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IDENTIFYING THE EFFECTS OF FIRING RESTRICTIONS THROUGH SIZE-CONTINGENT DIFFERENCES IN REGULATION

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ABSTRACT

Identifying the Effects of Firing Restrictions Through Size-Contingent Differences in Regulation*

We study the effects of the more stringent employment protection legislation (EPL) that applies in Italy to firms with over 15 employees. We consider firms' propensity to grow when close to that threshold and changes in employment policies when they pass it. Using a comprehensive matched employer-employees dataset, we find that the probability of firms' growth is reduced by around 2 percentage points near the threshold. Using the stochastic transition matrix for firm size, we compute the long-run effects of EPL on the size distribution, finding that they are quantitatively modest. We also find that, contrary to the implications of more stringent firing restrictions, workers in firms just above the threshold have on average less stable employment relations than those just below it. We document that this is because firms above the threshold make greater use of flexible employment contracts, arguably to circumvent the stricter regulation on open-end contracts.

JEL Classification: D21, J63, J65 and L11
Keywords: employment policies, firing costs, firm size distribution and matched data

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1 Introduction

Excessive regulation in the labor market has been pinpointed as one of the main reasons for the disappointing economic performance of continental Europe over the last twenty years. In particular, much attention has been devoted to the effects of employment protection legislation (EPL) on the grounds that firing restrictions would prevent the labor market from working efficiently. Despite this attention, a consensus view on the effects of EPL has not been reached (Gregg and Manning 1996). One problem is that most of the evidence is based on cross-country analysis, which is plagued by problems of collinearity, measurement and omitted variable: for example, countries with more regulated labor markets also tend to have more regulated product and financial markets (OECD 1999) .

To overcome this problem, a recent literature uses differences in regulation within countries, either over time or across space, to analyze the effects of EPL (Acemoglu and Angrist 2001, Autor 2003, Autor, Donohue and Schwab 2004). This paper follows the same line of investigation. We exploit the fact that in Italy, as in many other countries, *EPL provisions are more stringent above a certain employee threshold.*[1] This offers a powerful identification scheme of the effects of EPL: the discontinuous change in legislation at the threshold should result in a discontinuous change in firms' behavior, the more so the costlier the regulation. We use this idea to study two related aspects. First, we consider whether firms' growth propensity drops just below the threshold; second, we analyze weather employment policies change discontinuously above it, possibly in ways that could reduce the extra cost of more stringent legislation.

Our identification scheme is based on the idea that, if the more stringent EPL that applies above a given threshold is costly, firms will be reluctant to pass that limit. Thus we identify the impact of the threshold by comparing the propensity to grow of firms just below the threshold with that of firms at some distance from it. We assume a smooth relation between size and growth propensity, a hypothesis supported by the data, and check for a

[1] For example, in Germany and Austria establishments with less than 6 employees are exempted from EPL, in France firms with less then 10; in Spain, 40 per cent of the severance payment due upon dismissal (20 days' wages for each year of seniority, up to a maximum of one year) is covered by a state fund for firms with less than 25 employees; in Italy EPL is much less stringent for firms with less than 16 employees.

discontinuous drop just below the threshold. This drop can be seen as an indirect proxy of the cost associated with more stringent legislation.

We use data for Italy, a country that presents a natural laboratory for testing the effects of EPL thresholds on firms' propensity to grow. Italy has not only substantially more stringent regulations for firms over 15 employees but also one of the largest shares of small firms in industrialized economies (Bartelsman, Scarpetta and Schivardi 2005). Indeed, in policy debates EPL is often indicated as the most important factor in explaining the left-skewed distribution of Italian firms. We use a comprehensive longitudinal dataset of all Italian firms between 1986 and 1998. To measure the threshold effect, we run a probit of positive employment changes on a polynomial in size and additional controls. The model fits the data remarkably well, except close to the threshold, where it over-predicts growth by approximately two percentage points. This result is robust to a number of extensions and agrees with the findings of a similar study by Garibaldi, Pacelli and Borgarello (2004).

To get a precise quantitative assessment, we compute the threshold effect on average firm size in steady state, using a Markov chain representation of firm size evolution modified to account for the threshold effect. According to our computations, after removing the threshold average size would increase by less than 1%. This is a modest value, particularly in the light of the findings of Pagano and Schivardi (2003), who estimate that the size gap of Italian firms versus those of other industrial countries is in the order of 50%. This would indicate that the EPL threshold is not the main cause of the skewed size distribution of Italian firms.

To gather further evidence on the threshold effect and to understand why it seems so modest, we then consider whether other discontinuities in employment policies arise at the threshold. This could occur both because of a *treatment effect*: firms that pass the threshold might resort to more flexible employment contracts to circumvent the stricter regulations on open-end contracts; and a *selection effect*: if firms are heterogeneous in terms of the costs of EPL, those with lower costs are more likely to pass the threshold, all other things being equal. These firms might have different employment policies from those with higher firing costs to begin with.

To study employment policies, we use a sample of workers with individual level infor-

mation on compensation, weeks worked and demographics, matched with the firms that employ them at any point it time. We find that employment policies do change discontinuously at the threshold. First, the average annual compensation drops by approximately 3% above it, owing to a corresponding decrease in the average number of weeks worked. Second, workers in firms above the threshold are less likely to work for a full calendar year. Finally, the probability of separation increases above the threshold by almost 2 percentage points. These results are compatible with the hypothesis that firms that pass the threshold respond to the stricter legislation by using more flexible labor contracts, such as fixed-term, to avoid the more stringent provisions on open-end contracts.

All in all, our results indicate that, as expected, the threshold reduces firms' propensity to grow, but to a limited extent. Part of the reason might be that firms passing the threshold adopt more flexible working contracts, thus reducing the extra costs of the more stringent regulation. Indeed, we find that the employment relation becomes *less* stable above the threshold, an indication that EPL might not be very effective in grating workers more stable employment patterns.

Our analysis adds to the within-country empirical research on the effects of employment protection legislation. Autor (2003) and Autor et al. (2004) exploit cross-state variation in the adoption of common law exceptions to the employment-at-will doctrine in the US, to estimate its role in explaining the spread of the temporary-help supply industry (Autor 2003), and its impact on employment (Autor et al. 2004). Acemoglu and Angrist (2001) show that the detrimental effects the Americans with Disabilities Act on the employment of disabled people differ according to firm size, because its provisions do not apply to small firms. This suggests that the Act might have introduced a bias in the American size distribution similar to the one we find for Italy.

Our results on firm size contrast with previous work on Italian data that could not find any effect of the threshold on size distribution (Anastasia 1999). This is probably because of the relatively small effect, which can only be detected with a very large dataset such as the one we use. A recent exception is Garibaldi et al. (2004), who also find significant but quantitatively small effects of EPL on firms' propensity to grow. Our approach differs both in the modeling and the estimation strategy; moreover, we use a more comprehensive

dataset and compute the long-run effects on the steady-state distribution of firms; finally, we complement the growth analysis with an analysis of firms' employment policy.

Another line of investigation exploits changes in legislation differentially affecting firms below and above a certain size threshold. Verick (2004) finds mixed and inclusive evidence for Germany, while Kugler and Piga (2003) find a significant impact on workers' turnover in Italy.

In terms of employment policies, Boeri and Jimeno (2005) consider the implications of the EPL threshold for dismissal probabilities in Italy and Spain, finding that workers employed in firms whose size entails more stringent employment protection have a lower probability of being dismissed. Our results show that, in spite of this effect, workers' turnover in these firms is higher, possibly due to greater use of short-term contracts. This would suggest a two-tier labor market, with the demand for flexibility being disproportionately borne by workers without open-end contracts. With respect to these papers, we are, to the best of our knowledge, the first to use jointly evidence on growth propensity and employment policies to gain insights on the costs of EPL and on firms' responses.

The rest of the paper is organized as follows. Section 2 contains a brief summary of EPL in Italy; Section 3 illustrates the design of the experiments and describes the data. In Section 4 we report the results on the propensity to grow and Section 5 constructs the stochastic transition matrix and simulates the effects of EPL in the long run. Section 6 analyzes the effects of the threshold on employment policies and Section 7 concludes.

2 Institutional setting

In economies where "employment at will" does not apply,[2] firing costs can be thought of as the result 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 result of a possible trial. The first defines when firing is allowed; the second assesses the costs a firm can incur; the third describes the actual enforcement of the law and the

[2]Strictly speaking, even in the US, whose legislation is considered one of the least stringent among the industrialized countries, employment at will does not apply anymore, as several exceptions have been introduced by the courts (Autor, Donohue and Schwab 2005).

probability of winning a case for unfair dismissal.

According to Italian employment protection legislation, individual and collective dismissals of workers with open-end contracts are only allowed on a just cause basis. Workers can be fired because of misbehavior (*giusta causa o giustificato motivo soggettivo*), or the firm's need to downsize or reorganize its activities (*giustificato motivo oggettivo*). A worker cannot be fired to be replaced with another if this is not justified by worker misconduct or by the need to restructure the activity. For instance, it would not be possible to fire an employee with a long tenure and a high salary just to replace her with a young worker paid the minimum contractual wage.

Workers can appeal to the court against dismissal. If the judge rules the dismissal was unfair, workers are entitled to compensation that varies according to firm size.[3] Firing costs are nil when a dismissal is not contested or it is ruled to be fair, although firms may want to pay workers to make firing easier (this is especially true in collective dismissals, when lump-sum payments are sometimes explicitly bargained with trade unions). In cases of unfair dismissals, the cost changes substantially at the 15 employees threshold. Before 1990, firms at or below such threshold were not subject to EPL altogether. Since then, the regulation has been extended to such firms as well, but with substantially lower provisions: they must compensate unfairly dismissed workers with a severance payment that varies between 2.5 and 6 months of salary (*tutela obbligatoria*). As an alternative to the severance payment, firms with less than 16 employees can opt for reinstating the worker. We will come back to this change in legislation in the empirical section.

The potential cost of an unfair dismissal is substantially higher in larger firms. Firms with more than 15 employees,[4] to which Article 18 of the "*Statuto dei lavoratori*"[5] applies, have to compensate workers for the forgone wages in the time elapsing between the dismissal and the sentence, with no upper limits. As the trial can last up to five years, the firm that

[3]Discriminatory dismissals, such as for ethnic, religious or trade-union membership reasons are never allowed; in this case a worker always has the right to be reinstated in the work place irrespective of the firm's size.

[4]More precisely, the rule refers to establishments with more than 15 employees, firms with more than 15 workers in the same municipality or with more than 60 employees in all establishments combined.

[5]Law 300 of 1970, "Statuto dei lavoratori," was passed after the so-called "hot autumn" of 1969, when large-scale strikes were called all over the country, forcing the Parliament and the government to pass pro-labor reforms.

loses a case for unfair dismissal will have to pay the worker a large sum of money. Moreover, firms are obliged to reinstate the unfairly dismissed worker, unless he or she opts for a further severance payment equal to 15 months of salary.

Given that the definition of fair dismissal is not particularly restrictive (OECD 1999) and that the cost is nil if a dismissal is ruled to be fair, a critical variable in determining the expected firing costs in Italy is uncertainty about the result of the trial. The actual application of a rule is always difficult to assess, as it depends critically on the courts and on the judges' interpretation of the law. Some Italian jurists deem the discretionary power of judges to be 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 by the firm's needs or the worker's behavior. In fact, the firm bears the burden of proof. The judges' discretionary power is limited when the dismissal is due to the need to reduce employment or reorganize the production process. On the contrary, when the dismissal is due to worker misconduct, the judge is asked to assess the effective behavior of the worker. In this case it could prove difficult for a firm to show a worker deserves to be fired. For large Italian firms, this uncertainty can be extremely important, as the compensation in cases of unfair dismissal depends on the duration of the trial, which can be very long. Ichino (1996) argues that the uncertainty about the result of the case, together with the potential high cost in case of loss, is a strong deterrent to initiating a dismissal procedure even when the firm might think it has the right to do so. Thus, the expected firing cost should be substantially higher for firms with more than 15 workers, to which Article 18 of the *Statuto dei lavoratori* applies.

The threshold of 15 workers is also relevant for the establishment of the so called "Rappresentanze Sindacali Aziendali" (RSA). Workers of firms with more than 15 employees can elect trade union representatives at firm level (RSA), who can call general meetings, affix posters on union activities and call referendums. The practical relevance of this rule, however, is likely to be minor, as trade union membership and activity within the firm and firm level bargaining do not depend on the presence of a "RSA". Moreover collective agreements, which regulate working standards and set minimum wage by worker qualification

also apply to workers and firms that do not belong to unions and employers' organizations[6]. Some direct evidence on the scarce relevance of this threshold on the establishment of an RSA and on the practice of firm level bargaining can be drawn from the survey of the Metalworking Firm Organization. Data from this survey show how both the share of firms with an RSA and the share of firms with a firm level contract are not affected by the 15 employee threshold, although both these variables are positively correlated with firm size. All in all, it seems fair to say that the discontinuity on RSA establishment is of minor importance and does not affect the interpretation of our results.

3 Experiment design and data description

3.1 Experiment design

We identify the effects of the threshold by considering the propensity to grow of firms in the proximity of the threshold. We assume a smooth relation between firm size and the propensity to grow. The appendix constructs a simple model of firm size evolution with stochastic productivity shocks in the vein of Hopenhayn (1992) that delivers this result under fairly general conditions. In the presence of labor indivisibility and with productivity shocks proportional to size (Gibrat law), it is immediate to show that the probability of growing (as well as that of contracting) increases smoothly with firm size:

$$\Pr\{\Delta l > 0 | l\} = f(l)$$

where $f(.)$ is smoothly increasing, l is employment and Δl is employment change. We will show that this characterization fits the data remarkably well.

Consider now the existence of an EPL threshold like the one induced by the "*articolo 18*". Firms will be more reluctant to grow when this entails passing the threshold and becoming subject to the more costly firing regime. This will imply a lower propensity

[6]These agreements can even lower the 15 employee threshold to establish an RSA: this is the case of the retail trade contract, which actually applies to most firms of the service sector as a whole, of the members of the Small firms organization of metalworking, chemistry and textile sectors (Principe 2003). Moreover, irrespective of the establishment of an RSA, other collective contracts allow workers to call trade unions meetings also in firms below the 15 employees threshold.

to grow in the proximity of the threshold: in fact, some firms that would have found it convenient to expand employment without the threshold, will not do so because of the extra cost imposed by the more stringent legislation on firings above it. Thus if $\tilde{l}$ is the level of employment above which the threshold applies, then

$$\Pr\{\Delta l > 0 | \tilde{l}\} < f(\tilde{l})$$

Conditional on being at the threshold, the probability of increasing employment is lower than the one that would result in the absence of the threshold. Identification is then obtained by exploiting the smooth relation between size and growth: if we find a sizable drop to a otherwise smooth relation right below the threshold, than we take the deviation from the smooth pattern as the threshold effect. In the empirical analysis, we will approximate f non parametrically by fitting a polynomial in size to the propensity of growing.

It is important to note that firms might be characterized by heterogeneous firing costs. For example, some firms might have exogenously higher than average quit rates, due to unpleasant working conditions or scarce career opportunities; similarly, firms that do not require specific human capital might hire more on a short term basis. Such firms can reduce employment through quits or termination of temporary contracts, so that they are less influenced by EPL. With heterogeneous costs, both the productivity realization and the firm-specific firing cost will contribute to determine which firms pass the threshold: firms with lower firing costs will be more willing to pass the threshold, other things equal. Our analysis will abstract from heterogeneity; however, even if this were an important aspect, our approach will still correctly measure the *average* effect of more stringent legislation on the propensity to grow.

In the second part of the paper we will consider if other discontinuities in employment policies arise at the threshold. There are two distinct reasons why this could be the case. On the one end, firms that pass the threshold might resort to more flexible employment contracts to circumvent, at least in part, the stricter regulation on open-end contracts. In the terminology of the policy evaluation literature, this would be a *treatment effect*, i.e. a change in the behavior of firms induced by the more stringent legislation. On the other

hand, as firms are choosing between growing above the threshold and remaining below it, there might be also a *selection effect*: if, as discussed above, firms are heterogeneous in terms of the costs of EPL, we should expect that those with lower costs are more likely to pass the threshold following a positive shock. These firms might have different employment policies with respect to those with higher firing costs.

The empirical approach we will use for employment policies will be similar to that illustrated for the case of the growth propensity. We will again assume a smooth relation between size and employment policies and control for any structural break at the threshold. In doing so, we will not try to disentangle the selection from the treatment effect, leaving this for future work. Even so, we will show that the results nicely complement those obtained from the analysis on the propensity to grow.

3.2 Data description

We use different data sources. Our main dataset is collected by the Italian Social Security Administration (Inps)[7] and covers the entire population of private firms with at least one employee - about 1.1 million firms per year for around 9 million workers- for the period 1986-1998 . The dataset records some firm demographic characteristics (age, sector of activity, location) in addition to the total number of employees, the share of production and non production workers and the total compensation. We use information collected in January of each year so that the size of each firm is defined as the stock of employees registered in the Inps' archive in this month.[8]

Table 1 reports descriptive statistics for firms in the 5 to 25 employment interval, where most of the analysis will be conducted. The average firm is 11 years old; 44% of them are in manufacturing, and 60% in the North.

As a first investigation of the threshold effect, Figure 1 reports the annual average

[7] A comprehensive description of Inps' archives can be found in Contini (2002).

[8] The employment concept of the "Statuto dei lavoratori" relevant to determine the 15-employee threshold excludes workers with an apprenticeship contract; moreover, case-law allows firms to weight part time workers according to the hours actually worked and refers to the usual employment level. While this will introduce some noise in our estimates it does not seem to be very relevant. In fact, Garibaldi et al. (2004), using a richer data set for the province of Turin, that accounts for such factors, do not find major differences comparing the inaction probability of firms around the threshold computed according to two different concepts of employment, the first identical to the one we use, the other more similar to the one to which the law refers.

number of firms by firm size. A lower propensity to grow would imply a concentration of firms just below the threshold. The number of firms regularly declines until 12-13 employees; it still declines, but at a slower pace, at 14 and 15, and drops at 16, after which the number of firms starts to decrease again at a regular pace. These results are similar to those of ISTAT (2002), which uses data on 1999 from the Statistical Archive on Active Firms.

The analysis of employment policies will be based on individual worker information for a representative subsample of the workforce of the firms described above. Also these data are collected for social security purposes by the Social Security Administration.[9] Each worker can be matched to the firm that employs her, so that employment policies can be studied in relation to firms' characteristics. We defer a more detailed description of the data to the section where we use them.

4 Threshold and firm growth

4.1 Main results

Our identifying procedure is based on the assumption of a smooth relation between size and probability of growth. To verify if this is the case, we compute the growth probability for each employment level, defined as the share of firms that increase the number of employees from one year to the next. Figure 2 plots this probability against size in the 5-25 employment range. The relation is clearly smoothly increasing; moreover, a clear downward spike emerges at 14-15 employees, just at the EPL threshold. Similar patterns are observed when separately analyzing services and manufacturing, the main difference being that small firms in the service sector have a lower probability of growth (Figure 2).[10]

Consistently with the pattern of the probability of growth, the inertia probability shows

[9] This is the typical source of workers' information used in the literature on matched data for Italy. See Guiso, Pistaferri and Schivardi (2005) for further details.

[10] We have also checked that this probability is stable over time. The share of firms that increase employment from one year to the next for four size classes around the 15 threshold (5-10, 11-15, 16-20, 21-25) shows a clear cyclical pattern and a slightly negative trend. This, however, seems to mirror the differences in macroeconomic conditions between the first and second half of the period rather than a structural change in the firm size dynamics. Moreover, the four groups of firms share the same tendencies, so that it seems fair to say that the probability of growing net of cyclical factors has remained quite stable in the size range we consider.

an upward spike at 15 (Figure 3). The probability of reducing the number of employees is somewhat more irregular than the inertia and the growth probability (Figure 4), so that it is difficult to single out any clear threshold effect.

To quantify the threshold effect on growth propensity, we estimate a probit model at the firm-year level of the form:

$$y_{it} = \alpha + \sum_{j=1}^{4} \beta_j l_{it-1}^j + \sum_{k=1}^{n} \gamma_k D(16-k)_{it-1} + X_{it} + \epsilon_{it} \tag{1}$$

where $y_{it} = 1$ if $l_{it} > l_{it-1}$ and 0 otherwise. This binary variable is regressed on a fourth degree polynomial in size and a set of dummies $D(16-k)_{it-1}$ that are equal to 1 if $l_{it-1} = 16-k, k = 1, 2, ...$; X_{it} are additional controls. In particular, we always include the age of the firm (quadratic form), 2 digit sector, year and 20 regional dummies. The estimates of γ_k should capture the threshold effect due to EPL, given that the fourth degree polynomial in size should account for the smooth relation between size and the probability of growing. All our results are robust to alternative specification.[11]

Table 2 reports the results of the estimates and Figure 5 plots the actual probability of growth and the predicted values by size. As the figure shows, the model fits the actual probabilities quite well, and the dummy at size 15 is approximately -1.5 percentage points and significant, while at 14 it drops to -.35 percentage points, and it is not statistically different from zero at 13. Garibaldi et al. (2004) obtain remarkably similar results from a relatively smaller sample of firms and using annual averages instead of individual firm data, therefore without controlling for age, industry and location of firms.

We run several robustness checks. We have repeated this exercise for the service and manufacturing sectors in order to assess whether the apparently different relation between probability and size we saw above has any significant impact on the estimate of the threshold

[11] Our results do not change substantially if we include dummies for firms whose size is just above the threshold or extend the sample to firms with less than 5 or more than 25 employees, or restrict ourselves to firms belonging to specific age groups, such as young firms. As an alternative empirical strategy we have also estimated this effect by using only observations below the threshold of 15. This was done by comparing the actual probability at 15 with the probability of growing obtained as a forecast from a probit model estimated with firms in the range 5 to 14 employees, where the probability of growing was assumed to be a monotonic concave function of size. The results, again, did not change significantly.

effect.[12] Table 2, column 2, reports the estimates for manufacturing and column 3 for services. Once we split the sample, the threshold effect seems to be slightly higher (-1.78 in manufacturing and -1.76 in the service sector).We have also produced annual estimates, without observing any clear trend in their magnitude. We will return to this point later, when discussing the change in legislation that occurred in 1991.

Given that we consider the probability of growth, irrespective of by how much, the dummy at 14 is harder to interpret, as a firm with 14 employees could still hire one worker without passing the threshold. Our estimates of the threshold effect could therefore be downward biased for this size class. More generally we should expect that the threshold effect reduces the probability of passing it for any employment level below it. To visualize this effect, Figure 6 reports in each sub-panel the probability of growing by 1, by 2, by 3 and so on. These graphs show a drop exactly where expected, namely at 15 for the probability of growing by one, at 14 and 15 for the probability of growing by two, at 13, 14 and 15 for the probability of growing by 3 and so on. The effect is very apparent for employment levels not far from the threshold, while it tends to disappear as we move further away from it. This is due to the fact that the probability of experiencing a shock that prompts a sufficiently large size increase to cross the threshold diminishes as we move away from the threshold itself. The same pattern is observed with the probability of growing by one or more, two or more and so on (Figure 7).

Regressions with a the dummy 15 for the probability of growing by one or more, of the dummy 14 for the probability of growing by two or more, of the dummy 13 for that of growing by 3 or more and so forth (unreported for brevity), show that the impact of the threshold moving away from 15 rapidly becomes very low: we estimate that for a firm with 12 workers the threshold prompts a reduction in the probability of growing by 4 or more of 0.36 percentage points; for a firm with 10 workers the reduction in the probability of growing by 6 or more is 0.1 points and for firms with 8 workers the drop in the probability of growth by 8 or more is only 0.06 percentage points. The effects are negligible afterward.

All in all, the analysis of this section indicates that a threshold effect is clearly iden-

[12]Note that these two sectors are not exhaustive, as construction is not included therein. The construction sector due to the organization of companies on a project basis is less affected by EPL.

tifiable by the reduction in the probability of growth of firms right at the threshold. We estimate that firms at the threshold reduce their probability of growth of approximately two percentage points, from 36% to 34%. This seems a rather modest decline; we will discuss this point in the next section.

4.2 Extensions

As explained in Section 2, in 1990 a change in legislation increased the firing costs for unfair dismissal for firms below the threshold, although they remained substantially below those for firms with more than 15 employees. In addition, in 1991 a new law changed the regulation of collective dismissal for firms above the threshold, reducing the costs of downsizing and restructuring (Bertola and Ichino 1995). Both these changes in legislation should have reduced firing cost differences between firms above and below the threshold.[13]

In this section we try to assess the overall impact of these two reforms on the threshold effect. To do this, we separately estimate the threshold effect for each year to determine if the data register a break in the early nineties. In Figure 8 we report the yearly estimates of the 15 employees dummies from 1986 to 1997. While we do observe a reduction in the threshold effect at the beginning of the decade, this seems to reflect more cyclical factors than a permanent reduction in it. The correlation with the aggregate employment growth rate shows that the effect is lower in recessions and larger in expansions. This could be due to the fact that in recessions the share of expanding firms reduces substantially, thus decreasing the identifying power of the exercise.[14] In fact, by mid nineties the estimates return to the values of the beginning of the sample; moreover, the highest point estimate of the threshold effect is obtained for 1997, well after the two laws were passed. These results would suggest that the reforms did not affect substantially the behavior of firms around the threshold, arguably because the increase in costs they implied for small firms was rather

[13]Kugler and Piga (2003) have tried to gauge the effect of the 1990 reform of individual dismissals comparing turnover rates in periods before and after the reform. They find the somewhat surprising result of a reduction in turnover for both big and small firms, stronger however for firms below the threshold affected by the reform of 1990. The reduction of turnover they observe is however at odds with the evidence on the evolution of workers and job turnover in Italy (Leombruni and Quaranta 2005). Moreover, they ignore the fact that in 1991 the reform of collective dismissals was also passed making difficult a clear interpretation of their results.

[14]See Schivardi (2003) for a model of information spillovers that delivers such pattern.

limited. A longer time span, not available to us, would be needed to gain further insight on the point.

5 EPL and firm size in steady state

The analysis of the previous section suggests that the impact effect of the threshold is around 2 percentage point, an apparently modest value. However, we lack a precise metric to measure it: in fact, it could be that an apparently small effect on the year-to-year probability of growing is compounded in the long run and has a sizable impact on the steady-state distribution of firms. To assess the long-run consequences of EPL on the size distribution, we use a representation of firms' dynamics based on a stochastic transition matrix (STM). An STM is a matrix P whose entries p_{ij} represent the probability of a firm moving from size class j to size class i from one year to the next, for any size class subdivision. Given that our dataset comprises the firms' population, we can calculate the exact transition probabilities.

Define X^t as the n-dimensional vector $\{x_1^t, ..., x_{n+1}^t\}$, where x_i^t is the share of firms in size class i and $n+1$ represents exit. Then, the evolution of X is governed by the system of difference equations:

$$X^{t+1} = PX^t \tag{2}$$

The theory of Markov chains establishes that, under regularity conditions,[15] each STM is associated with a unique steady-state distribution, irrespective of the initial distribution X^0; the long-run distribution is obtained by solving the system of equations $X = PX$, in addition to the condition $\Sigma_j x_j = 1$. Our strategy is to calculate the steady state distribution associated with the actual STM and to modify the STM by removing the threshold effects according to the findings of the previous section. The corresponding steady state distribution can then be interpreted as the one that would emerge in the absence of the threshold effect, thus obtaining a well-defined measure of the long-run impact of EPL on

[15] A STM P is said to be regular if, when raised to some power k, it has the property that all its elements are strictly positive. In this case, there exists a unique long-run limiting distribution (Karlin and Taylor 1975)

firm size.

Table 3 reports the STM,[16] constructed as an average of the yearly matrices for the period 1986-98. We take the average over the period to minimize the possibility that business cycle factors influence the long-run analysis. A preliminary inspection of the matrix confirms a series of stylized facts from business demography (Dunne, Roberts and Samuelson 1989). Size is characterized by a fairly high level of persistence: the diagonal entries are always the largest in the column.[17] Moreover, firm size tends to evolve smoothly: in fact, entries in the cells adjacent to the diagonal are always larger than those farther away from it, indicating that big jumps are less likely than small ones. Entry occurs mostly at the small end of the size distribution, and the probability of death decreases with firm size.

Pagano and Schivardi (2003) show that the average firm size in Italy is approximately half of that of the European Union and that this effect is not due to the sectoral composition of the economy. Indeed, EPL is often indicated as the main responsible for such a skewed size distribution. We want to determine how much of this gap can be explained by the EPL threshold. Our probit estimates show that the threshold effect reduces the probability of growth by approximately 2 percentage points for firms in the 9th size class, which corresponds to the 13-15 employment interval. We therefore reduce the persistence probability for that class by reducing the entry in the diagonal; correspondingly, we increase the probability of growing in the size class just above the threshold.[18] We then compute a new steady state distribution $\tilde{X}$. Finally, assuming that the within class average size μ_i is invariant to the experiment, we compute the average size that would prevail in the absence of the EPL by weighting the within class average size with the new steady-state distribution: $\tilde{\mu} = \sum_{\iota=1}^{n} \tilde{x}_i \mu_i$. We find that an increase of two percentage points in the growth probability of firms in the 13-15 size class (an overestimate of the threshold effect,

[16]To accommodate entry and exit we use the following convention: the last row of the STM represents exit and the last column entry; x_{n+1}^t is the share of entrants between the beginning and the end of period t, so that $p_{n+1i}x_{n+1}^t$ is the contribution of entry to x_i^{t+1}; $x_{n+1}^{t+1} = \sum_j p_{n+1j}x_j^t$ is the share of exit between t and $t+1$. This implies that x_{n+1}^t represents exits during the previous period at the beginning of the period and entry during the current period at the end of it. This convention agrees perfectly with the steady state, where entry and exit are necessarily the same.

[17]The persistence probability depends on the range of employment that each cell covers, with persistence increasing with the size of the range. This explains for example why the diagonal entry for the 16-20 class is larger than that for the 13-15 class. Our results are robust to changes in the size-class subdivision.

[18]This assumes that firms influenced by the threshold are those with the smallest growth opportunities.

given that we are also attributing the larger decrease of firms with 15 employees to firms with 14 and 13 employees) would bring about an increase of 0.5% in the average firm size (from 9.24 to 9.28).

We have performed many robustness checks. We have used alternative assumptions about where to redistribute the probability of growing, involving all the size classes above the threshold; we have modified the growth probabilities for firms further away from the threshold; we have computed the STM with alternative size classes (details of these experiments are reported in Schivardi and Torrini 2004). The increase in average firm size was never larger than 1%. This is clearly a modest effect in the light of the "Italian anomaly", i.e., the smaller average size of Italian firms when compared to similar economies. All in all, we conclude that the EPL threshold has a clearly detectable but quantitatively small effect on firms propensity to grow.

6 Threshold effects on employment policies

In this section we explore further effects of the EPL threshold. We do this with two objectives in mind: first, to find further evidence that the threshold does influence firms' behavior; second, and more interestingly, to look for potential explanations of the seemingly small effect detected in the previous sections.

As explained in Section 3.1, there are two distinct reasons why one might find discontinuous changes in employment policies at the threshold. First, firms above the threshold might modify their policies to reduce the extra cost of EPL, for example hiring more on a fixed term basis (the treatment effect).[19] Second, if firing costs are heterogeneous across firms, then those with lower costs are more likely to pass the threshold; such firms might also have employment policies that differ from those with higher costs (the selection effect).

[19]There is evidence that a stricter regulation on open-end contracts induces an increase in the use of more flexible ones. In many European countries the liberalization of the use of fixed-term contracts, not accompanied by a decrease in employment protection on permanent ones, has led to a surge in temporary employment. See for instance Bentolila and Saint-Paul (1992) and the Economic Journal symposium on temporary work (Booth, Dolado and Frank 2002). For the US, Autor (2003) uses across-state and time variation to assess the impact of common law exception to the employment-at-will doctrine on the spread of the temporary help supply industry, finding that exemptions are related to a larger diffusion of temporary help agencies.

We do not have information on the type of contracts that firms use. We therefore focus on compensation, number of weeks worked and separation rates, that are likely to be related to contract types: in particular, workers on temporary contracts will be more likely to suffer unemployment spells and terminations, and therefore work and earn less. We match the firm data used before with the entire population of their employees whose birthday falls on either March or October 1st. We have information on sex, age, yearly wage, weeks worked and on a few job characteristics (apprentice, blue collar, white collar, manager), while we do not observe the type of contract (open end versus short term). Through the fiscal identifier we can also match each worker to the firm she is employed at any point in time, so that we also know the firms' characteristics, such as sector of activity and, more importantly for our purposes, firm size.

Table 1 compares firms characteristics for all the firms in the 5-25 employment interval, used in previous analysis, with the matched sample we use in this section. As expected the matched sample have a slightly higher average firm size, due to the fact that larger firms have a higher probability to be selected. With respect to the other characteristics, however, the two sets are virtually identical. Table 4 reports the workers' descriptive statistics, distinguishing between those employed in firms above and below the threshold. Workers employed in firms above the threshold earn more, work a higher number of weeks per year, are more likely to be production workers, have a lower probability of separation, are more likely to be employed in the northern part of the country and in the manufacturing sector.[20]

We begin by considering compensation policies. Figure 9 reports average log yearly compensation (independent by the number of weeks worked) and weekly compensation (total compensation divided by the number of weeks worked) by size class. Data are constructed by taking the average of the individual workers' compensation within each size cell. To account for time trends, we use deviation from the yearly mean; moreover, we normalize both series to zero at size 15, to make the patterns more easily comparable. As expected, earnings increase smoothly with size; however, a clear break emerges at the threshold. In

[20]The fact that the two samples differ in terms of workers characteristics does not invalidate our identification procedure. In fact, we exploit the smooth relation between size and employment policies that clearly emerges from the data to identify the threshold effect, and not average differences between the two samples.

terms of yearly earnings, the figure shows a drop at 16 of approximately 6%. This is a very sizable effect, indicating a clear discontinuity in compensations. A drop also occurs in weekly earnings;[21] however, this effect can only account for a small portion of the overall drop. The main difference in compensation stems therefore from the reduction of the average number of weeks worked in firms above the threshold.

The graphical analysis of Figure 9 is confirmed by the regression results, where we can also control for workers' and firms' characteristics. We use the same technique as before, with the important difference that the dependent variable is defined at the individual worker level and not at the firm level. Table 5 reports the results of wage regressions on a set of standard worker and firm characteristics, a fourth degree polynomial in size and a dummy for firms with more than 15 employees. We use this dummy, rather than one at 15 as before, because now we are trying to detect a discontinuity in behavior of potentially all firms above the threshold rather than a drop in the probability of growth localized right below it. The table shows that, when controlling for firms' and workers' characteristics, the effect is smaller, around 3 percentage points, but still well significant. On the contrary, the effect on the weekly wage basically disappears. All other regressors have the expected sign: wages display a concave profile in age, male workers earn approximately 20% more than female, and clericals 27% and manager 124% more than production workers. Moreover, differently from the dummy, the effects are generally similar for total and weekly compensation.

In Figure 10 we report the number of weeks worked as a function of firm size. Again, an increasing pattern emerges, with a clear break at 16 employees (from 40 to 38.5 weeks). The break is confirmed by the regression analysis reported in the first column of Table 6, where the (log) number of weeks is regressed on workers' and firms' characteristics and a 4 degree polynomial in size. Consistently with the wage analysis, we find that the number of weeks worked decreases discontinuously by approximately 3% above the threshold. Figure 10 shows that the model fits the data remarkably well.

[21] This drop could be due to the fact that firms just below the threshold use their workforce more intensively, for example resorting to overtime to face increases in demand rather than expanding the workforce. Another possibility is that workers of firms below the threshold require a higher wage as a compensating effect of the lower security they face. This interpretation is at odds with the subsequent findings: in particular, once we account for workers' characteristics, the difference in weekly earnings disappears (see below).

One possible explanation of the drop in the number of weeks is that firms that pass the threshold use more flexible working contracts than those that remain below it: in fact, temporary and seasonal contracts are more likely to be associated with inactivity periods. To further explore this possibility, we consider the relationship between firm size and the share of workers that work 12 full months with the same company, as a proxy of stable employment. This can be seen as an indirect measure of the use of fixed term contracts: if firms use more of them, we should find a higher share of workers that work less than 12 months.[22] This is reported in Figure 11, together with the predicted value of a probit model where the probability of working for 12 months in a single calendar year is regressed on the same set of variables as before. The break at 16 is clear and statistically significant (Table 6, second column). Controlling for other characteristics, workers in firms with more than 15 employees have a probability of working an entire year with the same firm which is roughly 2 percentage points lower than in firms with 15 employees or less.

We next consider the separation rate. If firms use fixed term contracts more intensively, then their turnover rate should be higher. Figure 12 reports the probability that a worker is not employed at a firm in year t, conditional on being employed in it in $t-1$. Even in this case, we find that workers in firms with more than 15 employees have a probability of separating which is almost 2 percentage points higher than workers employed in firms below the threshold (Figure 12 and Table 6, third column). This is a particularly interesting result: it implies that the effects of the stricter legislation are more than offset by the selection and/or treatment effects discussed above.

We have performed many robustness checks. We have used different definitions of separations, excluding for example those related to firm closures (firms above the threshold might shut down altogether to avoid costly firing and start a new firm if needed); we have also excluded workers that do not reenter the sample after separation, to avoid any bias coming from early retirement schemes that might be used more intensively by large firms. Our results proved to be robust to any change in definition of separation or sample restriction.

[22] In addition to termination, a fixed term contract is more likely to induce unemployment spells even in the case of a renewal. In fact, after a certain period of time continuously on a temporary contract, a worker shifts automatically to an open end contract. To avoid this, firms tend to allow for a certain number of months to elapse between the end of a contract and its renewal.

All in all, the evidence of this section confirms that the threshold does influence firms' behavior. It also suggests that the small effect on the propensity to grow could be explained by the fact that firms shift to employment policies that limit the negative consequences of legislation and/or because a large share of firms might have characteristics that make EPL less costly. Indeed, we find that all the characteristics of the employment relation analyzed (compensation, working time and separations) are less favorable to workers above the threshold, exactly the opposite of what one would expect in the absence of any endogenous response of firms to legislation. Thus, although it might be the case that firms above the threshold are less likely to dismiss their workers, as found by Boeri and Jimeno (2005), our results show that this does not reduce the overall turnover, arguably due to a more intense use of flexible work arrangements. This could attenuate the impact of higher firing costs, limiting on average the effectiveness of EPL in granting workers more stable working conditions.

7 Conclusions

This paper has analyzed the effects of the 15 employees EPL threshold on firms' growth propensity and on their employment policies. We have exploited the fact that EPL changes discontinuously at 15 employees to asses if the more stringent legislation reduces the probability that firms pass this threshold. Our results show that EPL does influence firm dynamics, but that its effects are quantitatively modest: average firm size would increase by less than 1% in steady state when removing the effect of the EPL threshold, a value that explains a minor fraction of the size gap of Italian firms with respect to the other industrialized countries.

Part of the reason of this small effect could be that firms that pass the threshold adopt policies that partially circumvent the stricter employment legislation. We have found evidence consistent with this hypothesis: the employment relation seems to become less stable above the threshold, arguably because firms hire more through flexible contracts, less subject to the firing restrictions. An important task for future work will be to disentangle the endogenous firms' response to the stricter legislation from the self selection of firms with

lower firing costs above the threshold.

Our results have important policy implications. While we do not directly measure the costs of EPL, the threshold effect is clearly a function of the perceived costs of passing it. Given that we find that the discouragement effect is modest, one can infer that the overall additional costs of the stricter legislation are not very large, possibly because firms modify their employment policies accordingly. Indeed, both the small drop in the propensity to grow and the more unstable employment relation above the threshold would suggest that EPL could be neither very costly for firms nor very effective in granting workers a more stable employment relation.

A A simple model of threshold effects and size structure

In this section we construct a model of size evolution in the presence of the threshold effect induced by EPL. In the tradition of modern theories of firm size distribution, we assume that firms are heterogeneous in productivity, which determines optimal individual firm size (see for example Lucas (1978), Hopenhayn (1992) and Jovanovic (1982)). The model has two main ingredients. First, we assume that labor is indivisible. Second, firms above a certain threshold face a higher costs of labor. This assumption formalizes the notion that EPL applies differentially to firms of different sizes. It clearly represents a shortcut with respect to modeling firing restrictions directly; however, as shown by Bentolila and Bertola (1990), firing costs can be thought of as increasing the expected cost of labor, because the firm takes into account the expected costs of firing. This assumption greatly simplifies the analysis while resulting in several general empirical predictions derived from the fact that the expected cost of labor is higher above a certain threshold. This is therefore a simple and convenient way of modeling the behavior of firms below the threshold. As we will see, the assumption is more problematic for firms above it.

Firms produce output with a decreasing return to scale Cobb-Douglas technology with labor as the only input, with a productivity or demand shock A that determines the marginal product of labor:

$$Y = Al^{\alpha} \tag{3}$$

For given wage w, optimal employment is:

$$l^* = (\alpha \frac{A}{w})^{\frac{1}{1-\alpha}} \tag{4}$$

In this economy, the size structure at any point in time is determined by the distribution of A, and its evolution by the stochastic evolution of A. We assume that $A = e^{\varepsilon}$ and that ε evolves according to a random walk:

$$\varepsilon_t = \varepsilon_{t-1} + u_t \tag{5}$$

where u is and *iid* normal random variable distributed according to a $N(0, \sigma^2)$. This formulation can accommodate two features that have appealing implications for firm-size dynamics:

1. Firm productivity is highly persistent;
2. Percentage changes in productivity are independent of the productivity level itself: $\Delta \log A = u_t$.

The first feature reproduces the empirical regularity that firm size is a regular process rather than an erratic one; the second, known in the literature as Gibrat's law of independent increments, implies that absolute changes in employment depend on size.

Consider now labor adjustment. From (4), and assuming that the wage is fixed, labor adjustment will be:

$$\Delta \log l = \frac{1}{1-\alpha} \Delta \log A$$

This equation assumes that labor is perfectly divisible. Given that the relevant entity for EPL legislation is the number of employees, and given that this is exactly what we observe in our data, we want to characterize employment behavior when $l \in N_+$, the nonnegative integers. Define l =int$((\alpha \frac{A}{w})^{\frac{1}{1-\alpha}})$ as the optimal integer employment given A. Given indivisibility, employment cannot change continuously with A, so that the employment-productivity relation can be represented with a step function. Consider first the case in which $A = l^{1-\alpha}\frac{w}{\alpha}$, $l \in N_+$, i.e., the value of productivity is such that an integer employment value would be exactly optimal even without indivisibility. To determine if the firm increases employment after an increase in productivity to A', we simply need to check if profits at $l+1$ are larger than at l, given the new productivity level: in fact, if the new maximum prescribes $l' > l$, then the profits are increasing in l as log as $l < l'$, so that profits at $l+1$ are larger than at l. Therefore, the condition is:

$$\text{increase } l \text{ if } A'(l+1)^\alpha - w(l+1) > A'l^\alpha - wl$$

or

$$A' > \frac{w}{(l+1)^\alpha - l^\alpha}$$

The probability of increasing employment conditional on $A = l^{1-\alpha}\frac{w}{\alpha}$ is then:

$$\Pr\{l' > l|A\} = \Pr\{A' > \frac{w}{(l+1)^\alpha - l^\alpha}|A\} = \Pr\{u' > \ln(\frac{\alpha}{l((\frac{l+1}{l})^\alpha - 1)})\} \tag{6}$$

where we use the fact that $A' = Ae^{u'}$ and $A = l^{1-\alpha}\frac{w}{\alpha}$,. The right hand side of the inequality is decreasing in l ; moreover, it is a smooth function of l. These two properties imply that the probability of increasing employment is a smoothly increasing function of employment itself: in fact, it reaches a minimum of $\Pr\{u' > \ln\frac{\alpha}{2^\alpha - 1}\}$ for $l = 1$, where $\ln\frac{\alpha}{2^\alpha-1}$ is strictly larger than zero, and converges to $\Pr\{u' > 0\} = \frac{1}{2}$ for $l \to \infty$. A similar argument applies to the probability of decreasing employment, which is also an increasing and smooth function of initial employment. As we will see, this property, which derives from indivisible labor and Gibrat's law, is very much in line with the empirical evidence. Note also that the probability of adjusting employment is independent of the wage, which influences the level of employment but not its changes.

We have derived the result under the assumption that $A = l^{1-\alpha}\frac{w}{\alpha}$ for l integer. In general, firms with employment level l will have productivity levels A in range around $l^{1-\alpha}\frac{w}{\alpha}$, i.e. the range for which l is preferable to both $l-1$ and $l+1$. Call this set $\mathbf{A}_l$. To determine the probability of increasing employment conditional on l, one needs to

integrate over this set: $\Pr\{l' > l|l\} = \int_{\mathbf{A}_l} \Pr\{l' > l|A\} dG(A)$, where $G(A)$ is the CDF of the productivity level over $\mathbf{A}_l$. As shown by the literature on Ss policy rules (Caplin and Spulber 1987), the behavior of the "representative firm" considered above is sufficient to characterize to a first degree approximation the average probability of adjustment, because the higher probability of increasing employment of firms in the upper part of $\mathbf{A}_l$ will be compensated by the lower ones of those in the lower range of $\mathbf{A}_l$.

We now turn to the threshold effect. We assume that for firms above the relevant employment threshold $\tilde{l}$ the cost of labor is $w_H = (w + \lambda)$, with $\lambda > 0$.[23] Here λ represents the average costs associated with the more stringent EPL, which is added to the pure wage costs. We temporarily put aside the integer problem, which, for this part of the argument, is inconsequential and would only make notation substantially more involved.

If we define $\Pi(A)$ as the maximized value of profits for a firm with productivity level A, we find:

$$\Pi(A) = (\frac{1-\alpha}{\alpha})(\frac{\alpha A}{w^{\alpha}})^{\frac{1}{1-\alpha}}. \tag{7}$$

Clearly, $\Pi'(A) > 0$: the higher the productivity level, the higher the profits. The problem of the firm in the presence of a threshold above which the EPL imposes additional costs can be formulated as follows:

$$\max_{l}\{Al^{\alpha} - [wI_{\{l \leq \tilde{l}\}} + w_H(1 - I_{\{l \leq \tilde{l}\}})]l\} \tag{8}$$

where $I_{\{l \leq \tilde{l}\}}$ is the indicator function taking the value of 1 if $l \leq \tilde{l}$ and zero otherwise. Define $\tilde{A} = \frac{w\tilde{l}^{1-\alpha}}{\alpha}$ as the minimum productivity level at which optimal employment is $\tilde{l}$. Clearly, optimal employment will be equal to $(\frac{\alpha A}{w})^{\frac{1}{1-\alpha}}$ for $A \leq \tilde{A}$. Moreover, if $A > \tilde{A}$ and the firm optimally chooses not to pass the threshold, the employment level which maximizes profits is $\tilde{l}$, because profits are increasing in l for $l < \tilde{l}$. For $A > \tilde{A}$, we therefore need to compare profits at $\tilde{l}$ with those at the optimized value of employment given $w_H = \lambda w$

$$A\tilde{l}^{\alpha} - w\tilde{l} \lesseqgtr (\frac{1-\alpha}{\alpha})(\frac{\alpha A}{(w_H)^{\alpha}})^{\frac{1}{1-\alpha}}. \tag{9}$$

By construction, evaluated at $\tilde{A}$, the left-hand side of (9) is larger than the right-hand side; moreover, the former increases linearly with A, while the latter exponentially. This implies that there exists one and only one $\bar{A}$ at which (9) is satisfied as an equality, and above which it is optimal to pass the employment threshold. It is easy to show that the size of the productivity range in which $\tilde{l}$ is the preferred employment level increases with λ. We

[23] Another possibility is to assume that firms that pass the threshold pay an additional fixed cost c. This assumption is less realistic and, in any case, leads to very similar predictions.

can therefore characterize optimal employment as follows:

$$l^* = \begin{cases} (\frac{\alpha A}{w})^{\frac{1}{1-\alpha}} & \text{if } A < \tilde{A} \\ \tilde{l} & \text{if } \tilde{A} \leq A < \bar{A} \\ (\frac{\alpha A}{w_H})^{\frac{1}{1-\alpha}} & \text{if } A \geq \bar{A} \end{cases}$$

The same conditions hold for the indivisible labor case. The difference is that the profits in (7) will not generally be attainable, so that profits will be lower than in the unconstrained case. This implies that $\bar{A}$ must be adjusted to compensate for this, so that the minimum value of A that prescribes adjustment will generally be larger. However, the reduction in profits because of indivisibility is rather modest, so that this constitutes a second order effect with respect to the impact of the increase in labor costs.[24]

Define $\tilde{A}_{+1}$ as the minimum value of A which, in the absence of EPL, would induce a firm which experiences a productivity gain from $\tilde{A}$ to $\tilde{A}_{+1}$ to increase employment from $\tilde{l}$ to $\tilde{l}+1$. If the costs of EPL are nontrivial, then $\tilde{A}_{+1} < \bar{A}$, the more so the larger λ. Then, we have that:

$$\Pr\{l' > \tilde{l}|\tilde{A}\} = \Pr\{A' \geq \bar{A}|\tilde{A}\} < \Pr\{A' \geq \tilde{A}_{+1}|\tilde{A}\} \tag{10}$$

if and only if $\bar{A} > \tilde{A}_{+1}$, where we use the notation $\Pr\{A'|z\} \equiv \Pr\{A|A_t = z\}$ The inequality in (10) formalizes the notion that EPL makes employment growth less attractive for firms within the proximity of the threshold. This implies that, with respect to a situation without the differential effect of the EPL, we should observe:

1. An increase in the share of firms within the proximity of the threshold;

2. A drop in the probability of growth for firms at the threshold.

These predictions, coupled with the smoothness of the relation between firm size and the probability of inaction implied by (6), offer an identification strategy to estimate the impact of EPL on the growth choices of firms below the threshold: if we observe that the probability of growth follows a smooth pattern, interrupted in the proximity of the threshold, then we can speculate that the deviation from this smooth relation is attributable to the effects of the EPL. Moreover, given that the difference between $\bar{A}$ and $\tilde{A}_{+1}$ increases with λ, the size of this deviation is an indirect measure of the costs of EPL itself.

This model has several additional predictions that can be empirically tested. First, by following a similar argument, it can be shown that, with respect to a situation with no threshold, firms that have employment level $\tilde{l} - j, , 1 \leq j < \tilde{l}$ should show a lower probability of increasing employment by j or more, because this would imply their passing the threshold. Second, define $\bar{l}$ =int$(\frac{\alpha\bar{A}}{\lambda w})^{\frac{1}{1-\alpha}}$, i.e., as the minimum value of l chosen by a firm that passes the threshold. Then, by using the implicit function theorem, one can show

[24]For example, fixing α to 2/3, $\tilde{l}$ to 15, w to $\frac{\alpha}{15^{1-\alpha}}$ (so that A at $l = 15$ is 1) and λ to 1.05, we find that $\bar{A}$ =1.1141, and the corresponding value for $\bar{l}$ is 20.75. At $\bar{l} = 21$, the minimum value of A that makes adjustment optimal would rise to 1.1145, an increase of less that .04%.

that $\frac{\partial \bar{l}}{\partial \lambda} > 0$. This in turn implies that, if the cost of passing the threshold is sufficiently large, the range of employment values $[\tilde{l}+1, \bar{l}-1]$ would not be chosen by an expanding firm.[25]

The simple way EPL is modeled is more problematic when considering the behavior of firms above the threshold. Here, employment adjustment will be influenced by EPL itself, arguably reducing the propensity to hire and fire with respect to an unregulated world (Bentolila and Bertola 1990). Indeed, our within country analysis would hardly identify the overall effects of EPL; in our simulations we will therefore keep the behavior of firms above the threshold fixed. This implies that we can only identify the size effect deriving from the reduction in the propensity to grow of firms below the threshold. While this is clearly an important limitation, theoretical models of EPL do not identify any clear cut effect of EPL *per se* on average firm size, because it should reduce both hirings and firings, with second order effects on average employment. It is therefore arguable that our analysis captures the most important channel through which EPL influences firm size, a conjecture that will require further work to be verified.

[25] Numerical analysis shows that $\bar{l}$ is very sensitive to λ: fixing as before α to 2/3 and $\tilde{l}$ to 15 and w to $\frac{\alpha}{15^{1-\alpha}}$ (so that A at $l = 15$ is 1), at $\lambda = 1.01$ the jump point is 19, and at $\lambda = 1.1$ it is 29.

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Figure 1: Number of firms by size class, average 1986-1998 (thousands)

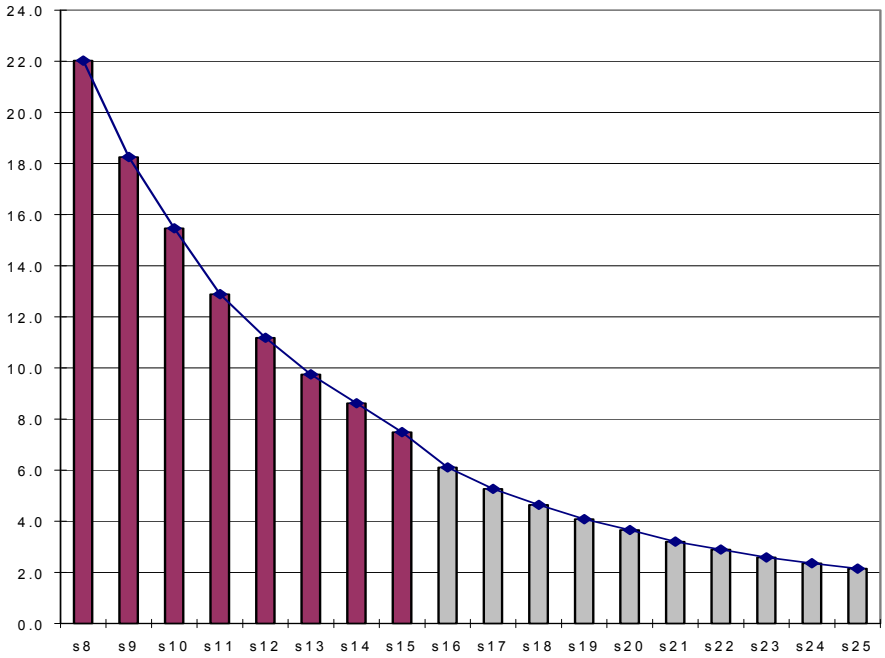

Figure 2: Probability of growth by size class

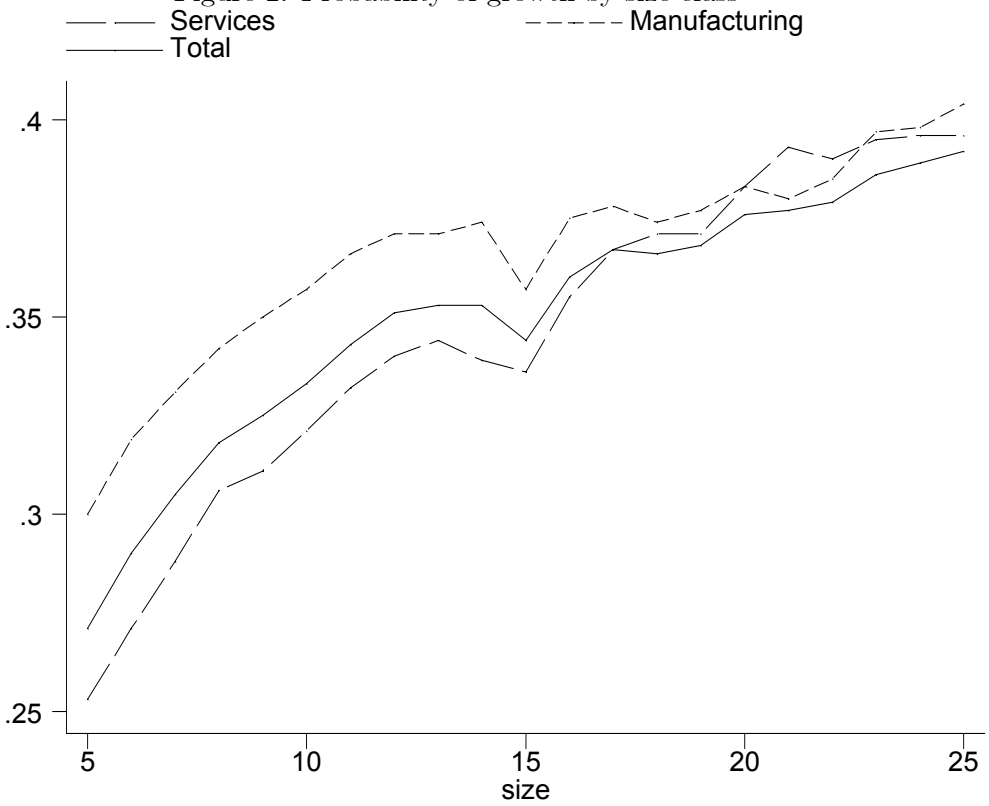

Figure 3: Inertia probability by size class

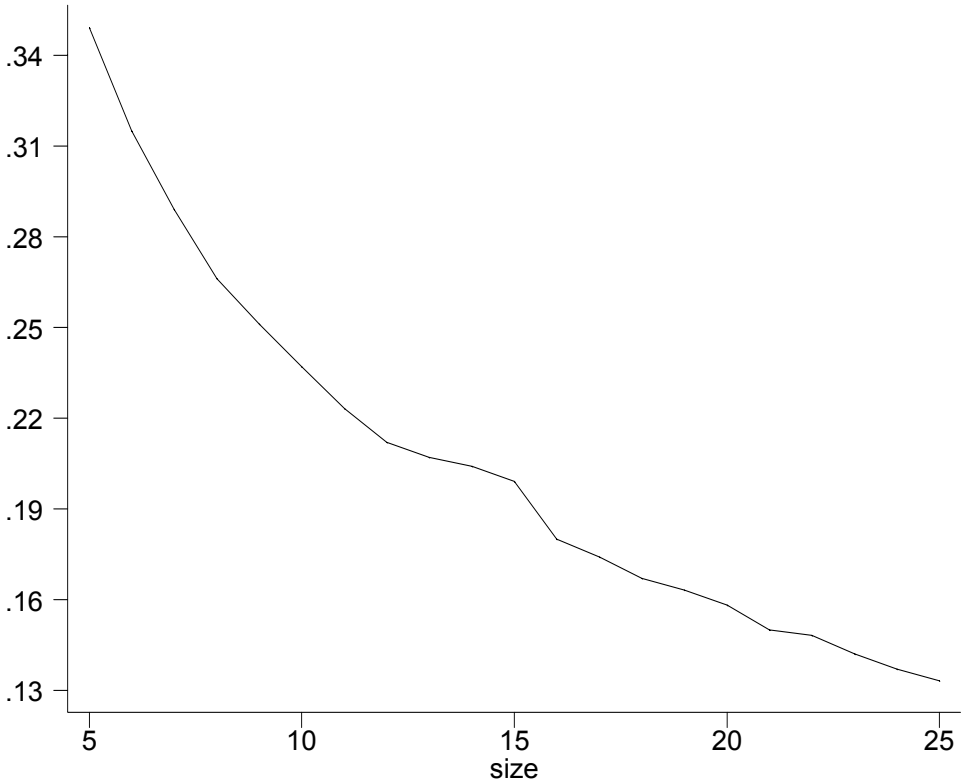

Figure 4: Probability of employment reduction by size class

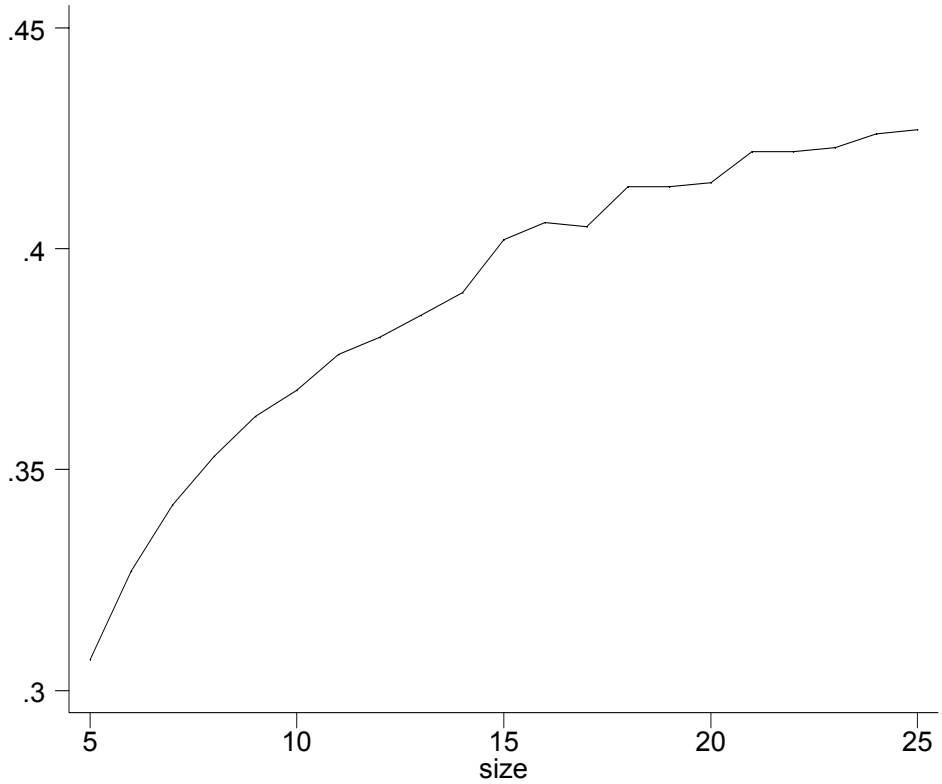

Figure 5: Probability of growth and predicted probabilities, all sectors

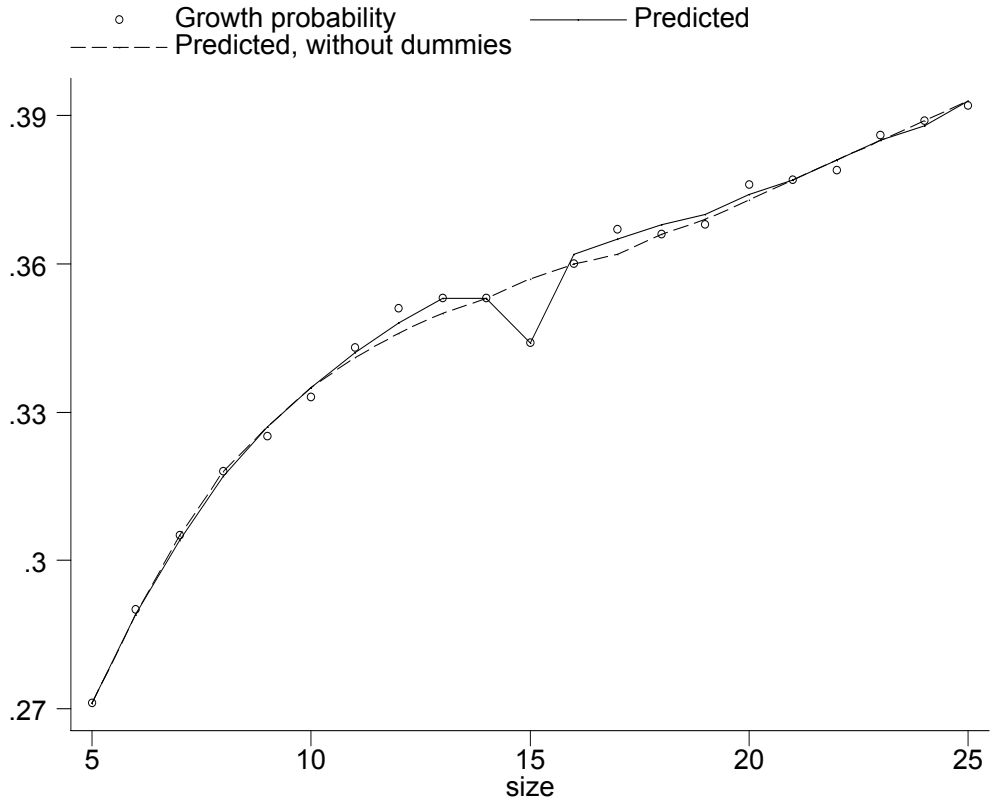

Figure 6: Probability of growing by size of the increase (1, 2, 3, 4) and firm size (The vertical bars indicate the larger size class for which the size of the increase does not imply passing the threshold)

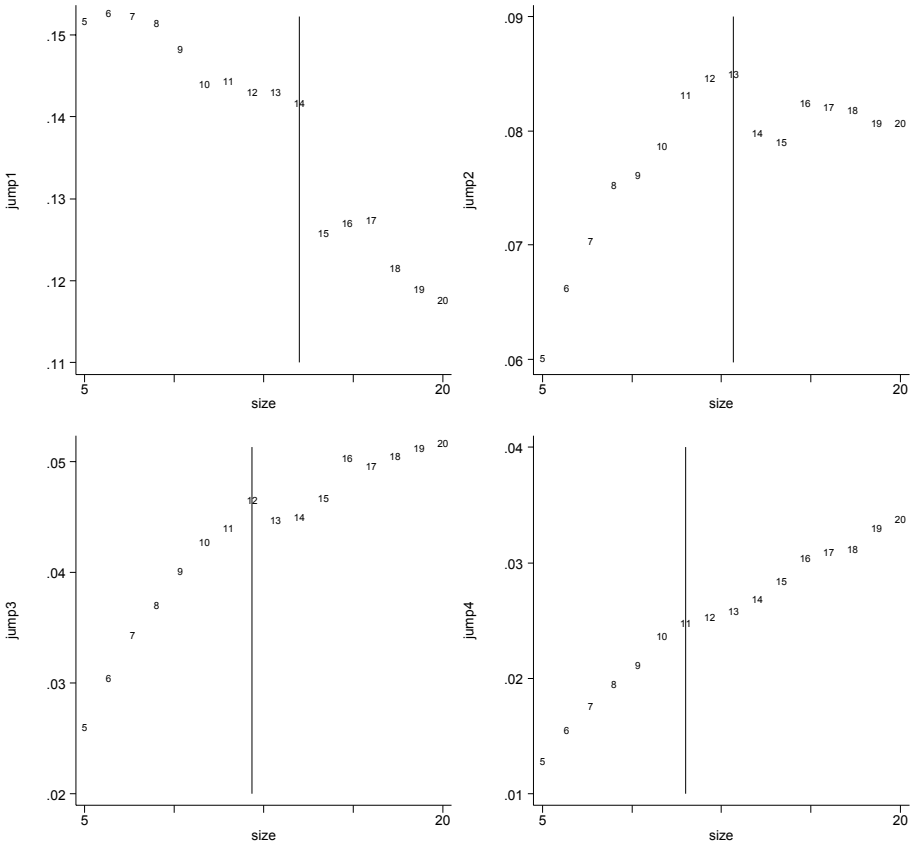

Figure 7: Probability of growing by size of the increase (1 or more, 2 or more etc.) and firm size

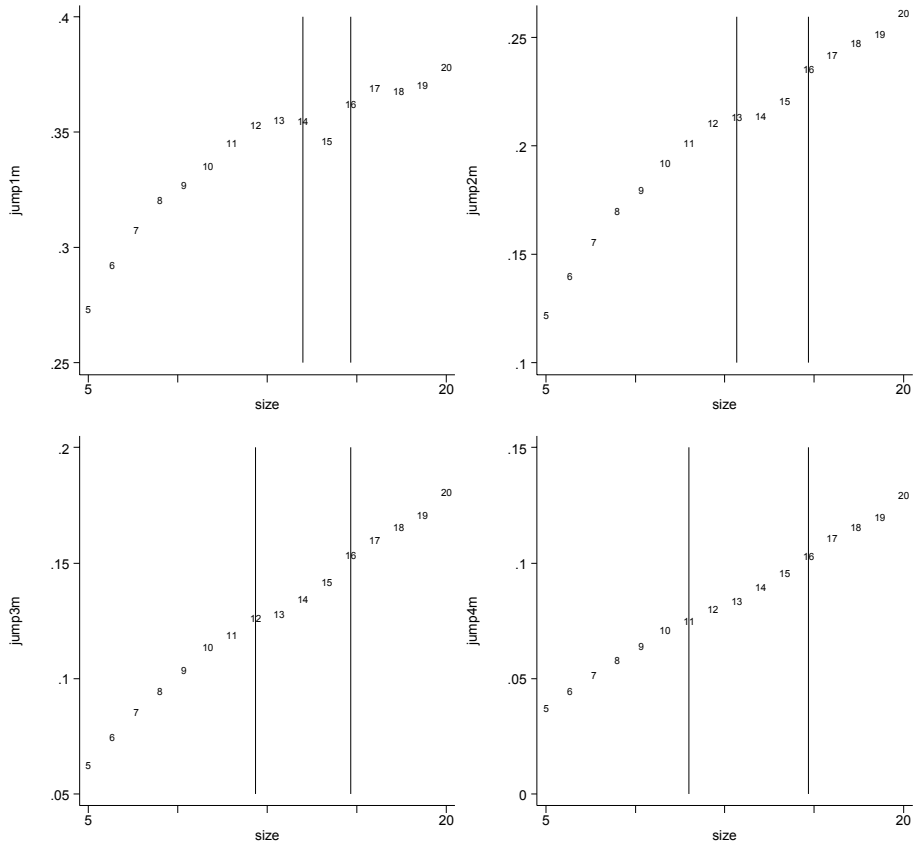

Figure 8: Year by year estimates of the threshold effect (15 employees dummy in the growth probit) and employment growth rates

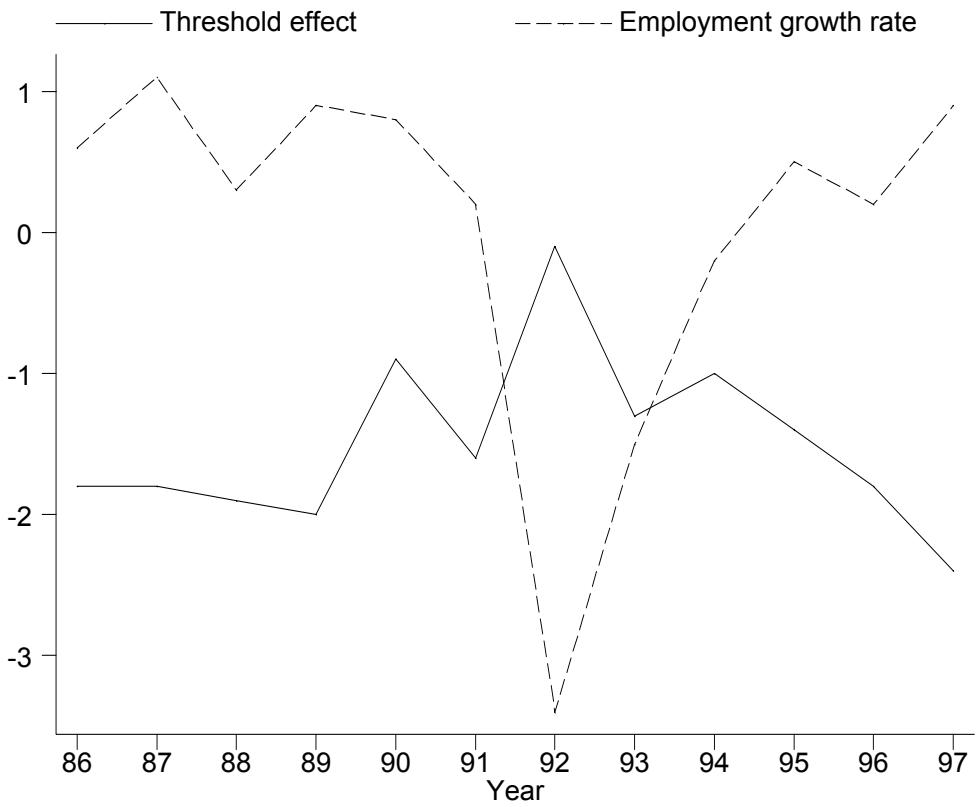

Figure 9: Average log compensation by size class (index, 15=0)

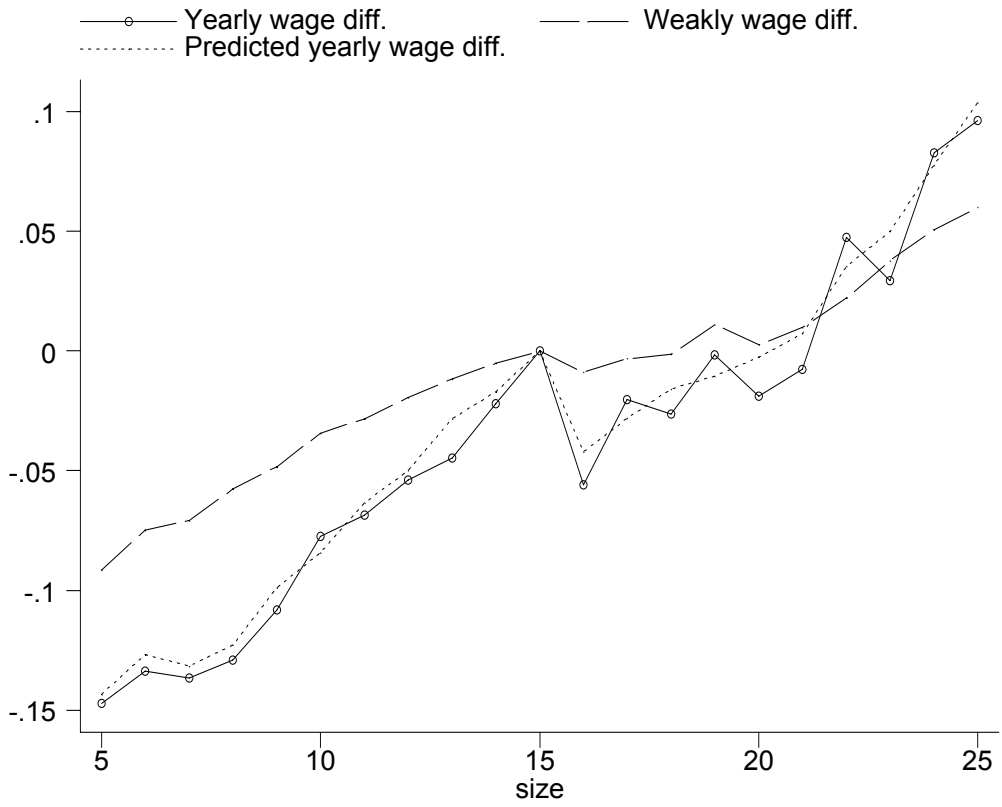

Figure 10: Average number of worked weeks per year by size class

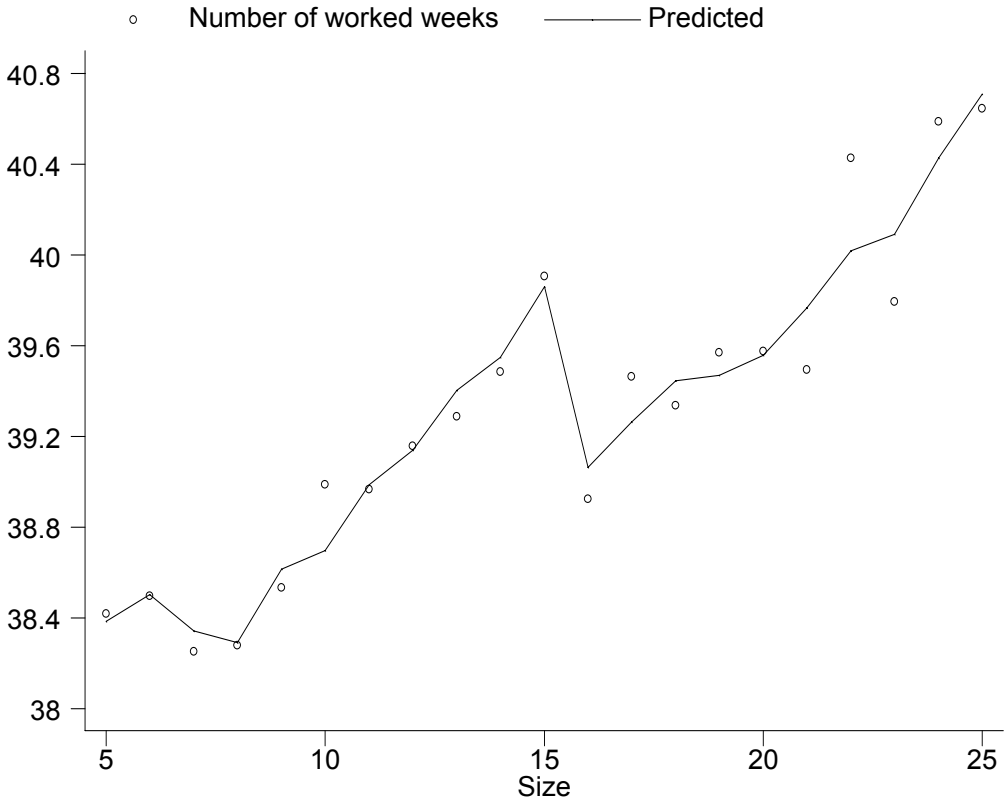

Figure 11: Probability of working a full calendar year by size class and predicted values from a probit model allowing for a shift in the intercept above the threshold

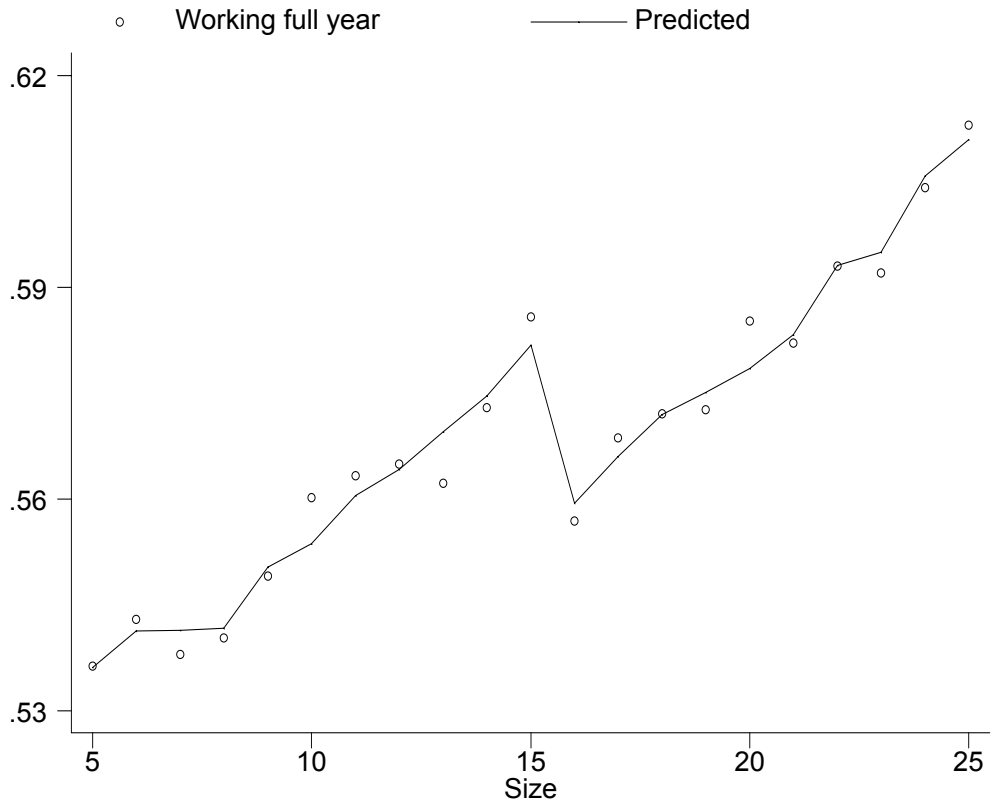

Figure 12: Probability of separation by firm size and predicted values from a probit model allowing for a shift in the intercept above the threshold

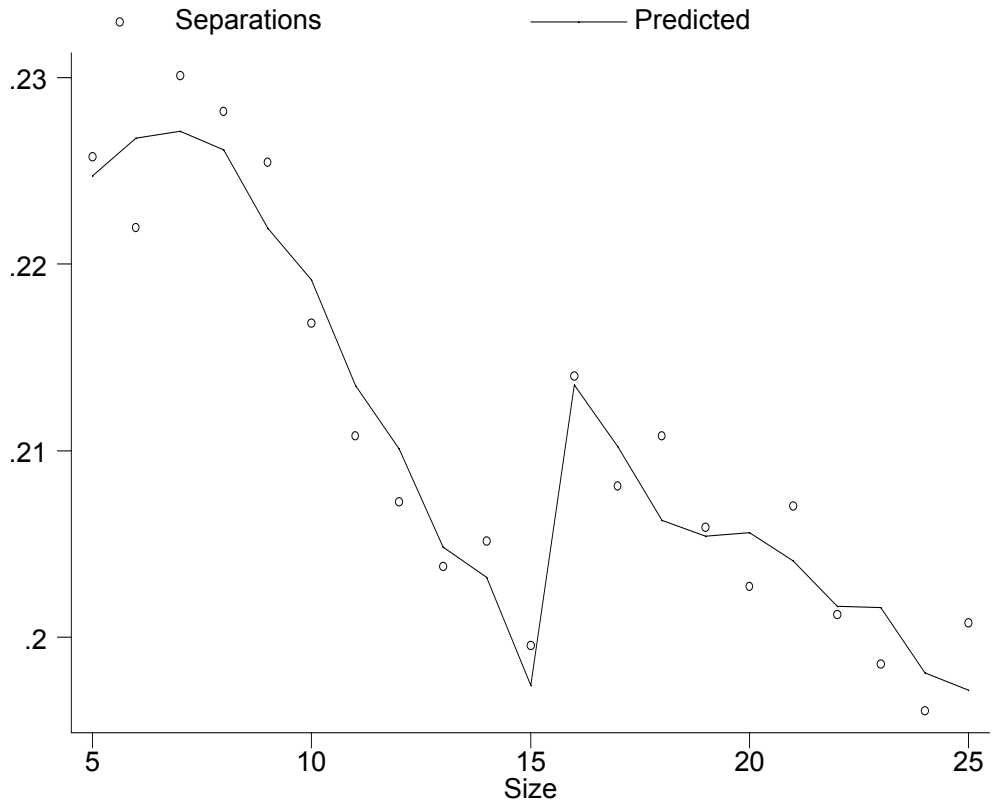

Table 1: Descriptive statistics: Firm characteristics, 5-25 employees

	Whole sample		Matched sample	
	Mean	Stand. Dev.	Mean	Stand. Dev
Size	9.9	5.0	12.2	5.7
Age	11.2	8.1	11.7	8.1
Share white coll.	31.7	36.2	31.6	36.1
Manuf.	44.0		45.1	
Services	42.0		41.2	
South	21.1		21.0	
Center	20.0		19.8	
North	58.9		59.2	
N. obs.	$3,270,360$		$221,493$	

The matched sample refers to firms that are matched with at least one employee

Table 2: Probit model. Probability of growth, by sector and area

	Total	Man.	Serv.
Du13	0.07	0.06	0.11
	(0.14)	(0.22)	(0.24)
Du14	-0.35^{**}	0.22	-0.96^{***}
	(0.15)	(.23)	(0.25)
Du15	-1.51^{***}	-1.78^{***}	-1.76^{***}
	(0.16)	(0.24)	(0.27)
Size	4.89^{***}	4.12^{***}	6.20^{***}
	(0.34)	(0.54)	(0.53)
Size^2	-0.37^{***}	-0.26^{***}	-0.52^{***}
	(0.04)	(0.07)	(0.06)
Size^3	0.01^{***}	0.01^{*}	0.02^{***}
	(0.02)	(0.00)	(0.00)
Size^4	-0.00^{***}	-0.00^{***}	-0.00^{***}
	(0.00)	(0.00)	(0.00)
Age	-0.78^{***}	-0.97^{***}	-0.74^{***}
	(0.01)	(0.01)	(0.01)
Age^2	0.01^{***}	0.01^{***}	0.01^{***}
	(0.00)	(0.00)	(0.00)
Pseudo Rsq	1.64	1.89	1.54
N. obs	$3,263,287$	$1,397,795$	$1,362,775$

Note: Probit estimates. The table reports the change in probability for an infinitesimal change in each independent, continuous variable and the discrete change in the probability for dummy variables. Sector, year and regional dummies included. Firms in the range 5 - 25 workers. *** indicates significance at 1%, ** at 5% and *10%. Standard errors in brackets.

Table 3: Transition matrix

	1	2	3	4	5	7	9	12	15	20	24	29	35	49	99	249	499	500+	entry
1	**74.5**	20.5	7.8	4.4	3.1	2.5	2.0	1.7	1.4	1.2	1.1	1.1	1.0	1.2	1.3	0.7	0.7	1.0	60.3
2	8.8	**52.6**	18.6	6.8	3.3	1.8	1.0	0.7	0.5	0.4	0.3	0.3	0.2	0.3	0.3	0.1	0.1	0.0	15.6
3	2.0	12.4	**44.7**	18.7	7.4	3.1	1.4	0.8	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.0	7.4
4	0.7	3.2	13.8	**39.3**	18.4	6.1	2.1	1.0	0.6	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.0	4.1
5	0.3	1.1	4.2	14.6	**35.1**	13.6	3.4	1.4	0.7	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.0	0.0	2.6
7	0.3	0.7	2.3	7.3	21.1	**46.6**	19.5	5.2	2.0	1.1	0.6	0.5	0.4	0.3	0.2	0.1	0.1	0.1	3.1
9	0.1	0.3	0.7	1.5	3.8	15.1	**41.7**	16.0	3.7	1.6	0.8	0.5	0.4	0.3	0.2	0.1	0.1	0.0	1.8
12	0.1	0.2	0.3	0.7	1.4	4.3	19.1	**47.8**	19.1	4.7	1.9	1.1	0.7	0.5	0.3	0.1	0.1	0.0	1.7
15	0.1	0.1	0.1	0.2	0.4	1.0	3.1	15.8	**45.5**	15.4	3.4	1.7	1.0	0.6	0.3	0.1	0.0	0.0	1.0
20	0.0	0.0	0.1	0.1	0.2	0.5	1.2	3.8	18.3	**52.5**	20.8	5.6	2.3	1.3	0.5	0.2	0.1	0.0	0.9
24	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.6	2.0	12.6	**42.3**	16.5	3.8	1.5	0.4	0.1	0.1	0.0	0.4
29	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.8	3.1	17.7	**45.0**	15.9	3.2	0.7	0.1	0.1	0.0	0.3
35	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	1.0	3.9	17.8	**49.4**	12.6	1.3	0.2	0.1	0.0	0.2
49	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.6	1.6	4.4	18.9	**60.7**	8.4	0.5	0.2	0.1	0.3
99	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.6	1.0	2.1	13.6	**77.4**	7.8	0.4	0.2	0.3
249	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	5.3	**83.3**	8.3	0.5	0.1
499	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	3.1	**81.6**	4.2	0.0
500+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	4.6	**90.0**	0.0
exit	12.9	8.8	7.1	6.1	5.6	5.2	4.8	4.5	4.2	4.2	3.8	3.6	3.2	3.1	2.8	2.8	3.2	3.6	**0.0**

Each entry represents the prob. of moving from the size class of the column to that of the row. Size classes are identified with the upper limit of the class, so that, for example, the class 20 is constituted by firms in the size interval 16-20. Diagonal entries are in boldface. Average values for the 1986-98 period.

Table 4: Descriptive statistics: Workers' characteristics

	5-15 empl.		16-25 empl.	
	Mean	Stand. dev.	Mean	Stand. dev.
Earnings (000s euros, 1995 prices)	10121	6907	11146	7610
Avg. n. of weeks worked	37.7	18.1	38.7	17.8
Age	33.0	11.3	33.8	11.2
Prob. of separation	25.4		17.0	
Male	62.2		62.8	
Apprentice	7.5		5.3	
Production	62.3		65.3	
White collar	29.8		28.9	
Manager	0.4		0.5	
Manufacturing	42.9		52.3	
Services	42.6		35.6	
South	21.2		19.9	
Center	20.0		19.3	
North	58.8		60.8	
N. of obs.	157,027		60,127	

Table 5: Wage equation

Dependent variable	Log(yearly wage)	Log(weekly wage)
Dummy 16 or more	-3.27^{***}	-0.32
	(1.19)	(0.43)
Worker's charact.		
Age	7.52^{***}	2.62^{***}
	(0.12)	(0.04)
Age squared	-0.08^{***}	0.03^{***}
	(0.00)	(0.00)
Male	19.04^{***}	21.13^{***}
	(0.49)	(0.00)
Apprentice	-33.70^{***}	-27.30^{***}
	(0.94)	(0.33)
White collar	26.94^{***}	16.46^{***}
	(0.65)	(0.23)
Manager	123.90^{***}	107.81^{***}
	(3.19)	(1.15)
Firm's charact.		
Age	1.12^{***}	-0.03
	(0.06)	(0.02)
Age square	-0.01^{***}	0.00^{***}
	(0.00)	(0.00)
Share of white collar	4.27^{***}	15.55^{***}
	(0.94)	(0.34)
Rsq.	0.21	0.35
N. of observations	201826	201826

Note: OLS estimates. A fourth-degree polynomial in firm size is included together with sector, year and regional dummies. Firms in the range 5-25 workers. *** indicates significance at 1%, ** at 5% and *10%. Standard errors in brackets.

Table 6: Regression analysis: Measures of job stability

Dependent Variable	Log of number of weeks worked	Probability of working 12 months	Probability of separation
Dummy 16 or more	-2.94^{***} (1.06)	-2.11^{***} (0.69)	1.62^{***} (0.58)
Worker's charact.			
Age	4.90^{***} (0.10)	4.76^{***} (0.07)	-1.62^{***} (0.63)
Age squared	-0.05^{***} (0.001)	-0.04^{***} (0.00)	0.02^{***} (0.00)
Male	-2.1^{***} (0.40)	-0.34 (0.28)	0.28 (0.23)
Apprentice	-6.4^{***} (0.80)	-0.58 (0.54)	1.57^{***} (0.44)
White collar	10.5^{***} (0.6)	6.74^{***} (0.37)	-2.94^{***} (0.30)
Manager	16.1^{***} (2.8)	10.16^{***} (1.66)	-2.03 (1.30)
Firm's charact.			
Age	1.1^{***} (.05)	1.07^{***} (0.04)	-0.93^{***} (0.03)
Age squared	-0.01^{***} (0.00)	-0.02^{***} (0.00)	0.01^{***} (0.00)
Share of white collar	-11.2^{***} (0.8)	-6.98^{***} (0.00)	0.91^{**} (0.44)
Pseudo Rsq	0.14	0.11	0.04
N. of observations	$210,826$	$205,132$	$188,210$

Note: First column: OLS estimates; second and third: Probit estimates. For the probit estimates, the table reports the change in probability in percentage terms for an infinitesimal change in each independent, continuous variable and the discrete change in the probability for dummy variables. A fourth degree polynomial in size is included together with sector, year and regional dummies. Firms in the range 5-25 workers. *** indicates significance at 1%, ** at 5% and *10%. Standard errors in brackets.