal product of a worker and his/her wage, thus generating revenues to be shared between workers and firms. Furthermore, imperfections in the labor market reduce the mobility of workers to other firms and determine a compressed wage structure in which wages rise less than productivity as the training given to the workers themselves increases.

Another aspect widely discussed in the literature concerns the efficient level of the training investment. If the amount of training is not efficient, public intervention could be useful, for example, by introducing minimum wages. At the same time, the presence of union, favoring a wage structure characterized by less dispersion, can have a positive effect on the firm's choice to invest on training program (Acemoglu and Pischke, 1999b).

From an empirical point of view, several studies have used data at firm level to show the relationship between workforce composition, firms characteristics, and training provided at the workplace (Lynch and Black, 1998; Zwick, 2005). If we consider the size of firm, the larger ones show a greater propensity to invest on training because, being able to distribute the fixed costs for training on a greater number of employees, the total costs of training per employee are lower compared to smaller firms (Frazis et al., 1995). In addition, the loss of production, resulting from having a worker occupied on a training program, will be less for the former. The sector of activity can also influence the decision to provide training. It is reasonable to think that if firms in private sector are more constrained by the need to make profits than those in the public sector, they will be relatively less willing to finance training (Booth, 1991). If we analyze the role played by work flexibility and focus attention on the use of fixed-term contracts, Arulampalam et al. (2004) show evidence of a negative relationship between temporary work and investment in human capital. The increase in fixed-term contracts recorded in many European countries, including Italy, therefore seems to be an obstacle to training. Changing point of view, the analysis conducted by Oosterbeek (1996) on a sample of dutch workers suggests that those hired with permanent contracts have higher training odds than their fixed-term counterpart. Bratti et al. (2018) analyze the relationship between worker protection and training, demonstrating that the former reduces the number of workers trained by firm by about 20%; on the contrary, Pierre and Scarpetta (2013) discover that higher protection is associated with greater investments and greater use of temporary contracts. Messe and Rouland (2014), distinguishing by age the workers of French companies, note a positive effect of employment protection when training is aimed at young people, while they do not identify any effect when dealing with the older ones. Finally, an important role regarding the employer's investment choices in training is given to industrial relations, in particular, to the presence of second-level bargaining or trade union organizations. In this regard, Arulampalam and Booth (1997) show that unions could be cooperative and thus increase the training and productivity of firms. Moreover, a study proposed by Isfol (Isfol, Ricci, 2013) shows a strong positive correlation between the presence of supplementary agreements and the probability of organizing a vocational training course. This result shows that in the workplace where trade unions and employers enter into

supplementary agreements for national collective agreements, more attention is given to training policies. On the other hand, the development of organizational structures that foster a cooperative attitude in industrial and trade union relations generates greater mutual trust regarding investments in human capital.

The studies just mentioned focus on the effects of one or more variables on the firm's decision to train its workers. In this paper we study the opposite relationship, that is, we ask if the fact that a firm offers on-the-job training has an effect on the use of permanent contracts. In line with this approach, Shire et al. (2009) suggest that firms offering training use long-term contracts rather than temporary employment. Albert et al. (2005) confirm this result, showing that firms that do not provide vocational training have higher shares of temporary workers than firms that offer training.

3. Data, the Empiric Strategy and Descriptive Statistics

3.1 The data

The relationship between on-the-job training and the number of days worked with standard contract is analyzed by using an original dataset built linking three main databases: *Comunicazioni Obbligatorie*, an administrative dataset provided by the Ministry of Labor and Social Policies, the archive of the ASIA firms and the sample survey RIL - *Rilevazione Imprese e Lavoro*.

The RIL - *Rilevazione Imprese e Lavoro* - survey is conducted periodically by the National Institute for the Public Policies Analysis (INAPP) and records in detail numerous characteristics of firms related to different areas (example.g. the number of workers trained, costs of training, ownership structure, type of industrial relations, organization and management of personnel). The ASIA archive - Statistical Register of Active Enterprises - of ISTAT covers the universe of Italian firms and records in detail the productive sector and the geographical location of each firm, as well as, their size and legal form. Finally, the Statistical Information System for Mandatory Communications (so-called *Comunicazioni Obbligatorie* - SISCO) tracks all events related to a job position (hiring, contractual transformation – e.g. from a fixed-term to an open-ended arrangement –, firing, dismissal), specifying in particular the calendar dates when the contractual relationship between the firm and the worker was created and stopped (or, eventually, transformed to a different arrangement).²

These three databases have been merged by using tax codes of the firms and the workers as the matching key. This leads to a final employer-employee dataset in which firms represent the unit of analysis; the final dataset thus records several characteristics of the firm plus the distribution – at the firm level – of some features of their employees.

Specifically, we start from the RIL sample using the 2010 and 2015 waves, enriched with additional firm's information deriving from the ASIA archive. For all workers of RIL firms, the information relating to each activation/end of the contract in the period 2009-2017 recorded in the SISCO archives was extracted. These communications, carried out by the firm, show, for each worker, the date of hiring, the date of foreseen and actual end of the job relationship, the type of arrangement – aggregated in five main categories: open-ended employee, fixed-term employee, apprenticeship,³ para-subordinate,⁴

² In Italy all occurrences concerning a job position must be electronically transmitted to the Regional agencies in charge of active labour market policies (and also made accessible to the Italian social security institute, INPS).

³ Individuals can then be hired as employees through open-ended or fixed-term arrangement or as an apprentice.

⁴ See Raitano (2018) for a definition and an overview of para-subordinate arrangements.

temporary work (*lavoro interinale*), some individuals characteristics (eg, gender, age, citizenship) and firm's characteristics. Thanks to the information regarding the date of activation and of actual end of each contract it was possible to calculate, for each year, the actual duration, expressed in days, of each contractual relationship experienced by a worker during the year.

SISCO is an extremely rich dataset but it has a main drawback: it detects only those workers who start, end a contract or experience a transformation of the contractual arrangement since 2009 (the first year of coverage of this archive). In other words, the merge between SISCO and firm data does not allow us to trace the entire stock of employees at the firm – and, therefore, does not bring to to a pure employer-employee linked dataset – given that long-term employees – i.e. those hired before 2009 and whose job relationship did not interrupt until the end of 2017 – are not observed in SISCO archives.

To overcome this limit and enrich the information about workers employed by the firm in a certain year, thus obtaining the whole stock of the individuals employed (as employees, para-subordinate or temporary workers) by each firm at every point of time, we use the administrative register ASIA-Employment 2015. This register shows, for the universe of firms active in 2015, the characteristics of each individual who has had an employment relationship with a firm in 2015 and the duration of that employment relationship during the year. Therefore, the linking between SISCO and Asia-Occupation 2015 allows us to construct the stock of workers employed in each firm in the 2009-2017 period.

Only contracts with open-ended employees can indeed last continuously between 2009 and 2017 without incurring interruptions or renewals, thus the part of the stock of employees at a firm that is never registered in the SISCO archive is identified by reconstructing for each firm, from ASIA-Occupation 2015, the number of people who had a permanent contract lasting the whole of 2015 and subtracting from this stock the number of individuals, among them, who, on the basis of the information provided by the SISCO archive, started or ended this contract from 2009 onwards.

Therefore, SISCO allows us to compute, for all individuals tracked in that archive, the number of days per year in which they had a contractual relationship with a certain firm in a given year, while the crossing with Asia-Employment allows us to add the stock of workers not observed in SISCO which, by definition, have been contractualized by the firm where they worked for the whole 2015 for the whole period 2009-2017.

Hence, the complex merge between all these databases allows us to perfectly reconstruct the distribution of the working days in the 2009-2017 period of all the individuals who worked (as an employee, a para-subordinate or a temporary worker) in a firm surveyed by the 2010 or 2015 waves. As a consequence, for the sample of firms surveyed in RIL we obtained an employer-employee dataset.

3.2 The empirical strategy

In this paper we want to study the relationship between the training program proposed by the firm and its use of standard contractual forms. Making use of the information collected in SISCO and linked with ASIA-Employment, the dependent variable of our analysis is the number of days worked during the year with permanent contracts compared to the total days worked at the firm with any other contractual form (i.e. apprenticeships, temporary employment, interim and parasubordinate collaborations).

In this analysis we focus on firms in the 2010 and 2015 RIL waves and which are, at the time of the survey, claim to have at least 50 employees since these are the firms in which the training activity is

most significant and the most represented in the ASIA archive. The total number of observations is 7761: 2631 observations in 2010 and 5130 in 2015. The main independent variable - obtained from the RIL survey - is a proxy for the training activity of firm - that is, the share of workers participating in training programs organized by the firm. In a further specification of our analysis we also include two dichotomous variables relating to possible introductions of product or process innovations in the 3 years preceding the RIL survey.

In order to take into account some structural characteristics of the company, the absence of a balanced panel (only a limited and selected number of firms is present in both RIL waves) and the fact that the dependent variable tends to be persistent over time, suggest to use the share of days worked with open-ended contracts in the previous year (see in this regard Van Reenen, 1997; Piva and Vivarelli, 2017). Therefore, the whole specification of the estimated model is the following:

$$sh_indet_{it} = \alpha + \beta sh_indet_{it-1} + \gamma Training_{it-1} + \delta_1 Union_{it-1} + \delta_2 Prod_{innit-1} + Process_{innit-1} + \partial X_{it} + \lambda Z_{it-1} + \varepsilon_{it} \quad (1)$$

where i, t represent the firm and the year respectively. The five independent variables are delayed with respect to the employee, the vector X_t includes a detailed number of checks at firm level at time t which, in the estimate of our relationship, contributes to reducing the omitted variable bias: fixed effects of year, region, 2-digit sector NACE, dummy on the size of firm (between 50 and 249 employees or at least 250), dummy for the company's revenue class (recorded in ASIA), composition employment by gender, age group (15-29, 30-49 and at least 50) and citizenship (Italian, other EU country, non-EU), and lastly, a third degree polynomial on the total number of days contracted by the firm in the year to eliminate the overall effect of the amount of work within the company. Finally, the vector Z_{t-1} contains two variables measured at time $t-1$ which control for the performance of firm: the logarithm of labor productivity (obtained from the information contained in ASIA), calculated as the ratio between value added and the number of employees, and the logarithm of investments in physical capital by employee (recorded in RIL).⁵

To be able to grasp the heterogeneity issue between firms, in addition to the OLS estimate, we perfume also estimates by separating for the two dimensional groups (50-249 employees and at least 250 employees) and through an unconditioned quantile approach (Unconditional quantile regression - UQR). In particular, we estimate the regression RIF - Recentered Influence Function - proposed by Firpo et al. (2009): for each quantile Q_τ (in our case P10, P25, P50, P75 and P90) we estimate a RIF regression that is equal to any other standard regression except for the fact that the dependent variable, the share days worked with permanent contract, is replaced by a function called influence function (IF) of the statistics of interest as follow (see Hampel, 1974):

$$RIF(Y_i; \hat{Q}_\tau) = Q_\tau + \frac{\tau - \mathbb{I}\{Y \leq \hat{Q}_\tau\}}{\hat{f}(Q_\tau)}$$

where $\hat{f}(Q_\tau)$ is the marginal density function of the dependent variable, Y , estimated by a kernel function, $\mathbb{I}\{Y \leq Q_\tau\}$ is a dummy variable that specifies whether the value of the dependent variable is greater or less than the quantile Q_τ . On the one hand, this method allows us to show the results at different quantiles of the distribution of the days worked with standard contracts, and, on the other hand, allows us, given the independence from the covariates, to compare among them the achieved results.

⁵ Weights are used in all the estimates.

3.2 Descriptive statistics

Table 1 describes the composition of the sample used in the analyzes, distinguishing by year and by firm size. Only 22% of firms has more than 250 employees, the remaining part is made up of medium-sized firms confirming the fact that the Italian productive fabric is mainly characterized by small and medium-sized firms.

Table 1: Sample composition by year and firm's size.

	Number of Observations	The share
Year		
2010	2,631	33,9%
2015	5,130	66,1%
Firm size		
50-249	6,057	78%
>=250	1,704	22%
Total	7,761	100%

Note: Our computations on COB-RIL data.

The share of days worked with permanent contract can be considered as an indirect measure of the use of non-standard contracts (fixed-term, interim and parasubordinate contracts) and therefore an indirect measure of the flexibility to which workers are exposed. Table 2 shows, in addition to the mean, the standard deviation, and the distribution in the five main percentiles of the share of days worked with permanent contract in firms that have more than 50 employees.

It is clear that, in general, the firms of our sample seem to make a moderate use of non-standard work; about 84% of the days worked on an annual basis are in fact permanent. However, comparing medium and large firms, those with more than 250 employees use permanent contracts to a greater extent, confirming that small and medium-sized firms, driven not only by lower labor costs but also by problems that may arise from the their greater exposure to labor market shocks, tend to use mostly fixed-term contracts.

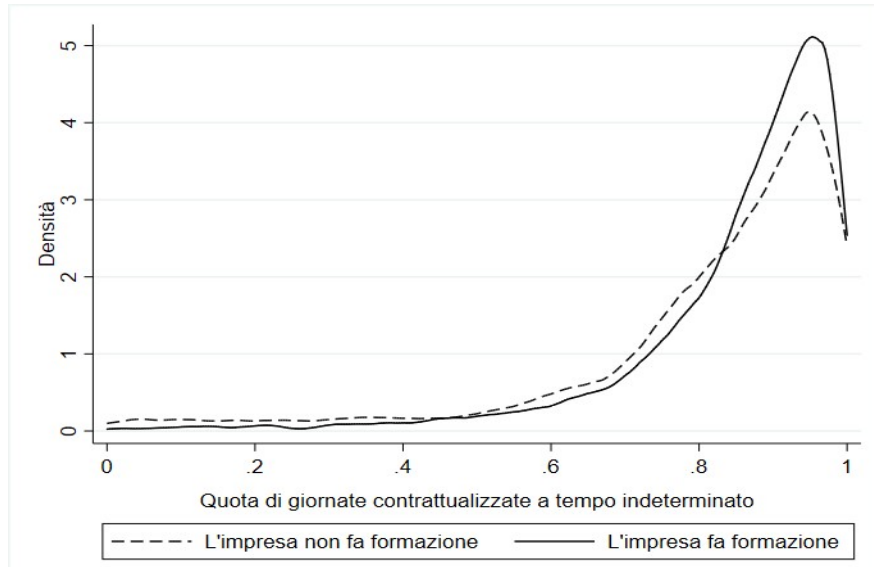
Table 2: Distribution of the share of days worked with permanent contract by firm's size.

	Mean	sd	p10	p25	p50	p75	p90
50-249	82.7%	0.18	61%	77%	88%	94%	98%
>=250	86%	0.16	69%	83%	91%	96%	98%
Total	84%	0.16	62%	78%	89%	95%	98%

Note: Our computations on COB-RIL data.

Figure 1 shows the distribution of the days worked with permanent contract for firms that in the previous year offered training to their employees and for those who declare that they did not form any employees. Firms whose employees have attended training courses have a higher share of days worked with permanent contracts than those whose employees have not been trained. This descriptive evidence confirms the positive link between on-the-job training and the firm's use of permanent contracts suggesting that training induces firm to make greater use of standard contracts to exploit to full the human capital increase of the worker formed thanks to the duration of his/her contract.

Figure 1: Distribution of the share of days worked with permanent contract.



Note: Our computations on COB-RIL data.

Finally, Table 3 shows the average and standard deviation of the main explanatory variable: share of trained workers, and of three other independent variables: the presence or absence of trade unions, the introduction in the previous 3 years of a process or product innovation. Focusing on firms with more than 250 employees, that is firms where the presence of unions is greater (83% vs. 55% of companies with 50-249 employees), it is clear that they are more inclined not only to innovate, both in terms of product and process, but also to train their employees. This result can in part be ascribed to the role played by unions in favour of on-the-job training.

Table 3: Mean and standard deviation of the main independent variables by firm's size.

	Share of trained workers		Union		Product innovation		Process innovation	
	Mean	sd	Mean	sd	Mean	sd	Mean	sd
50-249	37.1%	0.38	55%	0.50	51.4%	0.50	45.9%	0.50
>=250	45.2%	0.35	83%	0.37	62.6%	0.48	54.7%	0.49
Total	38.2%	0.37	58.7%	0.49	52.5%	0.50	47.1%	0.50

Note: Our computations on COB-RIL data.

The share of trained workers is around 38% for the total number of firms, an increase compared to previous years (Inapp, Ricci 2018). Unfortunately, our information does not allow us to distinguish the topics of training courses in which workers participate. An Istat report (2017) indicates as the main driver of this trend the increase in training courses in the environment and workplace safety. The picture outlined in Table 3 reflects the average of what happens in our economic system. This evidence can hide important differences in the productive characteristics, in the geographical location and in the nature of the technologies adopted. However, in this study we do not investigate these differences.

4. Results

4.1 OLS estimates

In this section we present the results of the estimates of Equation (1). In particular, Table 4 shows is a positive and statistically significant relationship between the share of trained employees and the share of days worked with permanent contracts. This result continues to be valid even when we control for the structural and non-observable characteristics of firm (model OLS 2). Regarding to the other explanatory variables, the presence of trade unions seems to have a positive effect on the degree of contractual stability observed in a firm.

Table 4: Estimate of the relationship between the number of days worked with standard contracts and firm's characteristics. Pooled sample – 2010-2015. OLS (1) e (2)

	OLS (1)		OLS (2)	
	M1	M2	M1	M2
Share of trained employees	0.023*** (0.0005)	0.023*** (0.0007)	0.0046** (0.002)	0.0042** (0.002)
Share of days with PC in t-1			0.904*** (0.0126)	0.905*** (0.0127)
Unions	0.0103* (0.0057)	0.0108* (0.0057)	-0.0013 (0.0016)	-0.001 (0.0016)
Product Innov.		0.0047 (0.0057)		0.0013 (0.0018)
Process Innov.		-0.0089 (0.0058)		0.0037 (0.0019)
Labor prod. (log)		0.010 (0.0072)		0.0037 (0.0026)
Other controls	Yes	Yes	Yes	Yes
R2	0.52	0.53	0.93	0.97
Num. Observations	6956	6956	6955	6955

Note: Covariates included in all models (M1 and M2) are the following: dummy for year, region, sector (2-digit hen), firm revenue classes, firms with at least 250 employees; third degree polynomial for the total number of days worked in a firm in a year, share of female employees, share of employees aged between 30 and 49 and over 50 years, share of employees with EU or non-EU citizenship. In the second model (M2) two other controls are added: (log of) physical capital per employee and (log of) labor productivity per employee. Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.10.

The relationship between training provided by firm and the use of permanent contracts could reflect specificities that vary according to the size of firm itself. According to Istat (2017) the smallest firms (less than 50 employees) invest less in the quality of work, and in particular, in training. Table 5 presents the results for medium-sized firms (50-249 employees) and for large ones (over 249 employees). Both medium-large and large firms show a positive and very significant association between training and the use of permanent contracts: an increase of 10% in the share of trained workers increases the share of days worked with permanent contracts of 0.3%. The presence of union seems to have a positive and statistically significant effect only for medium-large firms, unlike the very large ones in which it seems that trade unions have a negative effect. The results of Table 5 are, although with a lower level of significance, confirmed even when we control for non-observable firm's characteristics (Table 6).

Table 5: Estimate of the relationship between the number of days worked with standard contracts and firm's characteristics, by firm's size. OLS (1)

	M1	M1	M2	M2
	50-249	>=250	50-249	>=250
Share of trained employees	0.023*** (0.007)	0.028*** (0.009)	0.023*** (0.007)	0.027*** (0.009)
Unions	0.014** (0.007)	-0.023** (0.009)	0.013** (0.006)	-0.022** (0.01)
Product Innov.			0.008 (0.006)	-0.004 (0.008)
Process Innov.			-0.009 (0.006)	-0.002 (0.008)
Labor prod. (log)			0.011 (0.0083)	0.0105 (0.0106)
Other controls	Yes	Yes	Yes	Yes
R2	0.52	0.68	0.51	0.69
Num. Observations	5441	1515	5441	1515

Note: Covariates included in all models (M1 and M2) are the following: dummy for year, region, sector (2-digit hen), firm revenue classes, firms with at least 250 employees; third degree polynomial for the total number of days worked in a firm in a year, share of female employees, share of employees aged between 30 and 49 and over 50 years, share of employees with EU or non-EU citizenship. In the second model (M2) two other controls are added: (log of) physical capital per employee and (log of) labor productivity per employee. Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.10.

Table 6: Estimate of the relationship between the number of days worked with standard contracts and firm's characteristics, by firm's size. OLS (2)

	M1	M1	M2	M2
	50-249	>=250	50-249	>=250
Share of trained Employees	0.004** (0.0022)	0.0052* (0.0027)	0.0037* (0.002)	0.0051* (0.002)
Share of days with PC in t-1	0.905*** (0.0134)	0.888*** (0.235)	0.904*** (0.0134)	0.887*** (0.0232)
Unions	-0.0009 (0.0018)	-0.0042 (0.003)	-0.001 (0.0018)	-0.0041 (0.003)
Product Innov.			0.0012 (0.002)	0.001 (0.002)
Process Innov.			0.0033 (0.002)	-0.0012 (0.002)
Labor prod. (log)			0.0054* (0.0031)	0.0011 (0.0025)
Other controls	Yes	Yes	Yes	Yes
R2	0.93	0.96	0.93	0.96
Num. Observations	5440	1515	5440	1515

Note: Covariates included in all models (M1 and M2) are the following: dummy for year, region, sector (2-digit hen), firm revenue classes, firms with at least 250 employees; third degree polynomial for the total number of days worked in a firm in a year, share of female employees, share of employees aged between 30 and 49 and over 50 years, share of employees with EU or non-EU citizenship. In the second model (M2) two other controls are added: (log of) physical capital per employee and (log of) labor productivity per employee. Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.10.

4.2 RIF-reg estimates

Finally, Tables 7 and 8 show the estimates of the RIF regressions, or unconditioned regressions along the distribution of the dependent variable. This approach makes possible to understand the aspects of heterogeneity between firms. In line with expectations, both from Table 7 and 8, we can observe that only for firms that rank in the lowest quartiles of the distribution (<of the 50th percentile), having propose training program to their employees in a previous period is positively associated to the share of days worked in the current period with permanent contract: an increase in the number of employees trained of 10% increases the share of days worked with permanent contract by about 0.7%. For those firms that are in the highest part of the distribution, beyond the median, the relationship is not significant. This result should not come as a surprise since, as you go up the distribution of days worked, almost all firms declare that they have trained their employees.

Table 7: RIF-Reg estimate of the relationship between the number of days worked with standard contracts and firm's characteristics. Model M1

	P10	P25	P50	P75
Share of trained employees	0.0673*** (0.0241)	0.0246*** (0.0095)	0.0069 (0.0063)	0.0007 (0.0042)
Unions	0.0120 (0.021)	0.0076 (0.008)	0.0070 (0.005)	0.0108** (0.0034)
Other Controls	Yes	Yes	Yes	Yes
R2	0.30	0.35	0.25	0.26
Numb. Observations	7013	7013	7013	7013

Note: Covariates included in all models (M1 and M2) are the following: dummy for year, region, sector (2-digit hen), firm revenue classes, firms with at least 250 employees; third degree polynomial for the total number of days worked in a firm in a year, share of female employees, share of employees aged between 30 and 49 and over 50 years, share of employees with EU or non-EU citizenship. In the second model (M2) two other controls are added: (log of) physical capital per employee and (log of) labor productivity per employee. Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.10.

Table 8: RIF-Reg estimate of the relationship between the number of days worked with standard contracts and firm's characteristics. Model M2

	P10	P25	P50	P75
Share of trained employees	0.0640*** (0.0225)	0.0246** (0.0097)	0.0083 (0.0060)	0.0018 (0.0040)
Unions	0.0134 (0.0213)	0.0087 (0.0086)	0.0076 (0.0054)	0.0108*** (0.0033)
Product Innov.	0.0368* (0.022)	0.0051 (0.0086)	-0.0034 (0.0056)	0.0030 (0.0040)
Process Innov.	-0.0202 (0.0194)	-0.0049 (.0082)	-0.0069 (0.0055)	-0.0064* (0.0038)
Labor prod. (log)	0.0236 (0.024)	0.0078 (0.007)	-0.338 (0.0042)	-0.0105*** (0.0028)
Other controls	Yes	Yes	Yes	Yes
R2	0.29	0.28	0.30	0.32
Numb. Observations	6997	6997	6997	6997

Note: Covariates included in all models (M1 and M2) are the following: dummy for year, region, sector (2-digit hen), firm revenue classes, firms with at least 250 employees; third degree polynomial for the total number of days worked in a firm in a year, share of female employees, share of employees aged between 30 and 49 and over 50 years, share of employees with EU or non-EU citizenship. In the second model (M2) two other controls are added: (log of) physical capital per employee and (log of) labor productivity per employee. Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.10.

5. Conclusions

In the previous sections we have examined from an empirical point of view the relationship that links contractual stability and firm's training choices with the aim of investigating the role of human capital for the competitiveness of the economic system. The application of simple linear regression models and the use of an innovative dataset constructed by linking three different databases, RIL, COB and ASIA, allow us to demonstrate that firm provided training has a positive impact on permanent work, even when we take into account a wide range of control variables both for employment and firm characteristics. The positive correlation between permanent contracts and on-the-job training is a typical element of medium-large and very large firms. Moreover, the estimates along the distribution highlight that this positive relationship characterizes firms that position themselves up to the median distribution of number of days worked with permanent contracts.

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