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Enforcement of Employment Protection and the hiring behaviour of firms. Evidence from a large Italian region.

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Enforcement of Employment Protection and the hiring behaviour of firms. Evidence from a large Italian region

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Abstract
This paper investigates the effect of the Employment Protection Legislation (EPL) on the hiring behaviour of the firms when the level of the EPL is differentiated by firms size. In this respect, Italy represents an interesting case because workers hired by bigger firms enjoy a stronger protection than workers hired by small firms; the threshold size is fixed by law at 15 employees. A model derives the conditions under which firms decide whether to upsize or not and, in case of upsizing, whether to hire a temporary (i.e. workers who are not counted in the threshold, as apprentices in Italy) or permanent workers. The model has been tested using data drawn from the VWH (Veneto Workers History) registered data for firms and workers, from 1982 to 1997, for a large Italian region (i.e. Veneto). Firms close to the threshold are not scared to growth but they are more likely to hire apprentices than permanent workers.

Keywords
Employment Protection, Hiring, Random Effects, Regression Discontinuity Design.

JEL Codes
C21, C23, J21

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1 Introduction

The high rates of unemployment characterizing most of the European countries in the nineties have stimulated debates about the role and the efficiency of the institutions and the rules that regulate labor markets.
It is frequently argued that the strict regulations of the European labor markets can have a role in explaining the poor employment performances of the European countries (Bentolila and Bertola (1990)). Generous unemployment benefits, restrictions on hiring[1] and firing are examples that have led to rigid European labor markets.
Moreover, economists have long been concerned with the influence of firm firm size on economic performance (Schumpeter (1911)) and, as a consequences, with its determinants (Lucas (1978)). A robust empirical finding is that average firm size varies substantially even across countries at similar stage of development (Schivardi and Torrini (2004)). Bartelsman et al. (2003) report the average firm size for a set of Oecd countries for broad sectoral subdivisions. In manufacturing, for example, the average number of employees ranges from 80.3 in US, to 39 in Germany and 32 in France, reaching a minimum of 15.3 in Italy. These variations are confirmed by more sectoral disaggregated studies (Kumar et al. (1999)). In particular, cross-countries differences are not simply driven by the sectoral composition of the economy; rather, countries with a large overall size tend to show the same pattern even within narrowly defined sector[2]. This suggests that firm size distribution might have an important country specific component (Schivardi and Torrini (2004)).
Notwithstanding the relevance of these cross-countries differences, very little is known about their causes (Schivardi and Torrini (2004)). On the attempt to understand the forces behind country specific patterns, a branch of the literature[3] concentrated its attention on the role of labor market institutions, pointing on a particular institutional features, i.e. Employment Protection Legislation (EPL).
In the last decades, in fact, the role of EPL has attracted a large interest among labor economists and policy makers. The accumulated empirical evidences and theoretical analysis has greatly improved, in particular, the overall understanding on the effects of Employment Protection on the aggregated labor markets. The main empirical results in this field are that EPL reduces unemployment inflows and outflows, since countries with stricter EPL are associated with higher youth unemployment and larger self-employment (Garibaldi et al. (2003)).
From a theoretical point of view, most of the contributions treat the EPL as

[1] The restrictions on hiring refer, for example, to the mandatory quotas on hiring, the obligations on hiring disadvantaged workers, and so on.

[2] See, for example, Davis and Henrekson (1999) and Pagano and Schivardi (2003).

[3] See, for example, Garibaldi et al. (2003) and Pagano and Schivardi (2003).

a tax on labor shedding[4](Garibaldi et al. (2003)), without establishing any uncontroversial link between EPL *per se* and average firm size[5] (Schivardi and Torrini (2004)).

Most of the empirical literature works with macroeconomic data and analyzes the effect of Employment Protection on aggregate labor flows and stocks. The use of individual and firm level data in these analysis is more recent. For example, Kugler (1999) investigates the impact of firing costs on turnover and unemployment, in the context of the Colombian labor market reform. She finds an increase in the hazard rates into and out of unemployment for formal workers. Blanchard and Portugal (1998) finds that the higher employment protection is associated with lower flows and higher unemployment duration, with an ambiguous effect on unemployment rate.

Despite the increasing interest on the micro effects of the Employment Protection Legislation on the labor market, little attention has been devoted to the effect of EPL on the size distribution of firms and on the hiring behavior of firms with different size[6], in spite of the fact that in most of European countries the EPL varies across firms of different size[7]. In this context, Italy surely represents an interesting case. In fact, in the existing Italian legislation firms with more than 15 employees (i.e. threshold size for change in EPL level) are subject to stricter EPL.

Studies[8] on Italian data have been unable to find any effects of the threshold on the size distribution. Anastasia (1999) studied the firm size distribution in the Italian economy and in Veneto (a large Italian region), and did not find any significant bunching of firm close to the threshold. Tattara (1999) focused on two Italian provinces of the Veneto region, and did not find any significant threshold effect on accession and separation rates of workers, as well as on the probability of growing/shrinking of firms close to the 15 employees threshold (Garibaldi et al. (2003)).

Most of these works don't considered how the 15 employees threshold is computed. Some categories of workers, in fact, are not counted in the threshold (for examples, apprentices, short temporary contracts). This aspect together with the variable enforcement of Employment Protection might lead to some bias on the hiring behavior of firms close to the threshold.

The aim of this paper is then to investigate, both theoretically and empiri-

[4]See, for example, Bentolila and Bertola (1990), Bertola (1999).

[5]Bentolila and Bertola (1990), for example, show that firing costs reduce employment turnover, but have only second order effects on average employment.

[6]See, for example, Bauer et al. (2004), Acemoglu and Angrist (2001), Boeri and Jimeno (2003).

[7]For example, in Germany and Austria establishments with less than 6 employees are exempted from EPL, while in France firms with less than 10; in Spain, 40% of the severance payment due upon dismissal is covered by a state fund for firms with less than 25 employees.

[8]Excluding Garibaldi et al. (2003) and Schivardi and Torrini (2004) that individualized some small but significant threshold effects on firms size growth.

cally, the effect of the variable enforcement of Employment Protection on the growth's dynamics and the hiring behavior of firms close to the threshold.
I construct a model that determines the conditions under which a firm decides to upsize or not, and whether to hire a temporary worker or not, when there is some level of Employment Protection. The model considers both the case in which the EPL is homogenously and variable enforced by firm size.
To test the empirical implications of the model, data drawn from the Veneto Worker History (VWH) data set from 1982 to 1997 are used. VWH is a longitudinal rotating panel based on the Social Security Adminstration data for Veneto collected by the Italian Social Security System (Inps).
A random effect analysis has been performed and the main finding is that firms close to the threshold are not scared to upsize, but they are more likely to hire apprentices than permanent workers. Finally, I perform an evaluation analysis of the reform occurred in Italy in 1990, which modified the dismissal protection legislation for firms with less than 15 employees, using a Regression Discontinuity Design (RDD) approach.
The paper is organized as follow. Next section provides a brief description of the institutional setting in Italy. Third section presents the model and the empirical implications. Fourth section discusses the data and the empirical strategy. The fifth presents the results. The sixth discusses the 1990 reform. Finally, last section offers some concluding remarks.

2 Institutional settings

In economies in which "employment at will" does not apply[9], firing costs can be thought as the results of three main elements: the definition of fair and unfair dismissal; the cost of a no-fault dismissal and the penalty when the dismissal is ruled to be unfair; the odds for the results of a possible trial. The first defines when the firing is allowed; the second assesses the costs a firm can incur; the third describes the actual enforcement of the law and the probability of winning a case of unfair dismissal (Schivardi and Torrini (2004)).
Within the actual institutional setting, there are five types of regulations that depends on firm's size: Employment Protection (EPL), mandatory quotas on hiring, firm's level rights to organize union related institutions, firm safety standards and collective dismissal rules (Garibaldi et al. (2003)).
Surely, the most important institutional constraint is linked to the individual dismissal procedures, as legislated in the *Articolo 18* of the Labor Code (*Statuto dei Lavoratori*). In particular, an individual dismissal must be justified by a just cause rule, and workers have the right to appeal firm initiated

[9]Strictly speaking, even in US, whose legislation is considered one of the less stringent among the industrialized countries, employment at will does not apply anymore, as several exception has been introduced by courts (Autor et al. (2005)).

dismissal. In other words, workers can be fired because of misbehavior (*giusta causa* or *giustificato motivo*) or the firm's need to downsize or reorganize its activities (*giustificato motivo oggettivo*) (Schivardi and Torrini (2004)).
Workers can appeal to the court against dismissal. Whenever a judge rules the dismissal as unfair, workers are entitled to compensation that depends on firm size.
After 1990, firm employing less than 15 employees must compensate the unlawfully dismissed worker and pay a severance payment that varies between a minimum of 2.5 to a maximum of 6 months (the so-called *tutela obbligatoria*. Conversely, firms employing more that 15 employees must compensate the worker for forgone wages in the time elapsed between the dismissal and the sentence. Moreover, firms are obliged to rehire the worker (*tutela reale*)[10]. If the worker does not exercise the option to be reinstated, he or she receives a payment of 15 months of salary (Garibaldi et al. (2003)).
A critical variable in determining the expected firing costs in Italy is the uncertainty about the result of the trial. The actual application of the rule is always difficult to assess, as it depends critically on the courts and on the judge's interpretation of the law[11].
Thus, the expected firing costs should be substantially higher for firms with more than 15 employees, to which the *Articolo 18* applies.
There are other relevant constraints that apply above a given threshold[12]. Firms employing more than 10 workers are obliged to hire disadvantaged workers (i.e. officially registered long term unemployed). Further, as of 1999, firms employing more than 15 employees must employ disabled workers. Further, workers are entitled to set up a firm level institution that has the right to call general meetings, establish referendum, and post union related poster within the establishment. Also, firms with more than 15 employees have the right to vote for a workers representative for safety related issues. Finally, since 1991, collective dismissal procedures are in place above the 15 employees threshold. This procedure requires a credible risk of bankruptcy and requires the dismissal of at least 5 employees[13]; it implies negotiations with the unions but does not generate firing costs (or reinstatement risk) when implemented (Garibaldi et al. (2003)).

[10]This case is different from discriminatory dismissal (base on race, gender, political opinion, etc.) where the reinstatement is automatic and independent of firms size.

[11]Some Italian jurist deem the discretionary power of judges to far reaching (Ichino (1996)), so that firms undergoing a trial for unfair dismissal would not be sure of the result even when the dismissal is justified. In fact, the firm bear the burden of the proof. The judge's discretionary power is limited when the dismissal is due to the need to reduce the employment or reorganize the production process (Ichino (1996)).

[12]These thresholds are computed according to rules that are somehow different from those relevant for the Article 18 detailed above.

[13]Firms undergoing temporary crisis may access to supplementation schemes instead of firing part of their work force. The wages are temporarily paid by supplementation funds and the employment spell is not broken.

2.1 The threshold

The computation of the threshold is complex. The 15 employees refers to establishment as long as plants are located in the same city. In addition, the 15 employees refer to the date in which the firing is intimated, which can be ahead of the actual separation date. Further, apprentices, temporary workers below 9 months contract's length should not be computed. Conversely, part time workers should be included in proportion of their actual working time. Finally, any form of employment which does not classify as dependent employment (interim workers, full time and part time consultants) should not be included in the Labor Code based definition of employment (Garibaldi et al. (2003)).

3 The model

EPL is traditionally modeled as a firing tax on labor shedding, and the original theoretical framework is the dynamic demand under uncertainty[14] (Garibaldi et al. (2003)). Most of this literature takes EPL as given, and looks at the employment effect of different degrees of job security provisions (Garibaldi et al. (2003)).
To assess the effect of variable enforcement of Employment Protection on the hiring behavior of firms a threshold effect is introduced in a toy model of labor demand[15], deriving empirical predictions that mostly refers to increasing persistence in employment dynamics right below the threshold, i.e. firms close to threshold size are more reluctant to hire.
Another way to look at this issue is to construct a buffer stock model of labor demand. In other words, a firm can combine permanent and temporary contract at the same time. The idea is that the firm can hire a stock of permanent workers and can hire workers under temporary contracts when conditions are good, and dismiss them when conditions are bad (Garibaldi (2006)). Adding to this model firing and turnover costs is possible to construct a model that determines under which conditions a firm prefers to hire a permanent workers rather than a temporary one[16].
Considering that in Italy the EPL is differentiated by firm size and that some categories of temporary workers are not counted in the 15's employees threshold, this type of model appears particularly suitable[17].

[14] See, for example, Bentolila and Bertola (1990).
[15] See, for example, Garibaldi et al. (2003).
[16] See Garibaldi (2006) for further details.
[17] For simplicity of exposition I didn't insert comparative. For details about comparative statics contact the author.

3.1 The general model set up

The model, built on the one described by Garibaldi (2006), is a two period model and in the first period is a positive demand shock. At this stage the firm can choose between different alternatives: it maintains the same size and employs the workers for a large number of hours (*overtime*); it hires a new permanent worker or it hires a new temporary worker. Both temporary and permanent workers are equally paid and equally skilled.
Let's define y as the level of production in the first period (after the positive shock), c is the labor cost and is defined as the product between the hourly wage (w), the number of workers (l) and the hours worked (h_0 is the "normal" number of hours settled by law or national agreements).
To establish the circumstances under which a firm chooses among the options listed above, I first define the present discounted value (PDV) for each of the three possibilities.
Let's consider first the case in which the firm decides to increase the hours worked to the level h. For each extra hour the firm has to pay an extra wage, thus the labor costs is:

$$c = wlh_0 + \tilde{w}l(h - h_0) \tag{1}$$

where $\tilde{w}$ is the extra wage paid for working overtime. In the second period, the productivity is random: with probability δ the productivity will be lower (y_2) than in the first period (i.e. the positive shock is not permanent) and the hours worked need to be reduced, with probability $(1 - \delta)$ the productivity in the second period stays at y (i.e. the positive shock is permanent). The PDV[18] of having employees working overtime is then:

$$PDV_{ovt} = \frac{2 + r - \delta}{1 + r}[y - \tilde{w}l(h - h_0)] - \frac{2 + r}{1 + r}wlh_0 + \frac{\delta}{1 + r}y_2 \tag{2}$$

Let's consider then the two situations in which the firm decides to upsize. When the firm decides to offer a temporary contract (which last 1 period), the job can be terminated at no cost at the beginning of period 2; when the firm offers a permanent contract (which is a 2 period contract) the firm can terminate the job at a cost equal to $-T$. Even though the job filled by a temporary contract can terminate with no cost at the end of period 1, the worker can decide to quit and find another job somewhere else. Let's define λ as the probability that the temporary workers decide to quit. If the worker leaves, the firm has a chance to find a replacement. However, there is a positive probability that a replacement is not found: q is the probability that a replacement is successfully found (Garibaldi (2006)).
Consider first the case in which the firm decides to hire a permanent worker.

[18] For a formal derivation of the present discounted value see Appendix A.

The PDV is as follow:

$$PDV_{perm} = \frac{2+r-\delta}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}[y_2 - wlh_0 - T] \tag{3}$$

where l'[19] is the new level of employment.

In the case in which the firm decides to hire a temporary worker the PDV is:

$$PDV_{temp} = \frac{2+r-\delta-\lambda+\delta\lambda+\lambda q-\delta\lambda q}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}[y_2-wlh_0] \tag{4}$$

Following Garibaldi (2006), let's define the convenience of the firm to upsize with a permanent contract as:

$$\Delta_{upperm} = PDV_{perm} - PDV_{ovt} \tag{5}$$

where Δ is the net benefit associated with the upsize. The firm offers a permanent contract if and only if $\Delta upperm > 0$.
Using the definition 2.2 and 2.3:

$$\Delta_{upperm} = \frac{2+r-\delta}{1+r}[wlh_0 + \tilde{w}l(h-h_0) - wl'h_0] - \frac{\delta}{1+r}T \tag{6}$$

In the same way, I can define:

$$\Delta_{uptemp} = \frac{2+r-\delta}{1+r}[wlh_0+\tilde{w}l(h-h_0)-wl'h_0]+\frac{\delta\lambda+\lambda q-\delta\lambda q-\lambda}{1+r}[y-wl'h_0] \tag{7}$$

where Δ is the net benefit associated with the hiring of a temporary contract.

$$\Delta_{tempperm} = \frac{\delta\lambda+\lambda q-\delta\lambda q-\lambda}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}T \tag{8}$$

In this case, Δ is the net benefit associated with hiring a temporary worker instead of a permanent one.
Some conclusions immediately follow[20].

Proposition 1 *In absence of uncertainty (i.e. $\delta = 0$) and/or with no firing costs (i.e. $T = 0$), it's more convenient to offer a permanent contract as long as*

$$wlh_0 < \tilde{w}l(h - h_0) \tag{9}$$

[19] Considering that I'm looking at the behavior at the margin, l' can be rewritten as $l' = l + 1$.

[20] See Appendix A.

The risk associated to the hiring of a temporary worker is represented by the probability of quitting before the end of the contract (i.e. λ) and the probability to find a successful replacement (i.e. q). Looking to these parameters, a general conclusion immediately follows.

Proposition 2 *If the probability of quitting is small (i.e. $\lambda = 0$) and the probability of find a successful replacement is high (i.e. $q = 1$), it's more convenient to hire a temporary contract as long as condition (2.9) holds.*

3.2 The threshold effect

Let's assume that the firing costs are differentiated by firm size, i.e. firing costs are positive above a certain threshold ($\bar{L}$) measured by a stated number of employees.
The firing costs T, thus, can be decomposed in two part: T_L are firing costs related to the previous level of employment; ΔT is the variation in the firing costs dues to the change in the level of employment. The firing costs will be then:

$$T_{L'} = T_L + \Delta T \tag{10}$$

Let's consider first the case in which $L < \bar{L}$ and $L' < \bar{L}$ (i.e. "very small" firm). In this case, $T_L = 0$ and $\Delta T = 0$. The PDV_{perm} will be:

$$PDV_{perm} = \frac{2 + r - \delta}{1 + r}[y - wl'h_0] + \frac{\delta}{1 + r}[y_2 - wlh_0] \tag{11}$$

Given the new PDV the convenience on hiring a permanent worker with respect to working overtime is:

$$\Delta_{upperm} = \frac{2 + r - \delta}{1 + r}[\tilde{w}l(h - h_0) + wlh_0 - wl'h_0] \tag{12}$$

while the $\Delta_{tempperm}$ is given by:

$$\Delta_{tempperm} = \frac{\delta\lambda + \lambda q - \delta\lambda q - \lambda}{1 + r}[y - wl'h_0] \tag{13}$$

From (2.12) and (2.13) a proposition immediately follows:

Proposition 3 *It will be always more convenient to hire a permanent workers as long as:*

$$wh_0 < \tilde{w}l(h - h_0) \tag{14}$$

In other words, the "very small firms", if the cost of an additional worker is lower than the cost of overtime, has more convenience on hiring a permanent worker.
Let's consider now the other extreme case: the "big firms". In this case,

$L \geq \bar{L}$ and $L' \geq \bar{L}$, consequently $T_L > 0$ and $\Delta T = 0$. The PDV_{perm} will then become:

$$PDV_{perm} = \frac{2+r-\delta}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}[y_2 - wlh_0 - T_L] \tag{15}$$

From (2.15) the Δ_{upperm} and $\Delta_{tempperm}$ are immediately derived:

$$\Delta_{upperm} = \frac{2+r-\delta}{1+r}[\tilde{w}l(h-h_0) + wlh_0 - wl'h_0] - \frac{\delta}{1+r}T_L \tag{16}$$

$$\Delta_{tempperm} = \frac{\delta\lambda + \lambda q - \delta\lambda q - \lambda}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}T_L \tag{17}$$

The same conclusions obtained for the general case can be applied.
Finally, let's consider the firms with size close to the threshold. In this case, $L < \bar{L}$, $L' \geq \bar{L}$ and, consequently, $T_L = 0$ and $\Delta T > 0$. The PDV_{perm} will be:

$$PDV_{perm} = \frac{2+r-\delta}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}[y_2 - wlh_0 - \Delta T] \tag{18}$$

The change in the level of firing costs (i.e. ΔT) represents a cost when the firm hires a permanent worker, while could be seen as a gain when the firm hires a temporary workers who is not counted in the threshold[21].
Consequently, the PDV_{temp} becomes:

$$PDV_{temp} = \frac{2+r-\delta-\lambda+\delta\lambda+\lambda q-\delta\lambda q}{1+r}[y-wl'h_0] + \frac{\delta}{1+r}[y_2 - wlh_0 + \Delta T] \tag{19}$$

From (2.18) and (2.19) the expressions for Δ_{upperm} and $\Delta_{tempperm}$ immediately follow:

$$\Delta_{upperm} = \frac{2+r-\delta}{1+r}[\tilde{w}l(h-h_0) + wlh_0 - wl'h_0] - \frac{\delta}{1+r}\Delta T \tag{20}$$

$$\Delta_{tempperm} = \frac{\delta\lambda + \lambda q - \delta\lambda q - \lambda}{1+r}[y - wl'h_0] + \frac{2\delta}{1+r}\Delta T \tag{21}$$

Also in this case, the conclusions derived for the general case can be applied.
To conclude, the model suggests that the net benefit deriving from upsizing is increasing in size:

$$\Delta_{upperm}^{(small)} < \Delta_{upperm}^{(threshold)} \leq \Delta_{upperm}^{(big)} \tag{22}$$

[21] With respect to the threshold, the hiring of a temporary worker is akin to not upsize.

The gain deriving from hiring a temporary worker instead of a permanent one is greater for firm around the threshold:

$$\Delta^{(small)}_{tempperm} < \Delta^{(threshold)}_{tempperm} \geq \Delta^{(big)}_{tempperm} \tag{23}$$

3.3 Empirical implications

The first general implication deriving from the model is that if there is a permanent positive shock the firms are more likely to upsize and to hire permanent workers (i.e. the PDV_{perm} is increasing in δ, while $PDV_{overtime}$ is decreasing in δ).
Considering the situation in which the Employment Protection is differentiated by size, two implications are derived from the model. First, the convenience to upsize is increasing in size and there is no space for a threshold effect on the growing choice of the firms. Secondly, the firm close to the threshold have an higher gain on hiring a temporary worker that on hiring a permanent one. This implies the existence of a threshold effect on the hiring decisions of the firms.

4 Data and methodology

4.1 The Data

Data are from the Veneto Worker History (VWH) data set. The VWH data set is a longitudinal rotating panel built at the Department of Economics of the University of Venice on the ground of the Social Security Administrative data of the Italian Social Security System (Inps). It refers to the entire population of employers and employees in Veneto.
VWH data include register-based information on all establishments and employees that have been hired by those establishments for at least one day during the period of observation and the entire working life of all the employees has been reconstructed.
I select all the establishments with at least 1 year of life and a size between 1 and 30 employees in the period from 1982 to 1997[22], obtaining a sample of $1,604,459$ observations. For each plant, I compute the stock of employment, the stock of apprentices and the stock of permanent workers for each year[23].
I gather information on demand shocks occurred in this period from data related to the Veneto export at the industry level and regional GDP[24].

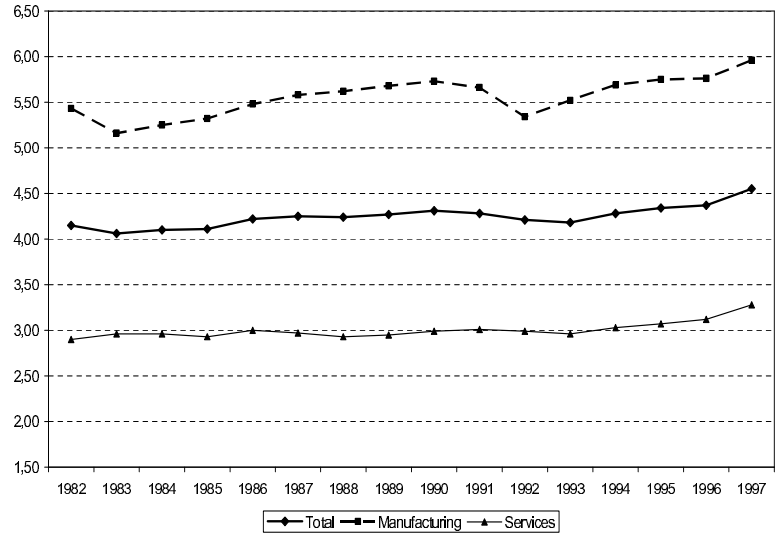
[22]Data relative to the period before 1982 has been excluded for reliability problems as well as the data after 1997.

[23]The stocks are computed considering the individuals employed in the firm the 31th of October.

[24]These data come from Istat public data on import and export. Data related to GDP variations come from Prometeia.

In tab. 1[25], the composition of the sample is described. The majority of the firms are more than 6 years old; the firms are equally distributed between manufacturing and services. In the same way, from a geographical point of view, the firms are more concentrated in the 5 main provinces (Treviso, Padova, Verona, Vicenza and Venezia).

Fig. 1: Average firm size by sector - Veneto 1982-1997

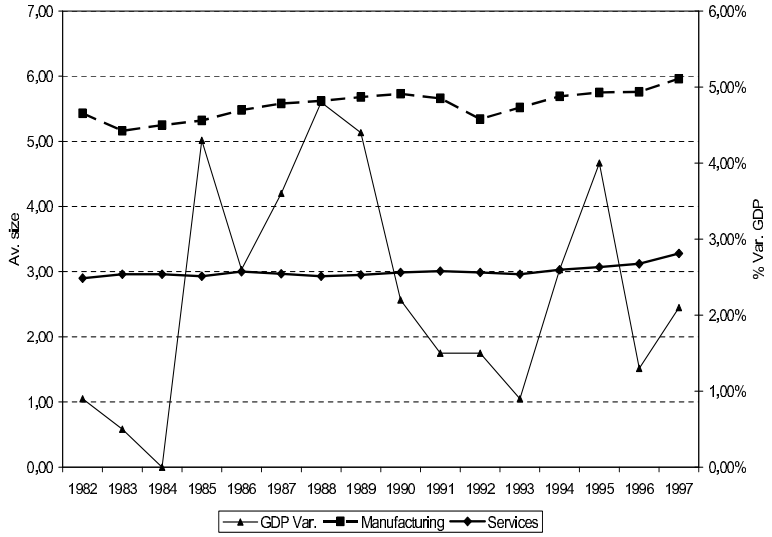


Note: VWH data.

In fig. 1 and 2 are represented, respectively, the average firm's size by year, differentiated by broad sectorial division and the average firm's size together with the GDP variations for Veneto.
The average firm's size in Veneto is very small (about 4 employees per firm), it has increased since the beginning of nineties, and it has remained stable afterwards.
Despite the high variability of the GDP the average size of the firm remains stable along all the period considered.
Figure 3 shows the number of firms by size class, where the size class is calculated using total employment. Figure 4, instead, shows the number of firms by size class using the "threshold" employment. In other words, each size class in constructed using the total employment minus the workers that are not counted in the threshold (i.e. apprentices).
The interesting aspect highlighted by the two graph is that looking to both total size and "threshold" size there is no evidence of an higher concentration of firms in the classes close to the threshold level of 15 employees. This could be seen as a first indication of the rightness of the first implication of the model, saying that the firms close to the threshold are not scared to upsize.

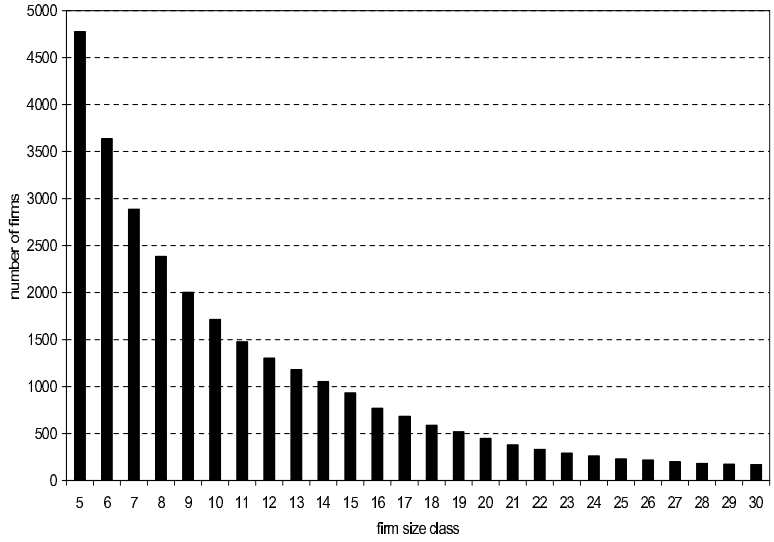
[25]See Appendix B.

Fig. 2: Average firm size and GDP - Veneto 1982-1997



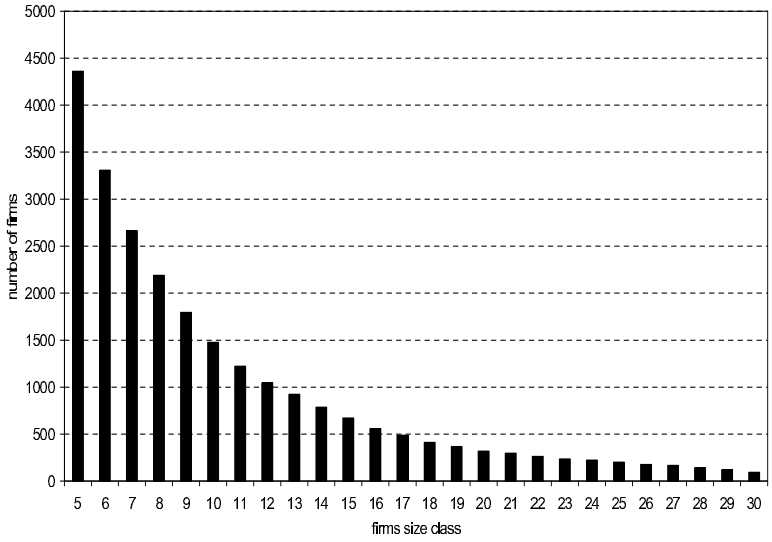
Note: VWH data and Istat.

Fig. 3: Number of firm by size class - Veneto 1982-1997



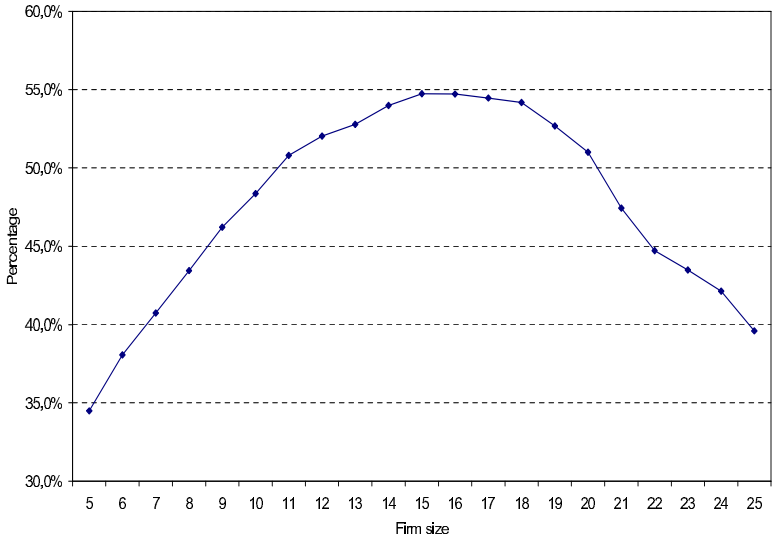
Note: VWH data.

Fig. 4: Number of firm by "threshold" size class - Veneto 1982-1997



Note: VWH data.

Fig. 5: Percentage of firm hiring apprentices by "threshold" size class - Veneto 1982-1997



Note: VWH data.

Finally, figure 5 shows the percentage of firms hiring apprentices on the total number of upsizing firms, by "threshold" size class.
The graph gives an intuition of the existence of a threshold effect on the use of apprentices. In fact, the percentage of firms hiring apprentices is increasing in size and it reach at the 15 employees class and, for greater classes, is decreasing dramatically.

4.2 Empirical strategy

In order to test the empirical implications deriving from the model I use three different specification. First, I consider the following equation:

$$y_{it} = \alpha + \beta X_i + \sum_{k=1}^{n} \gamma_k D_{size} + u_i + \varepsilon_{it} \tag{24}$$

where y_i is the outcome variable, i.e. yearly variations in the number of workers hired each year. X_i is a set of control variables composed by firm's age, age squared, industry dummies, year dummies, provincial dummies, GDP and export; u_i is the random disturbances. Finally, D_{size} is a set of size dummies, taking value 1 if the "threshold size" of the firm is equal to k ($k = 1, ..., 30$) and 0 otherwise.
I used the dummy relatives to the 15 employees size as baseline.
In the second specification, I estimated the same equation inserting all size dummies in order to see the effect at the threshold size (i.e. size15).
Finally, I estimated the following equations:

$$y_{it} = \alpha + \beta X_i + \gamma Big + u_i + \varepsilon_{it} \tag{25}$$

$$y_{it} = \alpha + \beta X_i + \gamma small + u_i + \varepsilon_{it} \tag{26}$$

where, instead of using the size dummies I use a variable measuring the distance from the threshold size. In particular, Big refers to firm greater than 15 employees and $small$ refers to firms smaller than 15 employees.
All the specifications have been estimated with a panel random fixed effect estimator. This choice is particularly suitable if the sample is drawn from a large population, as in my case.
Each specification has been estimated separately for yearly variations in the number of permanent workers and yearly variations in the number of apprentices. Moreover, the estimations have been carried out separately on the overall sample and by broad sectorial divisions (manufacturing and services).

5 Results

The two main implications deriving from the model, in a situation of variable enforcement of EPL, are: there is no threshold effect on the upsizing behavior of the firm (i.e. the firms with a size close to 15 employees are not scared to upsize) and, on the other hand, there is a threshold effect on the hiring behavior of the firms (i.e. the firms close to the 15 employees threshold prefer to hire apprentices than permanent workers).
The first specification of the model uses the dummy relatives to the 15 employees size as baseline. Table 3 and 4[26] shows the estimation results respectively for the yearly variations of permanent workers and apprentices.
Looking at the behavior around the threshold in tab. 3, there is no evidence of a threshold effect. In fact, the sign of the $size14$ dummy is negative and the sign of the $size16$ dummy is positive. This means that, with respect to firms with 15 employees, firms with 14 employees hire a lower number of permanent workers and, on the other hand, firms with 16 employees hire more permanent workers. Thus, the convenience on upsizing with permanent workers is increasing in size and the "threshold" firms has not a lower convenience on upsizing than all other firms. This results are confirmed looking at manufacturing and services separately[27].
In tab. 4, looking at the sign of the $size14$ and $size16$ signs, some evidences of a threshold effect, on the yearly variations of in the number of apprentices hired, appear. In fact, the sign for both dummies is negative. This means that firm with 14 and 16 employees hire less apprentices than firms with 15 employees. Also in this case, the results are confirmed looking to manufacturing and services separately.
To support the results obtained in this specification, I insert in the regression a variable measuring the size distance from the threshold ("small" is the distance from the threshold for firm with less than 15 employees and "big" is the distance from the threshold for firms with more than 15 employees).
Table 6 and 6bis shows the estimation results. The number of permanent workers hired is decreasing moving along smaller sizes and increasing moving along bigger sizes. Conversely, the number of apprentices hired is decreasing in both directions. The results are the same both for manufacturing and services.
Tab. 5 shows that for firms with 15 employees the effect on the number of permanent workers hired is positive, lower than for firms with 16 employees and greater (and different in sign) than for firms with 14 employees. The effects are particularly strong for the services sector. Finally, tab. 5bis shows that for firms with 15 employees the effect on the number of apprentices hired is negative but smaller than for firms with 14 employees and 16 employees.

[26] See Appendix C.
[27] The results are highly significant for services.

6 The 1990 reform

6.1 Institutional changes

In 1990 the Italian legislation on individual dismissal rules applied to small firms changed drastically.
Before 1990, workers dismissed from small firms could not appeal the employer initiated dismissal, i.e. before 1990 firms employing less than 15 employees were not obliged to obey to "just cause" rule for their individual dismissals.
Since 1990, small firms are required to justify their dismissals in accordance to the Labour Code, and whenever the dismissal is ruled as unfair, they are obliged to compensate the worker with a severance payment that varies between 2.5 to 6 monthly wages (with the actual payment linked to the seniority of the dismissed worker)(Garibaldi et al. (2003)).
As far as individual dismissal are concerned, after 1990, the difference in EPL between small and large firms was reduced: while large firm are obliged to rehire unlawfully dismissed workers, small firms can compensate workers through a severance payment. This policy change is akin to tightening in EPL on small firms to large firms (Garibaldi et al. (2003)).

6.2 Empirical strategy

The reform occurred in 1990 introduced some Employment Protection also for firms with less than 15 employees. This implies, looking at theoretical model, a reduction of ΔT, thus a reduction on the convenience, for firms close to the threshold size, on hiring apprentices.
To evaluate the impact of the reform, the presence of a threshold, makes the Regression Discontinuity Design approach particularly suitable.

6.2.1 The Regression Discontinuity Design

The Regression Discontinuity Design (RDD) is quasi-experimental design with the defining characteristic that the probability of receiving treatment changes discontinuously as a function of one or more underlying variables[28] (Hahn et al. (2001)).
There are two main types of discontinuity designs considered in the literature: the *sharp* design and the so-called *fuzzy* design. With a *sharp* design, the treatment x_i is known to depend in a deterministic way on some observable variables z_i - $x_i = f(z_i)$, where z_i takes a continuum of values. The point z_0, where the function $f(z_i)$ is discontinuous, is assumed to known (Hahn et al.

[28]The term *Regression Discontinuity Design* was first introduced by Thistlethwhite and Campbell (1960). Recent descriptions of the technique are Battistin and Rettore (2003) and Hahn et al. (2001). Some recent applications include Card and Shore-Sheppard (2001), Leonardi and Pica (2007).

(2001)).
With a *fuzzy* design, x_i is a random variable given z_i, but the conditional probability $f(x_i) \equiv E[x_i|z_i = z] = P[x_i|z_i = z]$ is known to be discontinuous at z_0 (Hahn et al. (2001).
The *fuzzy* design differs from *sharp* design in that the treatment assignment is not a deterministic function of z_i. The common feature it shares with the *sharp* design is that the probability of receiving treatment, $P[x_i = 1|z]$, viewed as a function of z_i, is discontinuous in z_0 (Hahn et al. (2001).
Given the model for the observed outcome can be written as:

$$y_i = \alpha_i + \beta_i x_i \tag{27}$$

the common shape of the Regression Discontinuity Design estimator is:

$$\beta = \frac{y^+ - y^-}{x^+ - x^-} \tag{28}$$

For both the designs the ratio identifies the treatment effect of $z = z_0$. Thus, given consistent estimators of the four one-sided limits in (2.25), the treatment effect can be consistently estimated by:

$$\hat{\beta} = \frac{\hat{y}^+ - \hat{y}^-}{\hat{x}^+ - \hat{x}^-} \tag{29}$$

6.2.2 Estimation strategy

In the evaluation design of this reform, the discontinuity point is given by the threshold size of 15 employees. Thus, the treatment group is composed by firm with less than 15 employees and the control group is composed by firm with more than 15 employees[29].
Given that the level of EPL affects differently firms depending on their size, it can be argued that there is selection bias on the construction of the treatment and the control groups (i.e. the threshold could be seen as exogenous). The results obtained in the first part of the paper, however, shows that there is no threshold effect on the upsizing behavior of firms, thus I can claim that the threshold is exogenous.
Moreover, the identification assumption in the RDD approach is essentially that the average outcome for firms marginally above the threshold represents a valid counterfactual for the treated just below the threshold (Leonardi and Pica (2007)). Thus, I select firms with a size between 10 and 20 employees and I estimate, using a panel random effect estimator, the following equation:

$$Y_{it} = \alpha + D_{15} + Post_{1990} + \gamma D_{15} * Post91 + \beta X_i t + u_i + \varepsilon_i t \tag{30}$$

[29]The construction of the groups is based on the "threshold size" of the firm (i.e. the size is defined by the number of permanent workers in each firm).

where Y_{it} is the number of apprentices hired by each firm; D_{15} is the treatment dummy taking value 1 if firms have less than 15 employees and 0 otherwise; $Post_{90}$ is the post-treatment dummy taking value 1 in the post-treatment period and 0 otherwise; and, X_i is a set of control variable[30]; u_i is the random disturbances. The coefficient γ associated to the interaction term gives the measure of the impact of the reform.
The period considered is from 1982 to 1997. 1990 has been excluded considering that the reform occurred in July of this year and the hiring behavior of firms are likely to be a mixture of pre and post reform period (Leonardi and Pica (2007)).
Table 7[31] shows the estimation results. Contrarily on what expected, the 1990 reform had a positive impact on the use of apprentices by firm close to the 15 employees threshold. However, the effect is very small. This is probably due to the fact that, even if it has been introduced some protection for workers hired in small firms, the difference in firing costs between small and big firms remain dramatically high and the convenience on hiring apprentices is not reduced.

7 Concluding remark

This paper investigates the effect of Employment Protection Legislation on the hiring behavior of the firms when the level of EPL is differentiated by firms size.
According to the model presented, the firm has, in case of positive shocks, three possible choices: do not upsize (working overtime), hires a new permanent worker, hires a new temporary workers. The firm chooses according to the present discounted value of each option.
The two main implications of the model are that firms close to the threshold size are not scared to upsize, but if they decide to upsize they have more convenience on hiring a temporary worker who is not counted in the threshold.
The two main simplifications of the model are that permanent and temporary workers are equally paid and equally skilled. This two assumption are pretty strong considering that in the reality workers are heterogenous in both senses.
However, the model could be easily extended in both directions. In the case in which, permanent and temporary workers are not equally paid (reasonably I could argue that temporary workers are paid less), the evidence of threshold effect on the hiring behavior of firms should be strengthened. In the case of heterogeneity in skill, the model should produces different results

[30] See control variables in the general case.
[31] See Appendix D.

for low and skill workers. For low skill workers, considering the absence of the cost of training, the results should holds. For high skill workers, instead, the higher convenience on hiring apprentices rather than permanent workers should disappear.
Using the VWH data set for Veneto, from 1982 to 1997, it appears that there is not a threshold effect on the choice between upsizing with a permanent workers and do not upsize. There is, instead, a threshold effect on the use of apprentices. Firms close to the threshold size hire more apprentices than other firms.
An analysis of the reform occurred in Italy in 1990 has also been performed. The introduction of some level of protection also for workers hired in firms with less than 15 employees produced a reduction in the level of firing costs between small and big firms. The effect should be a reduction of the convenience for firms close to the threshold size on hiring apprentices.
The analysis performed using a RDD approach highlights a very small and positive effect on the number of apprentices hired by small firms close to the threshold. This is probably due to the fact that the difference in the level of firing costs between small and big firms remains very high and the legislation change doesn't really modify the behavior of firms.

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A The model

In the general model:

$$PDV_{ovt} = [y - wlh_0 - \tilde{w}l(h - h_0)] + \frac{\delta(y_2 - wlh_0) + (1-\delta)(y - wlh_0 - \tilde{w}l(h - h_0))}{1+r} =$$

$$= \frac{(1+r)y - (1+r)wlh_0 - (1+r)\tilde{w}l(h-h_0) + \delta y_2 - \delta wlh_0 + (1-\delta)y - (1-\delta)wlh_0 - (1-\delta)\tilde{w}l(h-h_0)}{1+r} =$$

$$= \frac{(1+r+1-\delta)}{1+r}y - \frac{(1+r+1-\delta+\delta)}{1+r}wlh_0 - \frac{(1+r+1-\delta)}{1+r}\tilde{w}l(h-h_0) + \frac{\delta}{1+r}y_2 =$$

$$= \frac{2+r-\delta}{1+r}[y - \tilde{w}l(h-h_0)] - \frac{2+r}{1+r}wlh_0 + \frac{\delta}{1+r}y_2$$

$$PDV_{perm} = [y - wl'h_0] + \frac{\delta(y_2 - wlh_0 - T) + (1-\delta)(y - wl'h_0)}{1+r} =$$

$$= \frac{(1+r)y - (1+r)wl'h_0 + \delta y_2 - \delta wlh_0 - \delta T + (1-\delta)y - (1-\delta)wl'h_0}{1+r} =$$

$$= \frac{(1+r+1-\delta)}{1+r}y - \frac{(1+r+1-\delta)}{1+r}wl'h_0 + \frac{\delta}{1+r}y_2 - \frac{\delta}{1+r}wlh_0 - \frac{\delta}{1+r}T =$$

$$= \frac{2+r-\delta}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}[y_2 - wlh_0 - T]$$

$$PDV_{temp} = [y - wl'h_0] + \frac{\delta(y_2 - wlh_0) + (1-\delta)[(1-\lambda)(y - wl'h_0) + \lambda q(y - wl'h_0)]}{1+r} =$$

$$= \frac{(1+r)y - (1+r)wl'h_0 + \delta y_2 - \delta wlh_0 + (1-\delta)(1-\lambda)y - (1-\delta)(1-\lambda)wl'h_0 + (1-\delta)\lambda qy - (1-\delta)\lambda qwl'h_0}{1+r} =$$

$$= \frac{(1+r+1-\delta-\lambda+\delta\lambda+\lambda q-\delta\lambda q)}{1+r}y - \frac{(1+r+1-\delta-\lambda+\delta\lambda+\lambda q-\delta\lambda q)}{1+r}wl'h_0 + \frac{\delta}{1+r}y_2 - \frac{\delta}{1+r}wlh_0 =$$

$$= \frac{(2+r-\delta-\lambda+\delta\lambda+\lambda q-\delta\lambda q)}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}[y_2 - wlh_0]$$

$$\Delta_{upperm} = \frac{2+r-\delta}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}[y_2 - T] - \frac{2+r-\delta}{1+r}[y - \tilde{w}l(h-h_0) - \frac{2+r}{1+r}wlh_0 - \frac{\delta}{1+r}y_2 =$$

$$= \frac{(2+r-\delta)}{1+r}[y - wl'h_0 - y + \tilde{w}l(h-h_0)] + wlh_0] + \frac{\delta}{1+r}[y_2 - T - y_2] =$$

$$= \frac{(2+r-\delta)}{1+r}[\tilde{w}l(h-h_0) + wlh_0 - wl'h_0] - \frac{\delta}{1+r}T$$

$$\Delta_{uptemp} = \frac{(2+r-\delta-\lambda+\delta\lambda+\lambda q-\delta\lambda q)}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}[y_2-wlh_0]-\frac{2+r-\delta}{1+r}[y-\tilde{w}l(h-h_0)-\frac{2+r}{1+r}wlh_0-\frac{\delta}{1+r}y_2 =$$

$$= \frac{(2+r-\delta)}{1+r}[y-wl'h_0-y+\tilde{w}l(h-h_0)+wlh_0]+\frac{(\delta\lambda+\lambda q-\delta\lambda q-\lambda)}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}[y_2-y_2] =$$

$$= \frac{(\delta\lambda+\lambda q-\delta\lambda q-\lambda)}{1+r}[y-wl'h_0]+\frac{(2+r-\delta)}{1+r}[\tilde{w}l(h-h_0)+wlh_0-wl'h_0]$$

$$\Delta_{tempperm} = \frac{(2+r-\delta-\lambda+\delta\lambda+\lambda q-\delta\lambda q)}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}[y_2-wlh_0]-\frac{2+r-\delta}{1+r}[y-wl'h_0]-\frac{\delta}{1+r}[y_2-T] =$$

$$= \frac{2+r-\delta}{1+r}[y-wl'h_0+wl'h_0]+\frac{(\delta\lambda+\lambda q-\delta\lambda q-\lambda)}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}[y-y-wlh_0+wlh_0+T] =$$

$$= \frac{(\delta\lambda+\lambda q-\delta\lambda q-\lambda)}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}T$$

In the threshold model for "small" firm:

$$PDV_{perm} = [y-wl'h_0]+\frac{\delta(y_2-wlh_0)+(1-\delta)(y-wl'h_0)}{1+r} =$$

$$= \frac{(1+r)y-(1+r)wl'h_0+\delta y_2-\delta wlh_0+(1-\delta)y-(1-\delta)wl'h_0}{1+r} =$$

$$= \frac{(1+r+1-\delta)}{1+r}y-\frac{(1+r+1-\delta)}{1+r}wl'h_0-\frac{\delta}{1+r}wlh_0+\frac{\delta}{1+r}y_2 =$$

$$= \frac{2+r-\delta}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}[y_2-wlh_0]$$

$$\Delta_{upperm} = \frac{2+r-\delta}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}y_2-\frac{2+r-\delta}{1+r}[y-\tilde{w}l(h-h_0)-\frac{2+r}{1+r}wlh_0+\frac{\delta}{1+r}y_2 =$$

$$= \frac{(2+r-\delta)}{1+r}[y-wl'h_0+\tilde{w}l(h-h_0)+wlh_0-y]+\frac{\delta}{1+r}[y_2-y_2] =$$

$$= \frac{(2+r-\delta)}{1+r}[\tilde{w}l(h-h_0)+wlh_0-wl'h_0]$$

$$\Delta_{tempperm} = \frac{(2+r-\delta-\lambda+\delta\lambda+\lambda q-\delta\lambda q)}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}[y_2-wlh_0]-\frac{2+r-\delta}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}y_2 =$$

$$= \frac{(2+r-\delta)}{1+r}[y-wl'h_0-y+wl'h_0]+\frac{(\delta\lambda+\lambda q-\delta\lambda q-\lambda)}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}[y_2-y_2+wlh_0-wlh_0] =$$

$$= \frac{(\delta\lambda+\lambda q-\delta\lambda q-\lambda)}{1+r}[y-wl'h_0]$$

In the threshold model for "threshold" firm:

$$PDV_{perm} = [y-wl'h_0]+\frac{\delta(y_2-wlh_0-\Delta T)+(1-\delta)(y-wl'h_0)}{1+r} =$$

$$= \frac{(1+r)y-(1+r)wl'h_0+\delta y_2-\delta wlh_0-\delta\Delta T+(1-\delta)y-(1-\delta)wl'h_0}{1+r} =$$

$$= \frac{(2+r-\delta)}{1+r}[y-wl'h_0]+\frac{\delta}{1+r}[y_2-wlh_0-\Delta T]$$

$$PDV_{temp} = [y - wl'h_0] + \frac{\delta(y_2 - wlh_0 + \Delta T) + (1-\delta)[(1-\lambda)(y - wl'h_0)] + \lambda q(y - wl'h_0)]}{1+r} =$$

$$= \frac{(1+r)y - (1+r)wl'h_0 + \delta y_2 - \delta wlh_0 + \delta\Delta T + (1-\delta)(1-\lambda)y - (1-\delta)(1-\lambda)wl'h_0 + (1-\delta)\lambda qy - (1-\delta)\lambda qwl'h_0}{1+r} =$$

$$= \frac{(2+r-\delta-\lambda+\delta\lambda+\lambda q-\delta\lambda q)}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}[y_2 - wlh_0 + \Delta T]$$

$$\Delta_{upperm} = \frac{(2+r-\delta)}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}[y_2 - wlh_0 - \Delta T] - \frac{2+r-\delta}{1+r}[y - \tilde{w}l(h-h_0)] + \frac{2+r}{1+r}wlh_0 - \frac{\delta}{1+r}y_2 =$$

$$= \frac{(2+r-\delta)}{1+r}[y - wl'h_0 - y + \tilde{w}l(h-h_0)] + wlh_0] + \frac{\delta}{1+r}[y_2 - \Delta T - y_2] =$$

$$= \frac{(2+r-\delta)}{1+r}[\tilde{w}l(h-h_0) + wlh_0 - wl'h_0] - \frac{\delta}{1+r}\Delta T$$

$$\Delta_{tempperm} = \frac{(2+r-\delta-\lambda+\delta\lambda+\lambda q-\delta\lambda q)}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}[y_2 - wlh_0 + \Delta T] - \frac{(2+r-\delta)}{1+r}[y - wl'h_0] - \frac{\delta}{1+r}[y_2 - wlh_0 - \Delta T] =$$

$$= \frac{(2+r-\delta)}{1+r}[y - wl'h_0 - y + wl'h_0] + \frac{(\delta\lambda - \lambda + \lambda q - \delta\lambda q)}{1+r}[y - wl'h_0] + \frac{\delta}{1+r}[y_2 - wlh_0 - y_2 + wlh_0] + \frac{2\delta}{1+r}\Delta T =$$

$$= \frac{(\delta\lambda - \lambda + \lambda q - \delta\lambda q)}{1+r}[y - wl'h_0] + \frac{2\delta}{1+r}\Delta T$$

B The data

Tab. 1: Panel composition

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
N. Firms	87,095	87,929	87,926	91,887	93,519	97,712	102,235	105,323	107,517	108,433	109,407	107,742	105,658	106,213	106,924	98,939
Tot. Obs.	1,604,459															

Note: INPS data.

Tab. 2: Sample composition

Variables	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
% firms age ≥ 6	62.62	63.05	64.53	66.34	67.60	67.64	66.23	64.81	64.45	66.10	67.48	68.06	69.51	70.73	70.84	68.97
Manufacturing	42,831	44,159	43,702	45,446	46,195	47,795	49,732	51,001	51,878	51,993	52,296	51,084	49,892	50,303	50,714	46,990
Services	44,264	43,770	44,224	46,441	47,324	49,917	52,503	54,322	55,639	56,440	57,111	56,658	55,766	55,910	56,210	51,949
Treviso	14,419	14,916	15,019	15,826	16,272	16,901	17,642	18,366	18,748	18,949	19,264	19,094	18,700	18,916	19,006	17,727
Verona	16,170	16,448	16,475	17,140	17,300	18,126	18,929	19,400	19,728	19,869	19,951	19,502	19,191	19,307	19,529	18,029
Vicenza	15,170	15,688	15,858	16,574	17,132	18,008	18,701	19,263	19,710	19,938	20,017	19,842	19,611	19,759	19,947	18,642
Venezia	15,927	14,960	14,757	15,220	15,504	16,127	16,919	17,470	17,835	17,935	18,085	17,839	17,501	17,552	17,628	16,083
Padova	16,501	17,177	17,134	18,108	18,292	19,114	20,138	20,610	21,111	21,323	21,572	21,168	20,611	20,640	20,709	19,242
Belluno	4,617	4,266	4,283	4,473	4,431	4,648	4,784	4,934	4,995	5,011	5,094	5,080	4,959	4,967	4,963	4,569
Rovigo	4,291	4,474	4,400	4,546	4,588	4,788	5,122	5,280	5,390	5,408	5,424	5,217	5,085	5,072	5,142	4,647

Note: INPS data.

C Estimation results

Table 3: Estimation results: Upsizing with permanent workers

	All sample		Manufacturing		Services	
size	0.118	***	0.182	***	0.031	*
	(0.011)		(0.015)		(0.018)	
age	-0.034	***	-0.049	***	-0.023	***
	(0.001)		(0.002)		(0.001)	
size8	-0.040	**	-0.010		−0.052	
	(0.020)		(0.029)		(0.033)	
size9	-0.033		-0.003		-0.045	
	(0.021)		(0.030)		(0.033)	
size10	0.007		0.024		0.010	
	(0.022)		(0.031)		(0.034)	
size11	-0.060	***	-0.022		-0.090	***
	(0.022)		(0.032)		(0.033)	
size12	0.050		0.010		0.041	
	(0.038)		(0.053)		(0.062)	
size13	-0.046	*	-0.016		-0.084	**
	(0.024)		(0.035)		(0.035)	
size14	-0.123	***	-0.067	*	-0.225	***
	(0.026)		(0.039)		(0.038)	
size16	0.059	*	-0.001		0.119	***
	(0.033)		(0.047)		(0.052)	
size17	-0.016	***	-0.028	***	0.018	***
	(0.003)		(0.004)		(0.007)	
size18	0.145	***	0.212	***	-0.095	
	(0.043)		(0.060)		(0.073)	
size19	0.242	***	0.353	***	-0.102	
	(0.048)		(0.067)		(0.086)	
size20	0.164	***	0.298	***	-0.248	***
	(0.055)		(0.076)		(0.101)	
GDP	1.927	***	2.346	***	1.651	***
	(0.139)		(0.256)		(0.159)	
export	0.082	***	0.295	***	-0.055	***
	(0.023)		(0.042)		(0.026)	
year dummies	yes		yes		yes	
industry dummies	yes		yes		yes	
provincial dummies	yes		yes		yes	
N.Obs	411,495		164,574		246,921	

Notes: The standard error are indicated in parenthesis. * corresponds to 10%, ** to 5% and *** to 1% level of significance; 4 digits industry dummies; the dummy corresponding to 15 employees size has been used as baseline.

Tab. 4: Estimation results: Upsizing with apprentices

	All sample		Manufacturing		Services	
size	-0.026	***	0.038	***	-0.017	***
	(0.004)		(0.006)		(0.004)	
age	-0.001		-0.004		–	
	(0.001)		(0.001)		–	
size8	0.130	***	0.071	***	0.153	***
	(0.007)		(0.013)		(0.008)	
size9	0.108	***	0.071	***	0.111	***
	(0.008)		(0.013)		(0.008)	
size10	0.070	***	0.045	***	0.073	***
	(0.008)		(0.014)		(0.009)	
size11	0.051	***	0.032	**	0.056	***
	(0.009)		(0.015)		(0.009)	
size12	-0.040	***	0.025		-0.138	***
	(0.015)		(0.025)		(0.017)	
size13	0.018	*	0.029	*	0.002	
	(0.010)		(0.017)		(0.010)	
size14	-0.017		0.012		-0.056	***
	(0.011)		(0.018)		(0.011)	
size16	-0.078	***	-0.070	***	-0.055	***
	(0.014)		(0.023)		(0.016)	
size17	-0.071	***	-0.082	***	-0.081	***
	(0.001)		(0.002)		(0.002)	
size18	-0.034	*	0.032		-0.123	***
	(0.018)		(0.029)		(0.021)	
size19	-0.086	***	-0.035		-0.141	***
	(0.020)		(0.032)		(0.023)	
size20	-0.085	***	-0.003		-0.172	***
	(0.022)		(0.036)		(0.026)	
GDP	0.128	***	0.025		0.188	***
	(0.041)		(0.097)		(0.035)	
exp	-0.005		0.023		-0.024	***
	(0.007)		(0.016)		(0.006)	
year dummies	yes		yes		yes	
industry dummies	yes		yes		yes	
provincial dummies	yes		yes		yes	
N.Obs	324,800		123,288		201,512	

Notes: The standard error are indicated in parenthesis. * corresponds to 10%, ** to 5% and *** to 1% level of significance; 4 digits industry dummies; the dummy corresponding to 15 employees size has been used as baseline.

Tab. 5: Estimation results: Effects at 15 employees size on hiring of permanent workers

	All sample		Manufacturing		Services	
size14	-0.084	***	−0.043		-0.175	***
	(0.032)		(0.046)		(0.048)	
size15	0.082	**	0.048		0.100	***
	(0.036)		(0.051)		(0.059)	
size16	0.114	***	0.030		0.200	***
	(0.041)		(0.057)		(0.071)	
N.Obs	411,495		164,574		246,921	

Notes: The standard error are indicated in parenthesis. * corresponds to 10%, ** to 5% and *** to 1% level of significance.

Tab. 5bis: Estimation results: Effects at 15 employees size on hiring of apprentices

	All sample		Manufacturing		Services	
size14	-0.048	***	0.014		-0.102	***
	(0.013)		(0.022)		(0.013)	
size15	-0.044	***	0.004		-0.100	***
	(0.014)		(0.024)		(0.016)	
size16	-0.105	***	-0.067	**	-0.125	***
	(0.016)		(0.027)		(0.019)	
N.Obs	324,800		123,288		201,512	

Notes: The standard error are indicated in parenthesis. * corresponds to 10%, ** to 5% and *** to 1% level of significance.

Tab. 6: Estimation results: Effects of the distance from the threshold on hiring permanent workers

	All sample	Manufacturing	Services
Big (> 15 employees)	0.082 ***	0.071 ***	0.105 ***
	(0.006)	(0.007)	(0.011)
Small (< 15 employees)	-0.094 ***	-0.084 ***	-0.111 ***
	(0.001)	(0.002)	(0.002)
N.Obs	11,185	7,887	3,298
N.Obs	145,686	85,140	60,546

Notes: The standard error are indicated in parenthesis. * corresponds to 10%, ** to 5% and *** to 1% level of significance.

Tab. 6bis: Estimation results: Effects of the distance from the threshold on hiring apprentices

	All sample	Manufacturing	Services
Big (> 15 employees)	−0.006	−0.007	0.002
	(0.004)	(0.004)	(0.010)
Small (< 15 employees)	-0.025 ***	-0.024 ***	-0.029 ***
	(0.001)	(0.001)	(0.001)
N.Obs	4,335	3,646	689
N.Obs	147,972	34,244	13,728

Notes: The standard error are indicated in parenthesis. * corresponds to 10%, ** to 5% and *** to 1% level of significance.

D Reform

Tab. 7: Estimation results: 1990's reform effects on number of apprentices hired

	All sample		Manufacturing		Services	
reform	-0.893	***	-1.003	***	-0.557	***
	(0.020)		(0.026)		(0.025)	
post90	-0.455	***	-0.553	***	-0.189	***
	(0.025)		(0.033)		(0.026)	
treatment	0.047	**	0.064	**	0.034	
	(0.021)		(0.029)		(0.021)	
control variables	yes		yes		yes	
N.Obs	145,247		108,681		36,566	

Notes: The standard error are indicated in parenthesis. * corresponds to 10%, ** to 5% and *** to 1% level of significance.

Testo WP

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