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# Guess who's there: Employment Protection Legislation and the Degree of Substitutability between Labour Contracts

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# Guess who's there: employment protection legislation and the degree of substitutability between labour contracts*

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**Abstract**

Employment protection legislation may affect the degree of substitutability among different types of labour contracts by changing the individuals sorting into jobs and firms screening in and out jobs. Using administrative data, we document this substitutability in the context of a labour market reform that changed the informative content of individual dismissals and provided incentives to training contracts in Italy in 2012. We present and simulate a model that shows that individual's and firm's behaviour have important implications for the impact of policies that lower firing costs. A more flexible employment protection legislation regime combined with incentives to training contracts reduces inefficiencies of job sorting and screening due to asymmetric information.

**Keywords: Human Capital, Employment Protection Legislation,Asymmetric-information**

**JEL Codes: J24,J63,J68.**

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# 1 Introduction

Substitutability among different types of labour contracts is crucial for the study of employment protection legislation. When a firm hires a worker, it faces a trade-off when choosing the kind of labour contract to offer. On the one hand, open-ended contracts entail probationary periods. On the other, fixed-term jobs cannot terminate before their ending date. Then, employer screening of worker ability under temporary contracts is worthwhile only if the duration of the probationary period of permanent contracts is shorter than the length of fixed-term contracts (Cahuc, Charlot and Malherbet 2016). When workers are targeted by a policy that alters incentives to use a specific labour contract, changes in job sorting and screening may arise depending on whether how informative dismissals are. When the employment protection legislation is strict, dismissals cannot be informative of workers' characteristics to the second-hand market. It is not possible to reduce the gap in the relative informational advantage of incumbent employer. The proportion of workers who quits voluntarily is higher in this context, for reasons of firms letting them go. Alternatively, the fraction of temporary jobs is higher because of the high costs of a bad job match under an open-ended contract. In this framework, the uncertainty of an on-the-job training provision is higher since there could be a lock-in problem after bearing a costly investment. Hence, when individual dismissals are legally possible, the employment protection legislation becomes more flexible, affecting the employment/compensation package offers for both insiders and outsiders. Then the presence of individual dismissals impacts on workers careers, firms profits and their choice on how much invest in human capital.

In this paper, we propose a novel approach to study how the individuals' sorting into jobs and firms' screening in and out jobs relates to the informative content of individuals dismissals. A more flexible employment protection legislation combined with other policies that encourage the use of training contracts changes the composition of types of labour contracts (non-qualified jobs, versus training contracts, versus highly-qualified jobs). The employment protection legislation plays a twofold role with important implications for its impact on the labour market. First, when firms have discretion on the decision to whom lay off, the market infers that adverse selection characterises the pool of laid-off workers. Second, the extent to which a worker's ability is close to the second-hand wage offer depends on the level of firing costs. Therefore, it is primarily relevant to assess firm and worker responses to changes in the design of the employment protection legislation. Besides, it is crucial to examine whether and how their behaviour affects the substitutability of types of labour contracts. A vast amount of literature documents the labour market impacts that result when the incumbent employer has an informational advantage

concerning employees' abilities (see, for instance Waldman 1984, Greenwald 1986, Gibbons and Katz 1991, Waldman 2016, Abel, Burger and Piraino 2017, Upward and Wright 2019). Another rich strand of the literature shows how this employer's informational advantage paves the way for firm's sponsored training even when skills provided are general (i.e. these skills increase worker's productivity even at other than the firm providing on-the-job training) (see, for instance Acemoglu and Pischke 1998, Acemoglu and Pischke 1999, Autor 2001, Adhvaryu, Kala and Nyshadham 2018, Jahn and Rosholm 2018, Ferreira, de Grip and Van der Velden 2018, Bilanakos, Heywood, Sessions and Theodoropoulos 2018).

There is, on the other hand, limited evidence on how firms adjust labour demand and individuals adjust their labour supply in the presence of a reform of the employment protection legislation. Even more scant evidence refers to the relationship of these firms and workers behavioural adjustments to the degree of substitutability between different types of labour contracts. A 2012 reform - the Fornero reform - in Italy creates a unique setting to study this issue. This reform simultaneously changed the employment protection legislation allowing for individual dismissals, and encouraged the access to the primary market of open-ended contracts through training contracts (in Italy this training contracts are named vocational apprenticeships).

In this context, do firms change their hiring and firing rules? Does the optimal level of firm provision of training increase? Do these labour demand adjustments affect life cycle earnings profiles of employees? Do workers sort into job differently? Do more individuals sort into training contracts? Answering these questions sheds light on the degree of substitutability of different types of labour contracts and how it relates to employment protection legislation and incentives to on-the-job training.

To address these questions, we follow a twofold strategy. First, we provide some stylised facts on the worker sorting and firm offering training contracts. Second, we present a model that builds on Gibbons and Katz (1991) and Autor (2001). How employment protection legislation impacts on the degree of substitutability of different types of labour contracts and its empirical implications are unique to the current model. The objective of the first part of the analysis is to show under which circumstances individuals with the same observable, and hopefully unobservable characteristics, in the presence of the 2012 reform entered a new job through training contracts rather than under temporary contracts, as they would have experienced in its absence. The objective of the second part of the paper is to endogenise the percentile of the worker ability distribution of employee self-selecting into training contracts. We will then illustrate how this percentile changes as firing costs vary.

The first part of the analysis deals with some identification issues. The higher the worker and firm heterogeneity is, the higher the need for selection into jobs, the more job gain and loss changes face. However, estimating heterogeneous responses to reforms that reduce employment protection legislation while encouraging the use of a training contract poses two main identification challenges. First, worker sorting into jobs and firm screening out jobs are endogenous. Selection bias makes it hard to isolate heterogeneous responses. Second, this selection bias depends on the workforce age distribution if marginal costs and benefits of worker sorting and firm screening varies across age.

We then exploit the quasi-experimental variation of the 2012 reform to address both identification issues. We combine the features of this reform with the rule (enforced since 2003) that individuals who are aged 30 or more cannot sort into training contracts. We can then set a difference-in-discontinuity design to compare before and after the reform similar individuals who are just below and just above the age cut-off. The primary hypothesis is that individuals have imprecise control on the age at which the training contract is signed (if it is signed) (see for more details Maida and Sonedda 2019). Besides, the ability distribution between contiguous cohorts who reached the threshold age before/after the reform is similar. Individuals with similar ability levels in the presence of the reform entered a new job as apprentices rather than under a temporary labour contract. The difference-in-discontinuity treatment is independent of the characteristics of the empirical counterparts of the ability distribution as the percentile of the distribution of education conditional on age since it leverages idiosyncratic differences across cohorts of birth in this distribution within the narrow subset of employees on the cusp of the age cut-off. The treatment is also independent of the percentile of the distribution of monthly net job flows (hirings minus separations) since in a given month and year individuals just below and just above the age threshold are exposed to the same business cycle conditions. We can then add to the difference-in-discontinuity model a third interaction based on these percentiles to show that the design of the policy generated heterogeneous changes of substitutability for types of labour contracts across otherwise similar cohorts.

To conduct our empirical analysis, we use a rich administrative dataset on employer-employee records that covers about the 13% of all job flows in Italy between January 2011 and December 2013. We employ $1,279,730$ observations, gathering 99934 firms and 105275 individuals aged between 29 or 30 and turning to 30 or 31. To investigate the possible sources of heterogeneous change of labour demand for training contracts in response to the reform, we include the treatment into a difference-in-difference-in-discontinuity reduced form model looking at one margin: the training contract probability. We then document the worker characteristics that are

associated with a higher response to the reform to provide some stylised facts. These stylised facts explain the degree of substitutability between different types of labour contracts within and across cohorts in the presence of the reform.

The vocational apprenticeship probability increased by about one percentage point in the post-reform period at the age threshold for those sitting below the 25th percentile of the distributions of monthly multiple job episodes, and it did not change instead for those who do not.[1] The effect on the probability of a training contract is concentrated on those who are not low educated. We show that in the post-reform period at the age threshold this probability increased more for those who sit above the 25th percentile of the education distribution conditional on age compared to the increase experienced by those who sit below this percentile value. The former is about 1.6%, and the latter is about 0.6%. For those who sit below the 25th percentile of the distributions of monthly job separations[2], the difference-in-discontinuity impact is about 1.5%, and it is not statistically different from zero for those who do not. We summarise the implications of this micro-level substitutability for different types of labour contracts into three stylised facts. First, training contracts are costly. Not all individuals sort into them. Not all firms offer them to all individuals. Second, there are complementarities between former education and on-the-job training. This fact is, possibly, (at least part of) the observed counterpart of complementarities between individual ability and on-the-job training. Third, expected production opportunities cannot be short-term as when the number of monthly job separations is high.

These three stylised facts contribute to explain the worker and firm behaviour in sorting and offering training contracts. Nevertheless, they cannot directly show how the percentile of employee ability distribution varies with a more flexible employment protection legislation for two reasons. First, a randomised source of variation allows to compare individuals who have hopefully similar abilities. However, we cannot test this assumption because of the impossibility to observe the individual ability distribution. Second, we devote our attention to an aspect of the 2012 reform that is difficult to measure. This reform increased the flexibility of the employment protection legislation by allowing individual dismissals. In doing so, it increased the informative context of dismissals independently of size or other firm characteristics.

Hence, in the second part of the paper, we present a simple model to study how this increase in the flexibility of the employment protection legislation affected the substitutability between different types of labour contracts. We look at changes in firm wage offer of different types of labour contracts caused by a more flexible employment protection legislation. The model

[1] In the working sample, roughly 10% of workers have more than one job episode in a month.

[2] We calculate the number of job separations in a month for all workers included in the data. We then assign individuals to the percentile of the age-specific distribution of these monthly number of job separations.

builds on Gibbons and Katz (1991) and Autor (2001). How firms induce self-selection and perform subsequent screening of worker ability is similar to these models. As in Autor (2001), the costly human capital investment decision lead workers to sort into it based on their expected ability and firms to improve their screening in and out jobs. As in Gibbons and Katz (1991) and Autor (2001) the pools of workers in the second-hand market are a mixture of exogenous and endogenous departures. Hence, adverse selection characterises these pools. As in Gibbons and Katz (1991) the lay off rule determines the endogenous quits. However, the degree of firm discretion in lay off rules depends on the employment protection legislation. Therefore, the employment protection legislation affects the substitutability of different types of labour contracts. This analysis and its empirical implications are unique to the current model.

Then, we simulate this model to endogenise the percentile of the individuals' ability distribution over which workers sort into jobs and firms screen them in and out. We find that the percentile of the ability distribution to sort into training contracts rather than in a non-qualified occupation reduces when the employment protection legislation is more flexible. Hence, for marginal workers, a more flexible employment protection legislation has a positive effect on sorting into training contracts, but a negative impact on sorting into non-qualified jobs. Their lifetime earnings profiles increase when they exchange a lower initial wage for higher future earnings. The estimated positive effect of the Italian reform reflects a different composition of types of labour contracts. Some individuals would have had a non-qualified job and likely temporary job, absent the reform. Instead, they follow another working career. However, these individuals have higher marginal costs of training. Hence, more flexible criteria for dismissals reduce, the optimal amount of training provided by the firm to the marginal worker.

The previous literature has focused on empirical analysis on the effect of employment protection legislation on training finding mixed results (e.g. Bolli and Kemper 2017, Cabrales, Dolado and Mora Villarrubia 2017, Bratti, Conti and Sulis 2019). This paper shows that substitutability of different types of labour contracts - caused by a more flexible employment protection legislation - is also very important. It thus improves upon the existing literature focusing on the behavioural responses of firms and workers. This analysis represents a first step to evaluate the importance of substitutability of different types of labour contracts and workers' sorting into jobs and firms' screening them in and out for the analysis of employment protection legislation policies. Indeed, a more flexible employment protection legislation regime combined with incentives to training contracts can reduce the inefficiencies of job sorting and screening due to asymmetric information.

The remainder of the paper proceeds as follows: Section 2 reviews the related literature and

illustrates the institutional setting; Section 3 describes the data and present the reduced form analysis; Section 4 presents the model; Section 5 discusses the simulation of the model; Section 6 concludes.

# 2 Related literature and institutional framework

## 2.1 Brief overview of the literature

This research relates to at least three strands found in the literature.

First, this paper combines the analysis presented by Autor (2001) with the study by Gibbons and Katz (1991). Hence, it links to the literature on the role of asymmetric information on firm's training provision. The main economic reasoning is that in the presence of asymmetric information, firms have ex-post monopsony power (Acemoglu and Pischke 1998, Acemoglu and Pischke 1999). Incumbent firms have better knowledge of employees' abilities relative to other firms. Because of this informational advantage, earnings are lower than individual marginal product, and then employers benefit of financing general training. Firms can extract higher profits from workers with higher skill level and workers with more human capital.

The problem of hiring the *right* employee is quite complicated since employees are privately informed about relevant personal attributes and skills. Employees may have an incentive to misrepresent their abilities and overplay experience and qualifications. As firstly suggested by Salop and Salop (1976), firms might induce workers to reveal information before the hiring decision. In general, firms could offer compensation packages that are most valuable to the type of employee they wish to attract (Lazear 1990, Lazear 2009, Lazear 2018). Another stream of literature focuses on the role of intermediaries. Autor (2001) argues that free training in general skills provided by temporary agencies both induces worker self-selection and allows these firms to privately screen on worker ability. This paper combined this feature to the literature on the informational content of worker's dismissal and how it relates to the firm's hiring policy. Gibbons and Katz (1991) analyse another aspect of the selection on the part of the employers focusing on workers displaced due to slack work. Human resources management policies give likely preference in retention to more productive workers when demand declines. In contrast, employers must lay off all employees when a plant closes. Based on this argument, workers displaced due to slack work will fare worse when newly hired than employees displaced due to a plant closing. The employment protection legislation could influence the informational content of this selection process in two ways. First, by restricting the number of dismissals. Second, by affecting the number of workers who endogenously quit because the firms let them go.

This study then relates to the literature on the employment protection legislation. A widely recognised stylised fact is that the share of temporary jobs is higher in countries where open-ended contracts have higher protection. Since the eighties, some European countries in the name of fighting the high unemployment rates have eased the restrictions on the use of firing-cost-free temporary contracts. This increase in flexibility was only at the margin since there was no reform of the strict employment protection legislation governing permanent contracts. The rapid expansion of temporary contracts as employment contracts used in new hires led to segmented labour markets while failed to reduce unemployment. This labour market segmentation generated a strong divide between unstable jobs with poor working conditions and the others. Only few papers endogenise the choice between fixed-term and open-ended contracts (Caggese and Cuñat 2008, Berton and Garibaldi 2012, Cahuc et al. 2016, Guglielminetti and Nur 2017, Fialho 2017, Tealdi 2019). Temporary job contracts emerge in equilibrium because they provide production opportunities having short expected durations. Besides, firms' screening of temporary workers is worthwhile only if the duration of the probationary period of permanent contracts is shorter than the length of fixed-term contracts (Cahuc et al. 2016). In this framework, temporary contracts are likely to be more dead-end jobs rather than stepping stone into permanent employment. One stream of the literature suggests that earnings of temporary workers are lower (see for instance Blanchard and Landier 2002), they receive less on-the-job training (see for instance Cabrales et al. 2017) and their career prospects are worse relative to those experienced by workers employed in permanent contracts (García-Pérez, Marinescu and Vall Castello 2019).

This research links to the literature on the relationship between employment protection legislation and the firm's sponsored training and its developments. More recent empirical contributions focused on the effect of employment protection legislation on training by type of contract. One could expect that if a longer working time horizon increases the firm's monopsony rents on workers training, stricter employment protection legislation might raise the firm provision of training. This effect when estimated is typically either small or statistically insignificant (Almeida and Aterido 2011, Picchio and van Ours 2011, Bolli and Kemper 2017). However, stricter employment protection legislation increases the dualism of the labour market, enlarging the gap in training provisions between temporary and permanent workers. The overall impact on the economy should then depend upon the composition of the labour force by type of contract (Cabrales et al. 2017). For instance, Hijzen, Mondauto and Scarpetta (2017) use a regression discontinuity design to show that stricter employment protection legislation increases worker turnover because of the excessive use of temporary contracts. Bratti et al. (2019) exploits

the Fornero reform to show that the number of trained workers increased in firms just above the thresholds of 15 employees for reasons of a reduction in worker turnover and a lower use of temporary contracts.

In what follows, we use the same reform from a different perspective.

### 2.2 Institutional framework

The Italian employment protection legislation (EPL) was quite strict comprising, for instance, the reinstatement in the workplace in case of individual dismissals. During the period of analysis, which extends from January 2011 to December 2013, there has been the first reform of the employment protection legislation on open-ended contracts (Fornero Reform). Before this law, other interventions introduced only flexibility at the margin without impacting on EPL rules governing permanent labour contracts.

The Fornero reform aimed to favour more flexibility in hiring by way of open-ended contracts which make the dismissal easier. Severance pay, based on the age and tenure of the worker substituted the reinstatement in the workplace in case of individual lay-off. These new rules mainly applied to firms with more than 15 employees because smaller firms could, in principle, dismiss a worker even before the reform. We do not look at the margin of the firm size threshold for reasons of focusing on the informative content of the individual dismissal to the second-hand market. All the interventions of the new legislation moved in the direction of increasing this informative content by undoing the asymmetry based on the firm size. Collective lay-offs are now possible under reasons such as cutbacks, company changes or termination of activities after complying the information and consultation procedure with trade unions. The employer can fix possible irregularities in this procedure without incurring the risk of the reinstatement in the workplace, as ruled before the reform.

The 2012 reform eased the EPL rule on open-ended contracts to reduce the dualism of the Italian labour market. The law encouraged the substitution of temporary with training contracts, named vocational apprenticeships. It scaled back the scope of atypical and fixed-term work, either in salaried and quasi-subordinate employment. Besides, it outlined the central role played by these training contracts that share some characteristics with both open-ended and temporary contracts. They are an open-ended contract with a compulsory fixed-term training period. At the end of this period, they automatically convert into a standard open-ended contract absent any notice from the firm. In the presence of this notice, the employer pays no firing costs. Worker's dismissal at any other time than the end of the training period is subject to the same firing costs rules of open-ended contracts. The law fixes to six months the minimum length of

the training period. The reform quantifies the potential number of apprentices that an employer can recruit, which is determined by the number of qualified workers in the same occupation. The objective is the implementation of a mentoring scheme to increase the commitment to the firm provision of training. The reform enforces the open-ended nature of the contract by limiting the number of newly hired apprentices if the employer had not retained at least 50% of apprentices recruited in the previous 36 months.[3] Finally, the reform increases the social security contributions of temporary contracts.

In sum, this reform changed the sorting into and screening in and out of jobs through all these measures. In doing so, it changed the substitutability of different labour contracts while making the employment protection legislation more flexible.

# 3 Data and reduced-form analysis

## 3.1 Data

In estimation of reduced-form analysis on heterogeneous impact of the reform on the substitutability between different types of labour contract, we make use of a very rich administrative dataset by the Ministry of Labour and Social Policies, $CICO$. All individuals who activate, transform and dismiss a labour contract in all sectors including the Agriculture and Public Administration between 2009 and the second quarter of 2017 remain in the panel from first job episode recorded then onwards. The relevant dates (day, month, year) of each event are available in the database together with the sector, the region of work, the type of labour contract, and the benefit associated to it (if applicable). The units of observation are all individuals born on the 1st, the 9th, the 10th and the 11th of each month. The data record their gender, year of birth, region of birth, citizenship, and education.[4] The database associates each worker to his/her employers through an anonymous identifier. Using this worker's identification code, we link information recorded in two databases on self-employment activities and independent job episodes in the professional orders. The objective is to be sure that non-employment status is due to either unemployment or being out of the labour force. The working sample amounts to $1,279,730$ observations gathering 99934 firms and 105275 individuals aged between 29 or 30 and turning to 30 or 31 in a month during January 2011-December 2013 (i.e. we centred data $\pm$ 18 months around June 2012 when the labour market reform took place).

We consider the following covariates as potential mechanisms that could help to explain the

[3] This percentage reduced to 30% in the initial implementation of the reform.

[4] We include missing information on the educational level using an indicator function that controls for this status.

heterogeneous impact of the reform on the substitutability between different types of labour contracts: education, previous experience to the new job episode, and a bunch of dummy variables. These are a dummy equal to 1 for switching sector of activity, and changing region of work. We consider the age-specific distributions of three job characteristics: if the individual has more than one job in the month, if the labour contract benefits from tax rebates or similar policies, if the hiring resorts to subsides. The dummy variable takes the value of 1 for percentiles higher than the 25th of these distributions. Similarly, we take into account the age-and region of birth-specific distributions of the number of job separations and net job flows (hirings minus separations) in a month. The dummy variable is equal to 1 for percentiles higher than the 25th. Finally, we also include as covariates gender, dummies for worker's region of birth and work, a dummy for missing information on education and on past-experience.

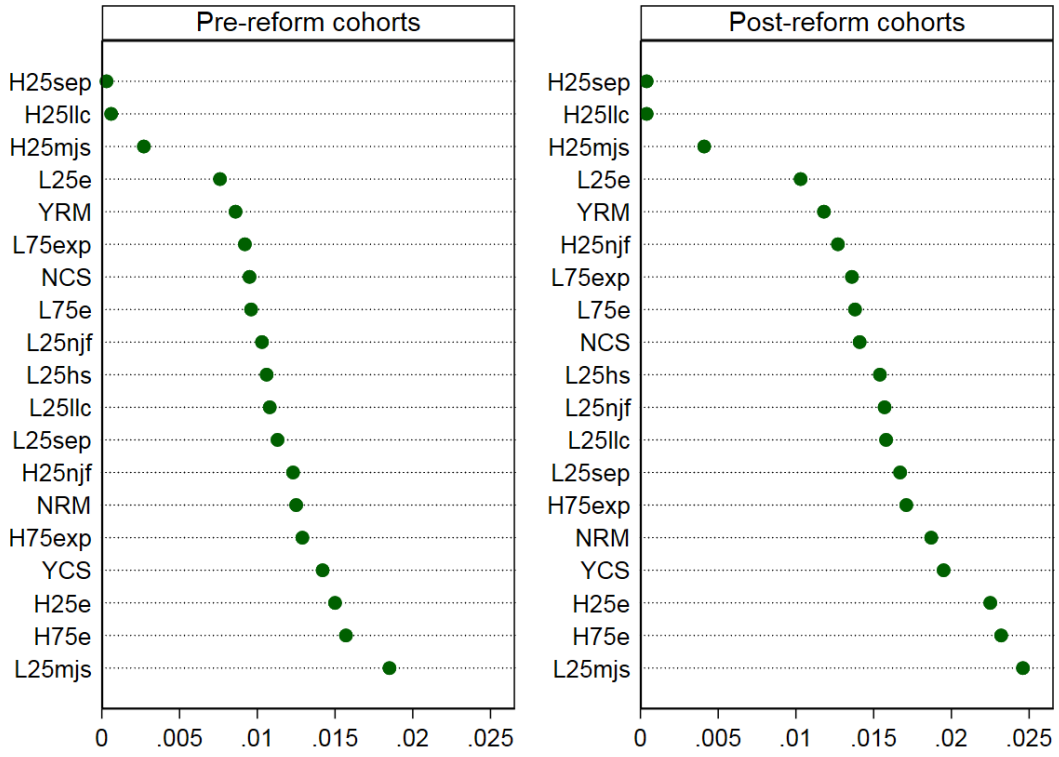
Figure 1 ranks the vocational apprenticeship probability in raw data based on these covariates to display some observed facts about it at the age threshold distinguishing between treated and untreated cohorts. The ranking is very similar across treated and untreated cohorts allowing to establish three stylised facts. First, vocational apprenticeship probability is zero when the number of job separations in a month is high, or the weakness of firms take the form of a large number of publicly subsidised labour contracts. This fact is consistent with the argument made by Cahuc et al. (2016). When firm expected production opportunities are short-term (even very-short ones), employers use only temporary contracts to fill them. Second, those who have an education level higher than the 25th (the 75th) percentile of the age-specific distribution have a higher probability of having a training contract at the age threshold. Then, complementarities between former education and current on-the-job training exist. Third, vocational apprenticeship contracts are costly for reasons of its incompatibility with other simultaneous jobs in a month.

Figure 1 clearly shows that there is a monotonic increase in the vocational apprenticeship probability distribution generated by the Fornero reform. We document its heterogeneous impact at the threshold in what follows.

### 3.2 Reduced-form analysis on the impact of the reform on job flows into job training contracts.

In Section 2.2, we discussed the combination of the four measures, introduced by the Fornero reform, that might have affected the screening in and out process of the employers and the worker sorting into jobs. These new rules are the enforcement of the permanent contract nature of vocational apprenticeships; the mentoring scheme to the apprentices to raise the firm's commitment to the training provision; the minimum length of the training period; the rise in

Figure 1: Some facts on vocational apprenticeship probability at the age threshold.




*Notes:* H25sep stands for sitting at a percentile higher than the 25th of the age-and region of birth-specific distribution of the number of monthly job separations; H25llc stands for sitting at a percentile higher than the 25th of the age-specific distribution of benefits from labour costs reduction; H25mjs stands for sitting at a percentile higher than the 25th of the age-specific distribution of the number of multiple job episode in a month; L25e stands for sitting at a percentile lower than the 25th of the age-specific distribution of education; YRM stands for working in a region different from the region of birth; L75exp stands for sitting at a percentile lower than the 75th of the age-specific distribution of previous experience to the new job; NCS stands for no switching sector of activity; L75e stands for sitting at a percentile lower than the 75th of the age-specific distribution of education; L25njf stands for sitting at a percentile lower than the 25th of the age-and region of birth-specific distribution of the number of net job flows in a month; L25hs stands for sitting at a percentile higher than the 25th of the age-and region of birth-specific distribution of hiring incentives; L25llc stands for sitting at a percentile lower than the 25th of the age-specific distribution of benefits from labour costs reduction; L25sep stands for sitting at a percentile lower than the 25th of the age-and region of birth-specific distribution of the number of job separations in a month; H25njf stands for sitting at a percentile higher than the 25th of the age-and region of birth-specific distribution of the number of monthly net job flows; NRM stands for working in the region of birth; H75exp stands for sitting at a percentile higher than the 75th of the age-specific distribution of previous experience to the new job; YCS stands for switching sector of activity; H25e stands for sitting at a percentile higher than the 25th of the age-specific distribution of education; H75e stands for sitting at a percentile higher than the 75th of the age-specific distribution of education, and L25mjs stands for sitting at a percentile lower than the 25th of the age-specific distribution of the monthly number of job episode.

labour costs of temporary contracts, and the change in the employment protection legislation by allowing individual dismissals for all firms independently of their size. In this section, we document its heterogeneous impact on the substitutability of temporary and training contracts that robustly support the three stylised facts displayed in Figure 1.

We exploit the unchanged discontinuity age rule in job entry as apprentices to find out the candidate mechanisms that could explain the effect of the Fornero reform on the vocational apprenticeship probability in the following difference-in-difference-in-discontinuity framework:

$$y_{i,t} = \alpha_{1v} + \alpha_1 k_{it} + \gamma_1 d_{it} k_{it} + \gamma_0 d_{it} + v_i + \beta_{1v} d_{it} v_i + \alpha_{1v} k_{it} v_i + \gamma_{1v} d_{it} k_{it} v_i + \epsilon_{i,t} \quad (1)$$

where $y_{i,t}$ is the vocational apprenticeship status of individual $i$ at time (year, month) $t$; $k_{it}$ is an indicator function which takes on the value of 1 if the individual is subject to Law No. 92/2012 and 0 otherwise; $d_{it}$ is an indicator function that assumes the value of 1 if the person is less than 30 years and 0 otherwise; $v_i$ are the bunch of dummy variables described above. We include the interaction of these dummies with the reform and age indicators separately for each of them.

The introduction of a third interaction extends the approach used to verify the stepping stone into permanent employment hypothesis of vocational apprenticeship by Maida and Sonedda (2019). Bratti et al. (2019) use a similar, albeit not identical strategy, to estimate the effect of the reduced firing restrictions for firms with more than 15 employees set out by the Fornero reform on the number of trained workers.[5]

We then compare the pre-reform January 2011-June 2012 data to the post-reform period between July 2012 and December 2013 in a $\pm 1$ year range around the threshold of 30 years separately for each group defined by a candidate mechanism, for instance sitting above the lowest 25th percentile of the age-specific distribution of education.[6] Equation 1 is a linear probability model with vocational apprenticeship as a dependent variable. The reported coefficient in Figures 2 and 3 is the interaction of being below the age cut-off with a post-reform dummy and with a group dummy for each candidate mechanism keeping fixed all the others. For instance, consider the differences in the difference-in-discontinuity impact of the Fornero reform across groups defined by the 25th percentile of the age-specific distribution of education. We also include in the regression model all the other dummies, our covariates, the firm identification code, and fixed effects.[7] The objective of including the covariates is to reduce sampling variability because they are not necessary to achieve identification of the treatment effect.

Table 1 supports this argument by showing the balancing-out of covariates at the age threshold between treated and untreated individuals. It clearly shows that there is not any statistical difference in each covariate at the age threshold generated by the Fornero Reform as estimated by a polynomial of degree zero in age. The table also indicates that this polynomial of degree zero perfectly matches the difference of the mean values of the covariates before/after the reform at the age threshold in raw data.[8] For instance, at the age cut-off of 30 years,

[5]The difference-in-discontinuities design aims at controlling for a confounding policy at the same threshold of 15 employees, rather than exploiting the difference generated by a reform in the same discontinuity policy rule (at the age threshold of 30 years) as in Maida and Sonedda (2019).

[6]The interaction of being below the age cut-off with the post-reform dummy measures, instead, the impact for individuals with educational level lower than the value of the 25th percentile.

[7]More specifically, we introduce time (month and year), sector, region of birth and work fixed effects.

[8]Information on the worker's birth date limited to the year impose some restrictions on the functional form of the regression model. See Maida and Sonedda (2019) for further details. The coarseness of the running variable

Table 1: Difference-in-discontinuity on covariates generated by the Fornero reform at the age threshold

| | Main Sample | | | |
|---|---|---|---|---|
| | Raw data | | Polynomial fit | |
| | [-1,1] | [-2,2] | [-1,1] | [-2,2] |
| **Covariates:** | DiD (Std. Dev.) | DiD (Std. Dev.) | DiD (Std. Err.) | DiD (Std. Err.) |
| Gender | $-0.005^{***}$ | $-0.005^{***}$ | $-0.005$ | 0.001 |
| | 0.001 | 0.001 | 0.056 | 0.095 |
| Region of birth | $-0.193^{***}$ | $-0.152^{***}$ | $-0.193$ | $-1.075$ |
| | 0.074 | 0.052 | 27.011 | 46.041 |
| Education | $-0.323^{***}$ | $-0.301^{***}$ | $-0.323$ | $-0.263$ |
| | 0.041 | 0.029 | 7.357 | 12.685 |
| Missing education | 0.001 | $0.003^{***}$ | 0.001 | $-0.006$ |
| | 0.001 | 0.001 | 0.137 | 0.235 |
| Previous experience to new job | $-16.086^{***}$ | $-110.236^{***}$ | $-16.086$ | 151.320 |
| | 1.290 | 0.892 | 79.416 | 126.001 |
| Missing past exp. | $-0.006^{***}$ | $0.007^{***}$ | $-0.006$ | $-0.025$ |
| | 0.001 | 0.001 | 0.023 | 0.039 |
| Region of work | 0.002 | $-0.015^{**}$ | 0.002 | 0.032 |
| | 0.010 | 0.007 | 0.950 | 1.659 |
| Changing sector | $0.002^{**}$ | $-0.001^{**}$ | 0.002 | 0.007 |
| | 0.001 | 0.001 | 0.024 | 0.042 |
| Regional mobility | $-0.006^{***}$ | $-0.006^{***}$ | $-0.006$ | $-0.014$ |
| | 0.001 | 0.001 | 0.233 | 0.398 |
| Higher 25 per. monthly job spells | $-0.005^{***}$ | $-0.003^{***}$ | $-0.005$ | $-0.006$ |
| | 0.001 | 0.001 | 0.033 | 0.056 |
| Higher 25 per. monthly sep. flows | $-0.001$ | $-0.001^{**}$ | $-0.001$ | 0.001 |
| | 0.001 | 0.000 | 0.008 | 0.014 |
| Higher 25 per. monthly net job flows | $-0.001$ | $-0.003^{***}$ | $-0.001$ | 0.002 |
| | 0.001 | 0.000 | 0.009 | 0.015 |
| Higher than 25 perc. costs reduction | $0.001^{***}$ | $-0.000$ | 0.001 | 0.003 |
| | 0.000 | 0.000 | 0.011 | 0.020 |
| Higher than 25 perc. soc. insurance benefits | $0.001^{***}$ | $-0.000^{***}$ | 0.001 | 0.001 |
| | 0.000 | 0.000 | 0.001 | 0.001 |

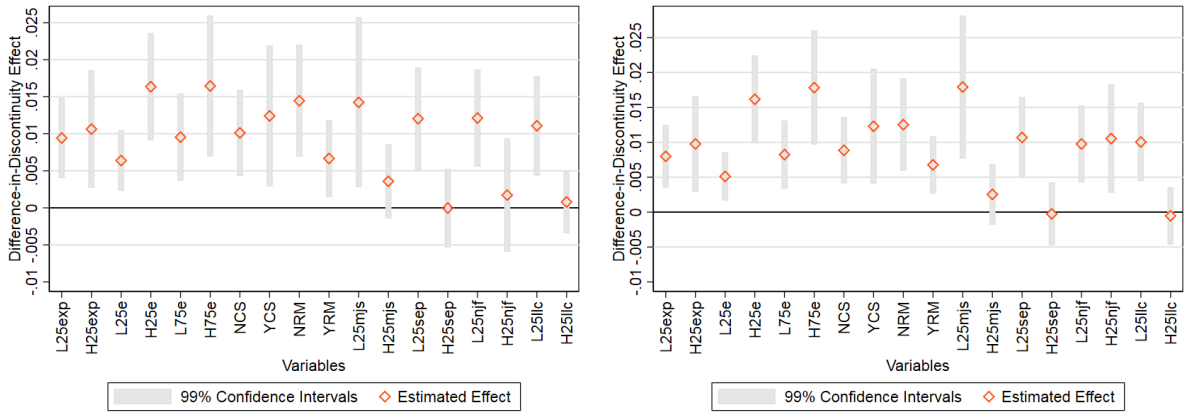
*Notes:* The independent samples t-test compares the difference in the means from the two groups (treated and untreated cohorts) around the age threshold, to zero. The polynomial fit corresponds to a zero (first) order polynomial in age when the age range is $\pm 1(2)$. Each variable, defined as higher than the 25th percentile, is a dummy variable which is equal to 1 if the job episode sits in a percentile higher than the 25th of the age-specific distribution of each covariate (e.g. educational level). We consider three job characteristics: if the individual has more than one job in the month, if the labour contract benefits from tax rebates or similar policies, if the hiring resorts to subsides. We take into account the age-and region of birth-specific distributions of the number of job separations and net job flows (hirings minus separations) in a month.

there is no difference between treated and untreated individuals in the propensity of sitting in a percentile higher (lower) than the $25th$ in the distribution of education. Hence, the unconditional independence assumption holds because, at the age threshold, the labour market reform generated a randomised source of variation.

In Figure 2, the results indicate that the relative position of the individual's previous experience to new job does not matter. Independently of being below or above the 25th percentile of this distribution, the vocational apprenticeship probability of individuals treated

(deviation from 30) and the measurement error in the age variable do not lead to a bias. Besides, we provide in the Appendix A1 the graphical analysis that sets the grounds of the validity of this reduced-form analysis.

Figure 2: Heterogeneity of the difference-in-discontinuity impacts.




(a) Centered around 18 months

(b) Centered around 24 months.

*Notes:* H25sep stands for sitting at a percentile higher than the 25th of the age-and region of birth-specific distribution of the number of monthly job separations; H25llc stands for sitting at a percentile higher than the 25th of the age-specific distribution of benefits from labour costs reduction; H25mjs stands for sitting at a percentile higher than the 25th of the age-specific distribution of the number of multiple job episode in a month; L25e stands for sitting at a percentile lower than the 25th of the age-specific distribution of education; YRM stands for working in a region different from the region of birth; L75exp stands for sitting at a percentile lower than the 75th of the age-specific distribution of previous experience to the new job; NCS stands for no switching sector of activity; L75e stands for sitting at a percentile lower than the 75th of the age-specific distribution of education; L25njf stands for sitting at a percentile lower than the 25th of the age-and region of birth-specific distribution of the number of net job flows in a month; L25hs stands for sitting at a percentile higher than the 25th of the age-and region of birth-specific distribution of hiring incentives; L25llc stands for sitting at a percentile lower than the 25th of the age-specific distribution of benefits from labour costs reduction; L25sep stands for sitting at a percentile lower than the 25th of the age-and region of birth-specific distribution of the number of job separations in a month; H25njf stands for sitting at a percentile higher than the 25th of the age-and region of birth-specific distribution of the number of monthly net job flows; NRM stands for working in the region of birth; H75exp stands for sitting at a percentile higher than the 75th of the age-specific distribution of previous experience to the new job; YCS stands for switching sector of activity; H25e stands for sitting at a percentile higher than the 25th of the age-specific distribution of education; H75e stands for sitting at a percentile higher than the 75th of the age-specific distribution of education, and L25mjs stands for sitting at a percentile lower than the 25th of the age-specific distribution of the monthly number of job episode. The reported coefficient is the interaction of being below the age cut-off with a post-reform dummy and with a group dummy for each candidate mechanism keeping fixed all the other covariates. We add to these covariates, time (month and year), sector, region of birth and work fixed effects, polynomial of degree 1 in the firm identification code.

by the labour market reform at the age cut-off increased by about one percentage point above the vocational apprenticeship rates of similar untreated individuals; these effects are highly significant. For those who sit below (above) the 25th percentile of the distributions of the number of job separations and net job flows in a month, and publicly provided subsidies the difference-in-discontinuity impact is (not) significantly different from zero. Hence, only firms with long-term production opportunities use an open-ended contract initially committed to the provision of on-the-job training. The vocational apprenticeship probability at the age threshold of those treated by the 2012 reform and sitting below (above) the 25th percentile of the distributions of monthly multiple job episode increased by about 1% (is not statistically different from zero) compared to the apprenticeship probability of similar untreated individuals. Then, the vocational apprenticeship labour contract could be too costly for some individuals

to benefit from it for reasons of the additional effort associated with the training provision and the initial lower wage. The difference-in-the-difference-in-discontinuity impact on the vocational apprenticeship probability across the 25th percentile of the age-specific distribution of education, is about 1% (1.6% for those above versus 0.6% for those below). The corresponding quantity for those above the 75th percentile of this distribution is in the same order of magnitude (about 1.6%). The difference-in-discontinuity impact for those who sit below the 75% percentile is about 1%, that is higher than 0.6%. Then, there might be a positive difference-in-discontinuity effect also for who sits in the interquartile range of the education distribution. Hence, there are complementarities between former education and current on-the-job-training.

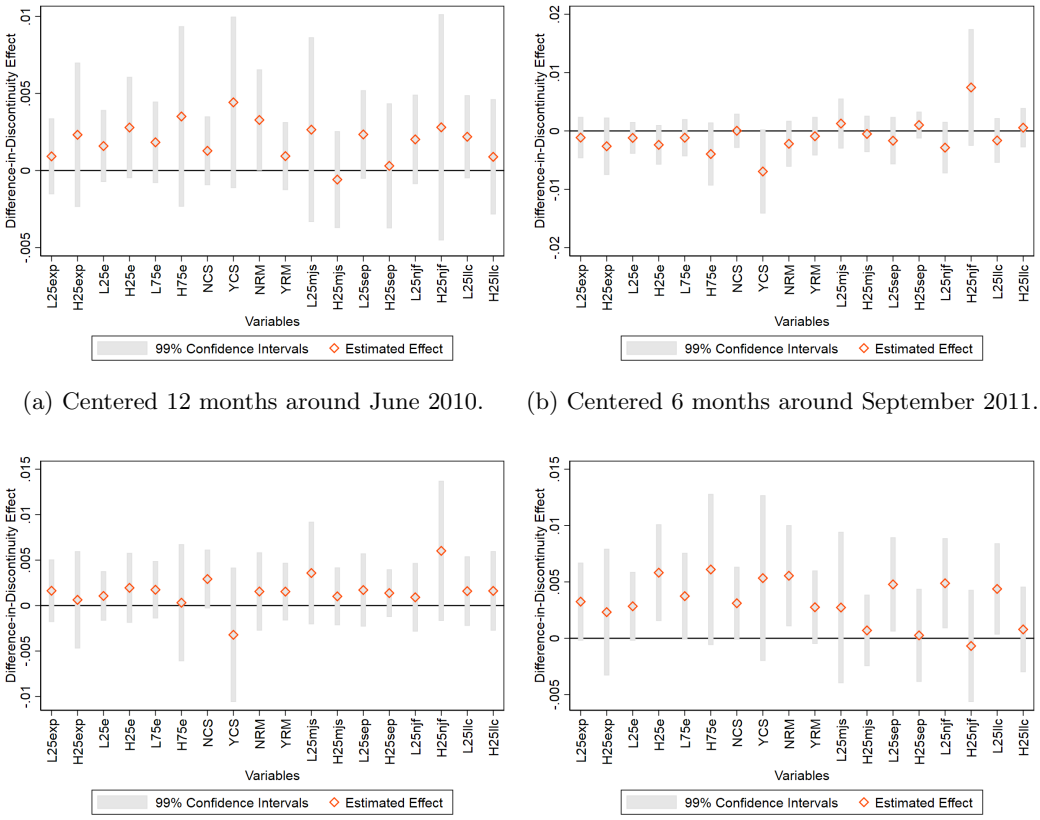
As a first robustness check, we centred data in ±24 months around June 2012, which allows us to estimate the difference-in-difference-in-discontinuity impact on vocational apprenticeship probability using a different month interval. We use the same linear probability model for vocational apprenticeship, controlling for potential mechanisms by adding one by one an interaction of being in this category with the difference-in-discontinuity interaction term. The results are in panel (b) of Figure 2. Estimates are very robust.

To further validate the approach, we also implement a set of placebo estimates on pairs of month intervals from the pre-reform period of 2009 to 2011. We carry out two of these placebo tests on data either centred ±6 months or ±8 months[9] around September 2011 when legislative decree no.167 took place. This legislative decree established nation-wide rules for the apprenticeship contract rather than regional regulations as ruled before the reform. We also centred data either ±12 or ±18 months around a placebo reform that took place in June 2010. Figure 3 presents estimates for the various pairs of months intervals: they are all very small and insignificant (with some few exceptions).

These graphs demonstrate that for almost all groups defined by each candidate mechanisms, individuals treated by the labour market reform at the age threshold have a higher vocational apprenticeship probability than similar untreated individuals. However, the difference-in-discontinuity diverges across groups. The reform is most relevant for those who are relatively not low educated, possibly, because it enhanced the commitment of training provision of vocational apprenticeships, and enforced the permanent nature of this contract. Those who started a new job in a month where job separations were high are unaffected by the reform at the age cut-off. For these groups, the difference-in-discontinuity impact is precisely zero. There is no evidence of a statistically significant difference-in-discontinuity effect for those who have more than a job in a month. Hence, this robust-reduced form analysis reproduces the same three stylised facts

[9]It is not possible to extend further the month interval without overlapping with the Fornero reform.

Figure 3: Placebo estimates on the difference-in-difference-in-discontinuity impacts.




(a) Centered 12 months around June 2010.

(b) Centered 6 months around September 2011.

(c) Centered 9 months around September 2011.

(d) Centered 18 months around June 2010.

*Notes:* H25sep stands for sitting at a percentile higher than the 25th of the age-and region of birth-specific distribution of the number of monthly job separations; H25llc stands for sitting at a percentile higher than the 25th of the age-specific distribution of benefits from labour costs reduction; H25mjs stands for sitting at a percentile higher than the 25th of the age-specific distribution of the number of multiple job episode in a month; L25e stands for sitting at a percentile lower than the 25th of the age-specific distribution of education; YRM stands for working in a region different from the region of birth; L75exp stands for sitting at a percentile lower than the 75th of the age-specific distribution of previous experience to the new job; NCS stands for no switching sector of activity; L75e stands for sitting at a percentile lower than the 75th of the age-specific distribution of education; L25njf stands for sitting at a percentile lower than the 25th of the age-and region of birth-specific distribution of the number of net job flows in a month; L25hs stands for sitting at a percentile higher than the 25th of the age-and region of birth-specific distribution of hiring incentives; L25llc stands for sitting at a percentile lower than the 25th of the age-specific distribution of benefits from labour costs reduction; L25sep stands for sitting at a percentile lower than the 25th of the age-and region of birth-specific distribution of the number of job separations in a month; H25njf stands for sitting at a percentile higher than the 25th of the age-and region of birth-specific distribution of the number of monthly net job flows; NRM stands for working in the region of birth; H75exp stands for sitting at a percentile higher than the 75th of the age-specific distribution of previous experience to the new job; YCS stands for switching sector of activity; H25e stands for sitting at a percentile higher than the 25th of the age-specific distribution of education; H75e stands for sitting at a percentile higher than the 75th of the age-specific distribution of education, and L25mjs stands for sitting at a percentile lower than the 25th of the age-specific distribution of the monthly number of job episode. The reported coefficient is the interaction of being below the age cut-off with a post-reform dummy and with a group dummy for each candidate mechanism keeping fixed all the other covariates. We add to these covariates, time (month and year), sector, region of birth and work fixed effects, polynomial of degree 1 in the firm identification code.

described above.

While the difference-in-difference-in-discontinuity impact on vocational apprenticeship probability is specific to this institutional context, this exercise serves to show that the combined features of the reform did indeed change the sorting into and screening in and out of jobs,

mechanisms that we can expect our model to replicate. We need to present a model for reasons of the impossibility to measure and directly test in the data the increase in the informative content of individual dismissals caused by the more flexible employment protection legislation introduced by the reform. The model will link the variation in the sorting into, and screening in and out of jobs, to a less strict employment protection legislation, and its implications can be generalised to all countries. Vocational apprenticeship is henceforth a training contract.

# 4 The model

## 4.1 The set up

This section presents a simple model on the relationship between the degree of substitutability of different types of labour contracts and employment protection legislation. The objective is to show how firms change their offer of training contracts to induce self-selection and perform subsequent screening of worker ability in the presence of a more flexible employment protection legislation. The model builds on Gibbons and Katz (1991) and Autor (2001). We discuss the similarities with these models below. The analysis on how the employment protection legislation affects the firm human capital provision and the substitutability between different types of labour contracts and its empirical implications, that are derived, tested and simulated are unique to the current model.

The model has three periods. Figures B1 and B2 in Appendix describe the timing of the events and the wage-setting games among the three periods. At the start of the first period, workers form two types of beliefs $b = H(high), L(low)$ about their ability based on an observed (i.e. the educational degree) and on a privately received signal. We assume that within the fraction of higher educated individuals, $\beta_h$, $\delta_{hh}$ is the portion of individuals with high-beliefs, while within the fraction $1 - \beta_h$, $\delta_{ll}$ is the portion of individuals with low-beliefs. These signals are (imperfectly) informative. A worker belonging to the $\beta_h$ category with high-beliefs $\delta_{hh}$ is more likely than the average worker in this category to be of ability $\eta_h$, required for a highly qualified job, and vice versa for low belief workers in this category. A worker belonging to the 1- $\beta_h$ category with low-beliefs $\delta_{ll}$ is less likely than the average worker in this category to be of ability $\eta_\tau$, required for a training contract, and vice versa for high belief workers in this category.

There are a large number of firms, some of which hire workers using training contracts, and some of which do not. Each firm offers a first-period wage. Since output is unobservable to prospective employers and so plausibly also to a court, firms cannot enforce labour contract contingent on it. Each worker then select to apply either at a highly qualified or non-highly

qualified job. In the latter case, the workers sort into a labour contract as either trainee or to other labour contracts. A training contract commits to provide on-the-job training, partly financed by the firm during the first period. Firms and workers matched by other labour contracts are not obligated to investing in human capital.[10] At this point, firms do not know the ability of any employee they have hired.

At the end of the first period, a fraction $\lambda$ of the workers quits for exogenous reasons, and a fraction $\mu$ leaves their first period firms voluntarily to enter the second-hand market. After observing a given worker's first-period output, the current employer let these workers quit by making a wage offer that is lower than wage offers from prospective employers. Another possible interpretation is that the first-period labour contract was temporary, and the current employer does not renew it or does not convert it into an open-ended contract. Once the second period arrives, firms which employ workers in non-highly-qualified jobs make lay-off decisions that depend on individuals' ability, as described below. In the second period, some workers could enter the second-hand market after being laid-off, the incumbent firm will retain some of them, and others will quit for either exogenous or endogenous reasons. A wage-setting game determines the fraction of voluntarily quitters. First, prospective employers observe that the worker was not laid-off by the first-period employer, and make a second-period wage offer. The current employer looks at these offers from prospective employers, and then makes its second-period wage offer to the worker. The worker accepts the highest of the wages offered (choosing the incumbent employer's proposal in case of a tie). At the beginning of the third period, all workers have open-ended contracts, and earnings equal their marginal productivity.

The first-period output of a worker of productive ability $\eta$ is $y_1 = \eta$. If the worker is not hired as trainee, the second and third period output of a worker of ability $\eta$ is $y_2(\eta) = \eta + s$ (where $s = s_1 + s_2$ and $s_1 > 0$, $s_2 > 0$) if the worker remains with the first-period employer but is $y_2(\eta) = \eta$ if the worker changes employer. If, instead, the individual is hired as trainee, the second and third period output of a worker of ability $\eta$ is $y_2(\eta|\tau) = \eta(1+\tau) + s_1 + s_2$ if the worker remains with the first-period employer but is $y_2(\eta|\tau) = \eta(1+\alpha\tau)$ if the worker changes employer. The parameter $\alpha$ is less than one if the trainee has been laid-off in the first period. The parameter $s_1$ can be interpreted as firm-specific human capital embedded by work experience, while $s_2$ measures a firing cost incurred by the first-period employer.[11] This parameter measures both monetary firing costs, but also opportunity costs of firings. We simplify the model assuming a

[10] For simplicity sake, we assume that, at job entry, firms provide general skills training only to workers hired using training contracts.

[11] We follow Gibbons and Katz (1991) in the interpretation of the parameters $s_1$ and $s_2$. However, differently from them, we distinguish the role played by the firing cost and the firm-specific human capital.

homogeneous $s_2$ for two reasons. First, its heterogeneity across periods and type of contracts does not impact on the main mechanisms of the model. Second, in reality, firing costs vary across employee tenure. The discrete structure of the model could not account for this empirical fact. As in Autor (2001) the multiplicative specification of the production function conditioned on-the-job training implies that ability and general skills training (inside and outside the firm) are complements.

The cost for each trainee is $c(\tau)$, which is incurred by the firm. This cost function is assumed to be everywhere strictly increasing, convex and differentiable. Each trainee pays a fixed cost equal to $K$.

As in Gibbons and Katz (1991), at the beginning of the first period, information is symmetric but imperfect. There is common knowledge of the distribution of worker ability, but neither firms nor workers know the ability level of any individual in the first period. We assume a probability distribution $F(\eta)$ on $(\eta_{MIN}, \eta_{MAX})$ with density $f(\eta)$. Besides, the density function is log-concave which implies that $\frac{d(E(\eta|\eta \geq x)}{dx} < 1$.

At the start of the first period, each worker and firm receive an observable imperfectly informative signal of his or her ability, the education degree. Worker's productive abilities and general skills and competencies acquired at school are complements. Then, the productive abilities of the fraction $\beta_h$ of individuals with the higher education degree distributes according to $F(\eta)$ on $(\eta_{minh}, \eta_{MAX})$. The abilities of the remaining fraction $1 - \beta_h$ distribute, instead, on $(\eta_{MIN}, \eta_{maxl})$, where $\eta_{minh} < \eta_{maxl}$.[12]

At the end of the first period, the worker's current employer looks at the worker's first-period output and so infers his/her ability. The training provision strengthens further the screening process of the firm that relies on what observed. Prospective employers instead do not examine output and so do not (yet) update their beliefs about the worker's ability except when a worker is laid-off. The amount of training given to each trainee is public knowledge. Therefore, second-hand wage may depend upon training received. In the third period, each worker's ability is common knowledge.

Depending on parameter values, the model has a continuum of equilibria. The equilibrium of empirical relevance, analysed below, is a separating equilibrium in which firms screen worker based on their ability and workers with intermediate levels of ability self-select into training contracts. After deriving the conditions for this separating equilibrium, we explore how a change in the employment protection legislation modifies the process of screening in and out, and sorting into types of contracts to formalise the intuition given at the introduction: a more flexible

[12] We provide further details on these ability distributions in Appendix B3.

employment protection legislation increases the range of ability of individuals hired as trainees. As a consequence, a reform of the employment protection legislation that encourages the usage of a training contract changes the substitutability of different types of labour contracts.

### 4.2 Separating equilibrium

We use the following notation to describe the players' (pure) strategies. Let D(i) represent the observational signal of an individual of ability $\eta$: $D(\eta) = 1$ if the worker has a higher education degree (i.e. a university degree); $D(\eta) = 0$ if the worker has not such degree. As discussed above, the proportion of those who have $D(\eta) = 1$ is observed and equal to $\beta_h$. Let $w_1(D, b, Q)$ denote the wage offer made by the firm to the worker who according to his/her beliefs, b, and educational degree, D, apply for either a highly qualified ($Q = 1$) or non-highly-qualified jobs ($Q = 0$, either as a trainee or not). Let A(i) represent the worker's decision to enter into the labour market as trainee given the package offered by the firm, his/her ability $\eta$ and his/her beliefs $b$: $A(\eta,\ b)= 1$ if the firm hires the worker as trainee; $A(\eta,b)= 0$ if he/she does not. Following Gibbons and Katz (1991), let L($\eta$) represent the firm's lay-off decision for a worker of ability $\eta$: $L(\eta)= 1$ if the current employer lays off a worker with ability $\eta$; $L(\eta)= 0$ if the firm does not lay off such a worker. Let $w_2(L, A)$ denote the wage offer made by the second-hand market if the current employer lays off a worker hired with labour contract $A$; let $w_2(R, A)$ denote the analogous offer if the firm does not lay off the worker. To construct the necessary conditions for a separating equilibrium in the model, we work backwards from the third (final) period. Since worker ability and training provided by the training contract are common knowledge in the third period, third-period firms set wages competitively:

$$w_3 = \eta_i(1 + \alpha\tau_i) \tag{2}$$

If the hiring was not under a training contract, $\tau$ is equal to zero.

In general, to retain workers in the second period, incumbent firms must pay them at least what they can earn in the second-hand market. Therefore, we first compute the firm's optimal wage offer to a worker it did not lay off, given the worker's ability, the wage offers made by prospective employers and worker's job $(Q_i, A_i)$. We then determine the market's optimal wage offer to a worker who was not laid-off, given that the firm's subsequent proposal will be the best response just derived, and given the market's conjecture about the lay-off rule used by the firm. (i.e. wages offered to separators, who were not laid-off, set the second-period wages). Finally, we assess the firm's optimal lay-off rule, given that the subsequent wage offers will be the

best responses just derived. We then set the worker's optimal sorting behaviour into job entry, given that the sub-sequent wage offers will be the best responses derived. In equilibrium, the market's conjecture must be identical to the corresponding decision taken by firms (lay-off rule) and workers (sorting into highly-qualified jobs, training contracts or other job qualifications.) We will discuss separately the nodes related to highly- and non-highly-qualified jobs leaving to the end the final discussion that the worker's sorting rule into job entry is the best response given the subsequent wage offers derived in the following sub-sections.

#### 4.2.1 Non-highly qualified jobs.

Consider a worker who was not laid-off after entering into the labour market in a non-highly qualified job and who was not a trainee. Let $w_{2,m}(R=1,A=0)$ denote the wage offer from the market. If the worker's ability satisfies $\eta + s \geq w_{2,m}$ the firm's best response is to offer the market wage to keep the worker for the second period. At the end of period 1, however, a fraction $\lambda$ of firm's workers are exogenously constrained to move. If, instead, the worker's ability satisfies $\eta + s < w_{2,m,A=0}$, the firm's best response is to offer less than the market wage, in which case the worker will also separate endogenously to pool with the exogenous departures. Let define $\psi$ the fraction of endogenous quitters. In equilibrium, prospective employers anticipate that the firm will play the best response just determined. To calculate their optimal wage offers, prospective employers must also have a conjecture about the lay-off rule used by the firm and the sorting rule used by the workers. In fact, at the separating equilibrium, the worker pool is composed exclusively of workers with ability level equal to or less than $\eta_{\tau m}$ (i.e. for higher ability levels workers sort into training contracts) who are not higher educated. Moreover, prospective employers believe that the firm lays off a worker if and only if the worker's ability is less than some cut-off, $\eta_R$. Accordingly, each worker receives the second-hand market wage offer that is equal to the expected productivity of the entire pool:

$$w_{2,m,A=0,L=0} = \frac{\lambda}{\lambda+\psi} E(\eta|\eta_R \leq \eta_i < \eta_{\tau m}) + \frac{\psi}{\lambda+\psi} E(\eta|\eta_R \leq \eta_i < w_{2,m,A=0} - s) \qquad (3)$$

where $\psi$ corresponds to $prob[\eta_i + s < w_{2,m,A=0} | \eta_R \leq \eta_i]$

At the separating equilibrium, the firm anticipates that the subsequent market wage offer will correspond to equation 3 and it will find it unprofitable to retain a worker of ability satisfying $\eta_i + s < w_{2,m,A=0,L=0}$. As a result, it offers the worker less than the market wage to let him/her quit. Thus, the firm's optimal lay-off rules is to lay-off individuals with ability level less than

$\eta_R$ and to induce the worker to quit if $\eta_R \leq \eta_i < w_{2,m,A=0,L=0} - s$. If the firm adopts this rule, then the market's conjecture is correct.

As in Gibbons and Katz (1991), a necessary condition to construct this separating equilibrium is $\eta_R + s < w_{2,m,A=0,L=0}$. This is because otherwise the incumbent firm will retain also workers with ability level $\eta_R$. Following Gibbons and Katz (1991), this condition holds provided that $\eta_R \leq \eta_1^*$ where $\eta_1^*$ is the unique solution to $\eta_1^* + s = E(\eta|\eta_1^* \leq \eta_i \leq \eta_{\tau m})$

Moreover, the incumbent firm's informational advantage about worker ability depresses outside wages, (Gibbons and Katz 1991, Autor 2001) for reasons of adverse selection characterising the second-hand pool of workers. If workers could not be laid-off, prospective buyers cannot distinguish individual ability, and individual workers cannot credibly signal to be exogenous separators. As a result, this informational advantage generates firm's limited monopsony power over-retained workers who are paid strictly below their actual productivity. The expected productivity of workers in the second-hand market is strictly below the productivity of the average worker with ability level between $\eta_R$ and $\eta_{\tau m}$. This ability range belongs to retained workers in a non-highly qualified job, as determined by the firm's lay-off rule and the minimum ability level required to hirings as a trainee.

At the separating equilibrium, the pool of workers who do not enter into the labour market as trainees is composed exclusively of workers, among those without higher education with low-beliefs, whom ability level ranges from $\eta_{min}$ to $\eta_{\tau m}$. It is too costly in terms of both effort and wage losses for them to enter into the labour market as trainees. Firms anticipate this individuals' selection process, and consequently, the first-period wage in non-highly-qualified jobs is equal to the expected productivity:

$$w_{1,m,A=0} = (1 - \beta_h)\delta_{ll} E(\eta|\eta_i < \eta_{\tau m}) \tag{4}$$

If a firm lays off a worker not hired as a trainee, and if market correctly conjectures that this firm lays off a worker if and only if the worker's ability is less than $\eta_R$, then second-period re-employment wage of a laid-off worker will be:

$$w_{2,m,A=0,L=1} = E(\eta|\eta_i < \eta_R) \tag{5}$$

#### 4.2.2 Training contracts

Similar behavioural responses are assumed when the worker is hired as trainee and he/she is not laid-off. Then, at the end of period 1, if the worker's ability satisfies $\eta + s \geq w_{2,m,A=1,L=0}$

the firm's best response is to offer the market wage, $w_{2,m,A=1,L=0}$, to employ the worker for the second period. All the other hired trainees who have an ability level that do not satisfy this condition are induced to endogenously quit. Let define $\phi$ the fraction of these quitters. As above, however, a fraction $\lambda$ of firm's workers separates for exogenous reasons. Then, the second-hand market wage offer amounts to the expected productivity of the worker pool who sorts into training contracts:

$$w_{2,m,A=1,L=0} = (1+\bar{\tau})\left(\frac{\lambda}{\lambda+\phi}E(\eta|\eta_\tau \leq \eta_i < \eta_h) + \frac{\phi}{\lambda+\phi}E(\eta|\eta_\tau \leq \eta_i < w_{m2}-s)\right) \quad (6)$$

where $\phi$ corresponds to $prob[\eta_i + s < w_{2,m,A=1,L=0}|\eta_\tau \leq \eta_i]$ and $\bar{\tau}$ is the expected amount of training of separators.

At the separating equilibrium, individuals whose ability level is higher than $\eta_{\tau m}$ compose the pool of workers who enter as trainees. At the beginning of period 1, individuals do not observe their ability but form expectation on this based on the signals privately received (beliefs) and publicly-observed (the education degree). Those who sort into training contracts have high-beliefs among the pool of individuals without higher education $(1-\beta_h)(1-\delta_{ll})$ and low-beliefs among the pool of individuals with the higher-education $\beta_h(1-\delta_{hh})$. The individual's ability level could be below the cut-off $\eta_\tau$ required by the firm to invest more in the worker's human capital and retain him/her for reasons of training costs $c(\tau)$ incurred by the firm. The cost function is assumed to be everywhere strictly increasing, convex and differentiable with $c(0)=0$, $c'>0$ and $c''>0$. As in Autor (2001), this cost structure ensures that some training is socially optimal for high ability workers. The optimal amount of training is a function of individual ability. Then, we assume that the expected amount of training of those who quit the firm is a fraction of the optimal amount of training of those retained.

Thus, the firm's lay-off rule for trainees is to lay-off a worker if her/his ability level is below $\eta_\tau$. Then, if prospective employers correctly guess the firm's lay-off rule, the second period re-employment wage of a laid-off trainee is:

$$w_{2,m,A=1,L=1} = (1+\alpha\tau)E(\eta|\eta_{\tau m} \leq \eta_i < \eta_\tau) \quad (7)$$

$\alpha$ is strictly below one and corresponds to the share of training received by the workers before being laid-off. The amount of training $\alpha\tau$ given to each worker is public knowledge.

Finally, since firms anticipate the individuals' sorting into training contracts, the first period wage for those hired as trainees is equal to the expected ability of trainees less the implicit cost

of this labour contract $K$:

$$w_{1,m,A=1} = (1-\beta_h)(1-\delta_{ll})E(\eta|\eta_{\tau m} < \eta_i \leq \eta_{maxl}) + \beta_h(1-\delta_{hh})E(\eta|\eta_i \geq \eta_{minh}) - K \quad (8)$$

#### 4.2.3 Highly-qualified jobs

Both public and private observable signals are informative. As a consequence, the ability level of those who sort into a highly qualified job is higher than the ability level $\eta_\tau$ below which the firm would laid-off the worker. Then, in this portion of the labour market workers are not laid-off. Nevertheless, among the high belief individuals who self-select themselves into these jobs, the firm let a fraction $\mu$ go since for them $prob[\eta_i + s < w_{2,m,Q=1}]$. A fraction $\lambda$ instead separates for exogenous reasons.

$$w_{2,m,Q=1} = \frac{\lambda}{\lambda+\mu}E(\eta|\eta_i \geq \eta_h) + \frac{\mu}{\lambda+\mu}E(\eta|\eta_{minh} \leq \eta_i < \eta_h) \quad (9)$$

where $\eta_h$ is the minimum level of ability for which is profitable for the incumbent firm to retain a worker in a highly qualified job. There exists an $\eta_h^*$ that is the solution to $\eta_h^* + s = E(\eta|\eta_h^* \geq \eta_i \geq \eta_h)$. Finally, market conjectures on workers' sorting are correct only if $\eta_{maxl} \leq \eta_h$ otherwise it would be profitable to hire in a highly qualified job position also those who have not got the higher education qualification but have the highest ability levels.[13] Then, if the higher education degree is an informative signal, individuals who sort into the highly-qualified jobs belong to the pool of those with high-belief and the higher education degree. The first-period wage for those hired in highly-qualified jobs is equal to the expected ability of those who belong to this pool:

$$w_{2,m,Q=1} = \beta_h\delta_{hh}E(\eta|\eta_i \geq \eta_{minh}) \quad (10)$$

#### 4.2.4 Main implications of the model

This model has several implications in terms of the worker and firm behaviour. The worker sorting into jobs, the employer screening in and out employees, the human capital investment decision, all depend on the employment protection legislation. As in Autor (2001) and Gibbons and Katz (1991), adverse selection characterises the second-hand pools of workers, who are not laid-off. These pools are a mixture of exogenous and endogenous departures. For instance, this amounts to saying that the expected productivity of trainees in the second-hand market is strictly

[13] In the simulation exercise we will assume $\eta_{maxl} < \eta_h$.

below the productivity of the average trainee. Prospective buyers cannot distinguish individual ability, and individual workers cannot credibly communicate the reason they separated from their first-period firm. Hence, the second-hand market offers each worker the expected productivity of the entire adverse selected pool.

The main new result of this paper is that a reform of the employment protection legislation that increases the informative content of individual lay-off affects the sorting into and the screening in and out process of jobs. In doing so, it changes the type of labour contracts composition of the workforce for two reasons. First, the employment protection legislation, through the parameter $s_2$ that measures the monetary and opportunity costs of firings, differently impact on the informative content of the lay off rule (i.e. it affects the wage offers). Second, it directly impacts on the threshold ability level, for instance, $\eta_1^*$, that determines who is screened out (i.e. letting him/her endogenously quit) by the incumbent firm. We turn next to a simulation of the model that displays this result.

# 5 Simulation of the model

We start by assuming that individuals' ability follows a gamma distribution, i.e. $\eta \sim \Gamma(\xi)$ whose probability density function is equal to:

$$f(\eta) = \frac{(\frac{\eta-\theta}{\chi})^{\gamma-1} exp(-\frac{\eta-\theta}{\chi})}{\chi\Gamma(\xi))} \tag{11}$$

where $\theta$ is the location parameter and $\eta \geq \theta$; $\xi > 0$ is the shape parameter and $\chi > 0$ is the scale parameter.

As benchmark, we generate the gamma distribution of 1000000 individuals' ability by setting $\xi = 50$, $\chi = 0.1$ and $\theta = 6$. Table 2 displays how the relevant parameters of the model are fixed at the baseline:

Table 2: Baseline parameters and endogenous percentiles of the ability distribution

| | **Percentiles of the ability distribution** | | | | | **Parameters** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\eta_R$ | $\eta_{\tau m}$ | $\eta_\tau$ | $\eta_{minh}$ | $\eta_h$ | $\delta_{ll}$ | $\delta_{hh}$ | $\beta_h$ | K | $\alpha$ | $\gamma$ | $\lambda$ |
| Fixed at | $p_5$ | $p_{10}$ | $p_{16}$ | $p_{65}$ | $p_{87}$ | 0.129 | 0.86 | 0.3 | 9.3 | 0.2 | 0.08 | 0.15 |

*Notes:* $p_j$ means the jth percentiles of the ability distribution.

The parameter $\gamma$ belongs to the training costs function, that we assume equal to $c(\tau) = \frac{\tau^2}{\gamma}$.

This parameter configuration ensures the existence of a separating equilibrium. We will provide a robustness check based on shape and scale parameters estimated by maximum

likelihood on Programme for the International Assessment of Adult Competencies (PIAAC, OECD) data for Italy. The value of $\beta$ corresponds to the percentage (34.3%) of higher educated individuals at age 25 in the academic year 2008-2009 (Italian Office for National Statistics data). These are the cohorts of individuals who reached the threshold age in 2012 in our reduced-form analysis. The proportion of high- and low-beliefs workers are roughly symmetrical in the category of with and without higher education employees. A value of $\alpha$ equal to 0.2 amounts to about 7.2 months of on-the-job training. Six months is the minimum training period in the vocational apprenticeship contract in Italy, and three years is the maximum amount (excluding some exceptions).[14] The value of the exogenous job separation rate seems to resemble more the corresponding value for the US. Usually, in its calibration for European countries, it is smaller, about 0.04, which is consistent with an unemployment rate of 10% and a quarterly job finding rate of 0.25 (see, for instance, Tesfaelassie and Wolters (2018)). We carry-out our robustness check simulation using both values for the parameter $\lambda$ and obtaining the same results. Finally, we set the implicit cost of training contracts $K$ to match a 0.35% of the ability distribution. This high implicit costs serve for achieving a separating equilibrium where both bottom-and top coded individuals sort into a labour contract different from a training contract.

### 5.1 Do firms change their hiring and firing rule? Does the optimal level of firm provision of training increase? Endogenising the percentile of the ability distribution to enter into training contracts

As a first simulation exercise, we endogenise the percentile of the individuals' ability distribution over which firms induce workers to sort into training contracts to screen them in and out. We can separate the values of $\eta_{\tau m}$ (i.e. minimum ability level to enter into training contracts) from $\eta_{\tau}$ (i.e. minimum ability level to retain a trainee in the incumbent firm) if and only if firing costs are low. In general, if firing costs increase the probability to have a parameter configuration associated to a separating equilibrium reduces. We consider then all the parameters reported in Table 2 to which we add the lowest value of $s = 0.1$.[15] We fix a convergence criterion (0.0001) to the difference between the earning histories under the two main alternatives that the individual faces based on the employment-earnings package offered him/her by the firm. In other words, the life-time earnings of the worker with the lowest ability level to self-select into training contracts, (i.e. $\eta_{\tau m}$), have to be at least equal to those of the worker with ability ($\eta_{\tau m}$-$\epsilon$) who, instead, sorts into a non-qualified job.[16] This condition is consistent with market beliefs that those with

[14] Six months also correspond to the highest length of the probationary period in open-ended contracts.
[15] For the sake of simplicity, we assume $s = s_2$ (i.e. $s_1 = 0$).
[16] We assume $\epsilon \to 0$ and amounting to the convergence criterion.

ability lower than $\eta_{\tau m}$ do not sort into the labour market as trainees.

Similarly, we determine the percentile $\eta_\tau$ by equalising the earnings histories of the highest ability individual, who started as a trainee, (i.e. $\eta_h$-$\epsilon$) to the earnings histories in a highly-qualified occupation of an individual with ability level ($\eta_h$) which, in this simulation exercise, corresponds to the $87th$ percentile. A natural interpretation of this percentile is that it is higher than (or equal to) the maximum ability level of those without higher education $\eta_{maxl}$.

Table 3 summarises the results.

Table 3: Endogenous percentiles of the ability distribution, firing costs and optimal amount of training of marginal workers retained by the firm.

| | **Endogenous percentiles** | | **Optimal training at $\eta_\tau$** |
|---|---|---|---|
| $s$ | $\eta_{\tau m}$ | $\eta_\tau$ | $\tau$ |
| 0.1 | $p_{11}$ | $p_{23}$ | 0.197 |
| 0.2 | $p_{16}$ | $p_{16}$ | 0.193 |
| 0.3 | $p_{23}$ | $p_{23}$ | 0.198 |
| 0.4 | $p_{32}$ | $p_{32}$ | 0.210 |

*Notes:* $p_j$ means the jth percentiles of the ability distribution.

As in Gibbons and Katz (1991) these percentiles of the ability distribution are determined endogenously by the firm's lay-off decisions. They depend on the employment protection legislation through two mechanisms. First, in the presence of strict employment protection legislation, the second-hand market cannot infer the firm lay-off rule (for instance, firms dismiss individuals with ability level lower than $\eta_R$). Second, the institutional setting fixes the firing cost $s_2$ and then contributes to determine $s$. Even when the employment protection legislation is strict, firm turnover is not zero but mainly takes the form of endogenous quits. Consider, for instance, the interpretation of endogenous quits as temporary contracts that are not renewed or not converted into open-ended contracts. The stricter the employment protection legislation is, the higher the number of these non-renewed fixed-term contracts.[17]

Employment protection legislation affects not only firms hiring policies but also their firing policies. Its variation impacts on the firms' screening out process by modifying the firm's lay-off rule and the proportion of those who endogenously quit for reasons of $\eta_1^*$ and $\eta_h^*$ decreasing with s. As shown by Gibbons and Katz (1991), it stems from implicit differentiation of $\eta_1^* + s = E(\eta|\eta_1^* \leq \eta_i \leq \eta_{\tau m})$ using the assumption of log concavity of the ability distribution function. In the limits, $\eta_1^*$ approaches the upper limit $\eta_{\tau m}$ as s approaches zero.[18]

Table 3 also shows that as firing costs increase the difference between $\eta_{\tau m}$ and $\eta_\tau$ converges

[17]Gibbons and Katz (1991) argue that even if $\lambda$ is arbitrarily small, there exist equilibria in which turnover does not vanish.

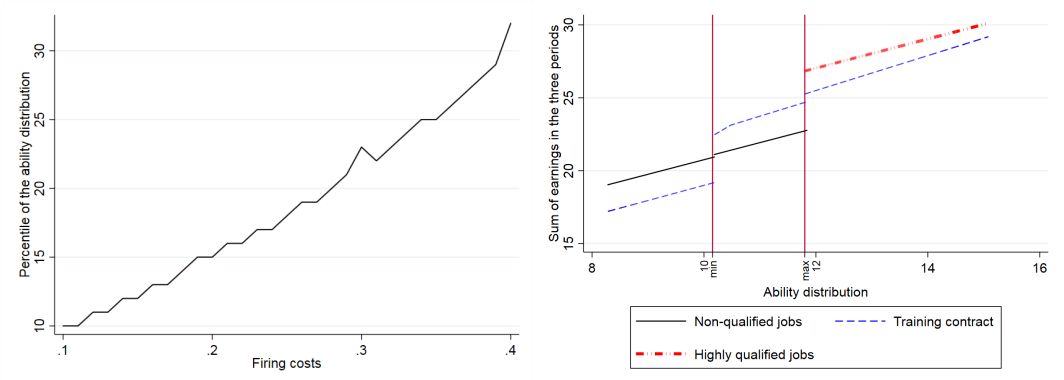
[18]See Appendix B4 for more details on the characterisation of the separating equilibrium.

to zero.[19] The optimal amount of training equalises firms' marginal costs and benefits, and varies with the employee ability. The last column of Table 3 displays that if the ability level of the marginal worker (i.e. $\eta_\tau$) increases as firing costs rise, the optimal amount of training to this marginal worker increases as well. When the parameter s increase from 0.1 to 0.2, the firm retains all individuals hired as trainees. This lock-in effect decreases $\eta_\tau$, also lowering the optimal amount of training to the marginal worker with this ability level. From $s_2 > 0.2$ onwards, when firing costs are higher, the job flows into training contracts are smaller, but the average ability in the pool of trainees is higher.

### 5.2 Do these labour demand adjustments affect life cycle earnings profiles of employees? Do workers sort into job differently? Do more individuals sort into training contracts?

Starting from the baseline scenario, we now simulate how the ability range ($\eta_{\tau m} - \eta_{maxl}$ ($\eta_h$)), that drives how firm induce individuals to self-select into labour contract to improve their screening on worker abilities, changes over different levels of firing costs. Since $\eta_{maxl}$ is exogenously given, this exercise amounts to analyse how the minimum ability level to enter into a training contract, $\eta_{\tau m}$, varies with the level of firing costs. We set the lowest level of $s$ equal to 0.1 to which we add 0.01 at each iteration of the model simulation.

Figure 4 illustrates the main result of this simulation.




(a) Changes in firing costs.

(b) Cumulated earnings profile.

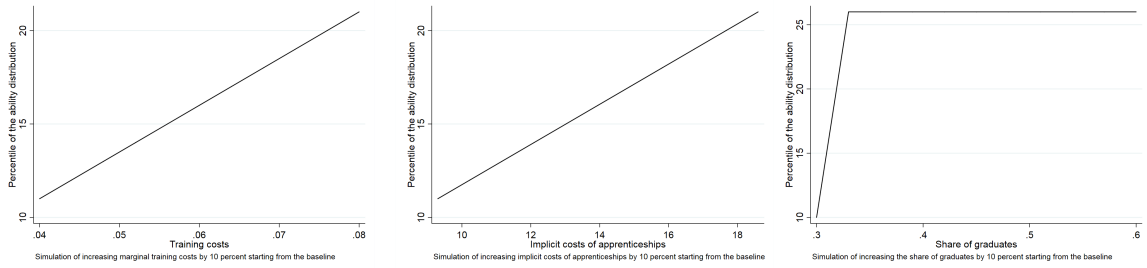
Figure 4: Sorting into training contracts and employment protection legislation.

By inducing sorting of workers with an ability level higher than a certain threshold, training contracts improve the firm's worker pool. By revealing private information about worker ability, training contracts then allow the firm to profit from this pool. These two roles interact with the

[19] When firing costs are high, we cannot determine with the same rate of convergence the marginal values of the percentiles of the ability distribution implying that high firing costs sensibly weaken the informational content of the sorting and screening processes.

employment protection legislation regime. Panel (a) of Figure 4 shows a positive relationship between firing costs and the percentile of the ability distribution that sets the threshold above which workers sort into training contracts. This finding is consistent with Table 3. A firing costs reduction lowers the corresponding ability threshold level and hence increases the ability range over which individuals enter into a job position as trainees. Although employers incur training costs upfront in the first period, in the second period they retain workers whose ability is equal or strictly higher than the ability threshold required to equalised marginal costs and benefits of the training during the first period. Hence, incumbent firms capitalise on their informational advantage about ability developed through training and need only pay workers a wage strictly below their actual productivity. While training employers recognise worker's skills, firms in the second-hand market do not. Firm's discretion on dismissals creates the Greenwald (1986) and Gibbons and Katz (1991)'s insight framework that incumbent firms' informational advantage about worker ability generates adverse selection in the second-hand market, thereby depressing outside wages. This process generates incumbent firm rents that are higher in the presence of training because of the complementarities between training and abilities. Panel (b) of Figure 4 displays the cumulated earnings profile over the ability distribution simulated using the lowest value of $s$, 0.1. A relevant result of the information structure visible from Figure 4 is that only workers with ability levels between $\eta_{\tau m}$ $(min)$ and $\eta_h$ $(max)$ would sort into training contracts. At a separating equilibrium, the expected period three wage gain for trainees with ability level between $\eta_{\tau m}$ $(min)$ and $\eta_h$ offsets at a minimum their training wage penalty in period two and one, while for lower and higher ability workers it does not. Although all workers with ability lower than $\eta_h$ would forgo some earnings to receive training, workers with ability level just higher than $\eta_{\tau m}$ will forgo proportionally more because their expected period three gains more than compensate the wage loss. Hence, they would self-select to receive training because of the complementarity between training and ability. Complementarities between training and skills have a positive effect on lifetime earnings, but the wage penalties of having a training contract impact negatively on it. As the worker ability increases, the difference between the wage gains and losses reduces because the negative effect increases more than the positive one due to the log-concavity of the density function. Hence, individuals with ability level higher than $\eta_h$ sort into highly-qualified jobs giving up the wage gain due to the complementarities between training and abilities. If the implicit costs of the training contract were not high enough, all individuals would sort into training contracts. We will come back to this issue in the robustness analysis.

If training and ability were not complements, a separating equilibrium would be infeasible. If, however, firms did not acquire private information about trainee ability, as Becker (1962) argued,




(a) Cost of training. (b) Implicit cost of the contract. (c) Share of graduate students.

Figure 5: Sorting into training contracts and other model parameters

employers would not hire trainees because each trainee would receive his marginal product after training in the first period. The on-the-job training provided during the first period increases trainees' productivity by more than it increases their period two wages. This result follows from the fact that in period two, it is not productivity that sets wages at training firms but rather the degree of adverse selection in the outside market. How this occurs depends on the employment protection legislation regime.

The separating equilibrium is not satisfied at all parameter values. The lower the firm's discretion on dismissals (i.e. the higher the degree of employment protection legislation), the lower the influence of the adverse selection on second-period wages. To the best of our knowledge, this feature of the model is new to the literature. A reform of the employment protection legislation that increases the firm's discretion on lay-off increases the ability range over which individuals would sort into training contracts and reinforces the screening-in and out process of the firms that lead to firms sponsored training even if the skills provided are general.

### 5.3 The role of other parameters of the model

The percentile of the ability distribution to self-select into training contract depends on other parameters, such as the cost of training, $\gamma$, the implicit costs of the training contract $K$ and the share of graduates $\beta$ in the population. Figure 5 displays how these parameters affect the screening and the sorting into these contracts. An increase in both $K$ and $\gamma$ reduces the range of individual's abilities that drives individuals sorting into training contracts. The minimum percentile $\eta_{\tau m}$ increases linearly with both of them. However, the mechanisms differ. When the implicit costs increase, it is too costly to sort into training contracts for a larger fraction of low ability individuals. Employer burden the costs of training instead. When they increase, the firm reacts by rising in the second period the lay-off rate of trainees and then lowering the expected life-cycle earnings of marginal workers. Hence, these marginal workers self-select into

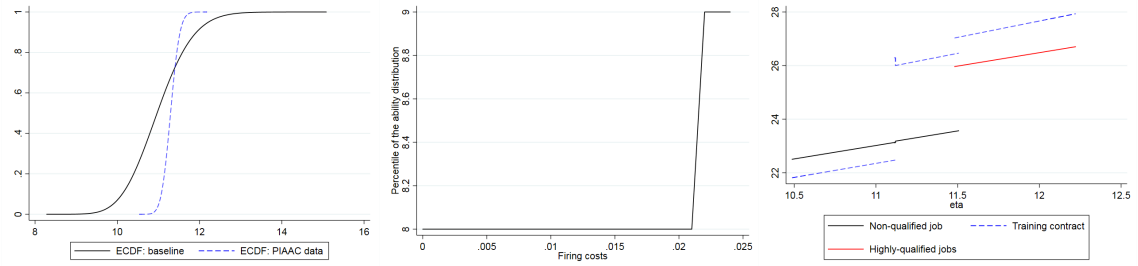
non-qualified jobs.

An increase in the share of graduates in the population has two counterbalancing effects on the expected life-cycle earnings of trainees. On the one hand, it reduces them by increasing the fraction of high skilled who enter into the labour market in high-qualified job positions. On the other, it raises the fraction of low belief graduates who enter as trainees leading to a rise in individuals' abilities in the pool of trainees. Figure 5 shows that when the share of graduates starts increasing from the baseline value, the latter effect dominates the former. Then the two mechanisms balance out. In such a case, the $\eta_{\tau m}$ percentile is constant and independent of the share of graduates.

### 5.4 Robustness Analysis

The primary simulation analysis uses a parameter configuration that ensures the existence of a separating equilibrium. In what follows, we take the first wave of the OECD PIAAC data for Italy to estimate by maximum likelihood the shape and the scale of the gamma distribution. These survey data gather information on adults' proficiency in literacy, numeracy and problem-solving. We devote our attention to the log of the literacy index (variable pvlit1 in the survey). We start by selecting the 893 individuals in the age range between 25 and 35, and deleting all the other 3721 adults. The maximum likelihood estimates indicate that the shape and scale parameters are equal to 882.78 and 0.006, and they are both statistically different from zero. So the estimated value of the shape is much higher than our baseline value, while it is slightly smaller for the scale parameter. If PIAAC data are capturing the unobservable ability distribution of young adults in Italy, this distribution is more compressed than our baseline one (panel (a) of Figure 6). With this degree of compression, we have to set the firing costs at a maximum value of 0.025 to endogenise the percentile of the ability distribution to sort into training contracts. We re-run our simulation, using these values for the gamma distribution and keeping constant all the other parameters but the measure of the implicit cost of the training contract $K$. We have to lower it at 8.1 to be able to determine the endogenous value of the percentile of the ability distribution to self-select into training contracts.

Panel (b) of Figure 6 shows that when we reduce firing costs, the percentile of the ability distribution to self-select into training contracts reduces confirming the positive relationship between these two variables. In this case, however, it never gets below the value of 8. The combination of this compressed ability distribution and lower implicit costs of training contracts, induce all workers with ability level above the threshold to self-select into them because of the complementarities between training and skills (panel (c) of Figure 6). Wage losses never




(a) Cumulative distribution functions. (b) Changes in firing costs. (c) Cumulated earnings profile.

Figure 6: Sorting into training contracts and employment protection legislation.

overcome wage gains from training in this simulation exercise but for individuals with a low ability level. In Appendix B5, we show that this robustness analysis is consistent with our baseline case also when we look at the impact on the percentile of the ability distribution to self-select into training contracts of the other relevant model parameters.[20]

## 6 Conclusions

Employment protection legislation that influences employment decisions may change individual careers by affecting the accumulation of human capital as well as wage offers. How and if employment protection legislation impact on individuals' sorting into jobs and firms' screening in and out jobs requires to take these features into account. In this paper, we use a reform implemented in Italy in 2012 - the Fornero reform - that caused sudden and heterogeneous change in the degree of substitutability between training (vocational apprenticeships) and temporary contracts. We assign individuals to the percentile of the distribution of some observed characteristics that may act as sources of this heterogeneity such as individual education, the number of monthly job episode, and the number of job separations in a month. For instance, we can then verify if the increase of the apprenticeship probability of treated cohorts at the age cut-off, compared to the corresponding figure for similar untreated individuals, differ across the age-specific education distribution. We design this difference-in-difference-in-discontinuity reduced-form model to provide three robust stylised facts. First, training contracts are costly. Not all individuals sort into them, or not all firms offer them to all individuals. Second, expected production opportunities might not be short-term to offer these contracts. Third, there are complementarities between former education and current on-the-job training. Hence, leveraging on quasi-experimental variation generated by this reform, we argue that it changes both the

[20] Available upon request from the author is the replication of this robustness analysis using an exogenous separation rate equal to 0.04 rather than 0.15. Nothing changes to the mechanisms underlined in this Section.

individual's sorting into jobs and firms' screening them in and out. In part, this is because of the more flexible employment protection legislation regime that increases the informative content of individuals' dismissals. In part, this is because this reform combines more flexible employment protection legislation with incentives to use training contracts rather than temporary contracts to screen in and out workers.

To fully explain the relationship between the change in the employment protection legislation and the substitutability of different type of labour contracts, this robust reduced form analysis cannot be enough for two reasons. First, we cannot find an observable measure of the informative content of individual dismissals. Second, the percentile of the ability distribution that leads to sorting into training contracts is also unobservable. We then develop a simple model on the relationship between the degree of substitutability of different types of labour contracts and employment protection legislation. The model shows how firms change their offer of a training contract to induce self-selection and perform subsequent screening of worker ability in the presence of a more flexible employment protection legislation. As a result of the individual's sorting and firms' screening, the degree of substitutability between different types of labour contracts changes.

We simulate this model to endogenise the percentile of the individuals' ability distribution over which workers sort into jobs and firms screen them in and out. The results are informative about the degree of substitutability between different types of labour contracts within and across firms. Although we do not explicitly model the endogenous creation of temporary contracts, we also interpret the endogenous quitting of the individuals as the end of a temporary contract without renewal. A more flexible employment protection legislation encourages individuals' sorting into training contracts lowering the percentile of the ability distribution for which is convenient to sort into these jobs. Life-time earnings profiles of these individuals are higher if they exchange a lower initial wage, to partly finance the human capital investment, for higher future earnings. Hence, some individuals, in the absence of the reform would have had a non-qualified job and likely temporary job, followed, instead, another working career and received some training. However, reducing firing costs lowers the optimal amount of training provided by the firm to the marginal workers since their marginal training costs are higher (i.e. their ability level is lower). Nevertheless, in the absence of this firing costs reduction, these marginal workers would not receive any training. This paper shows that a more flexible employment protection legislation regime combined with training contracts can reduce the inefficiencies of job sorting and screening due to asymmetric information.

## References


Abel, M., Burger, R. and Piraino, P. (2017). The value of reference letters, *Working Papers 06/2017*, Stellenbosch University, Department of Economics.

Acemoglu, D. and Pischke, J.-S. (1998). Why do firms train? Theory and Evidence, *The Quarterly Journal of Economics* **113**(1): 79–119.

Acemoglu, D. and Pischke, J.-S. (1999). Beyond Becker: Training in imperfect labour markets, *Economic Journal* **109**(453): F112–42.

Adhvaryu, A., Kala, N. and Nyshadham, A. (2018). The skills to pay the bills: Returns to on-the-job soft skills training, *NBER Working Papers 24313*, National Bureau of Economic Research, Inc.

Almeida, R. and Aterido, R. (2011). On-the-job training and rigidity of employment protection in the developing world: Evidence from differential enforcement, *Labour Economics* **18**(S1): S71–S82.

Autor, D. (2001). Why do temporary help firms provide free general skills training?, *The Quarterly Journal of Economics* **116**(4): 1409–1448.

Becker, G. (1962). Investment in human capital: A theoretical analysis, *Journal of Political Economy* **70**.

Berton, F. and Garibaldi, P. (2012). Workers and firms sorting into temporary jobs, *Economic Journal* **122**(562): F125–F154.

Bilanakos, C., Heywood, J., Sessions, J. and Theodoropoulos, N. (2018). Does demand for product quality increase worker training?, *Journal of Economic Behavior & Organization* **155**(C): 159–177.

Blanchard, O. and Landier, A. (2002). The perverse effects of partial labour market reform: fixed–term contracts in france, *Economic Journal* **112**(480): F214–F244.

Bolli, T. and Kemper, J. (2017). Evaluating the impact of employment protection on firm-provided training in an rdd framework, *KOF Working papers 17-433*, KOF Swiss Economic Institute, ETH Zurich.

Bratti, M., Conti, M. and Sulis, G. (2019). Employment protection and firm-provided training: Quasi-experimental evidence from a labour market reform, *IZA Discussion Papers 12773*, Institute of Labor Economics (IZA).

Cabrales, A., Dolado, J. and Mora Villarrubia, R. (2017). Dual employment protection and (lack of) on-the-job training: Piaac evidence for Spain and other European countries, *SERIEs: Journal of the Spanish Economic Association* **8**(4): 345–371.

Caggese, A. and Cuñat, V. (2008). Financing constraints and fixed-term employment contracts, *Economic Journal* **118**(533): 2013–2046.

Cahuc, P., Charlot, O. and Malherbet, F. (2016). Explaining the spread of temporary jobs and its impcat on labour turnover, *International Economic Review* **57**: 533–572.

Ferreira, M., de Grip, A. and Van der Velden, R. (2018). Does informal learning at work differ between temporary and permanent workers? Evidence from 20 OECD countries, *Labour Economics* **55**(C): 18–40.

Fialho, P. (2017). Who gains from labour market flexibility at the margin?, *mimeo*.

García-Pérez, J. I., Marinescu, I. and Vall Castello, J. (2019). Can fixed-term contracts put low skilled youth on a better career path? Evidence from Spain, *The Economic Journal* **129**(620): 1693–1730.

Gibbons, R. and Katz, L. (1991). Layoffs and lemons, *Journal of Labor Economics* **9**(4): 351–80.

Greenwald, B. C. (1986). Adverse selection in the labour market, *Review of Economic Studies* **53**(3): 325–347.

Guglielminetti, E. and Nur, J. (2017). Dual labour markets and (lack of) on-the-job training: Piaac evidence from spain and other eu countries, *mimeo*.

Hijzen, A., Mondauto, L. and Scarpetta, S. (2017). The impact of employment protection on temporary employment: Evidence from a regression discontinuity design, *Labour Economics* **46**(C): 64–76.

Jahn, E. and Rosholm, M. (2018). The cyclicality of the stepping-stone effect of temporary agency employment, *IZA Discussion Papers 11377*, Institute of Labor Economics (IZA).

Lazear, E. P. (1990). Job security provisions and employment, *The Quarterly Journal of Economics* **105**(3): 699–726.

Lazear, E. P. (2009). Firm-specific human capital: A skill-weights approach, *Journal of Political Economy* **117**(5): 914–940.

Lazear, E. P. (2018). Compensation and incentives in the workplace, *Journal of Economic Perspectives* **32**(3): 195–214.

Maida, A. and Sonedda, D. (2019). Getting out of the starting gate on the right foot: employment effects of investment in human capital. LABORatorio Revelli Working Paper n. 164.

Picchio, M. and van Ours, J. C. (2011). Market imperfections and firm-sponsored training, *Labour Economics* **18**(5): 712–722.

Salop, J. and Salop, S. (1976). Self-selection and turnover in the labor market, *The Quarterly Journal of Economics* **90**(4): 619–627.

Tealdi, C. (2019). The adverse effects of short-term contracts on young workers: Evidence from Italy, *Manchester School* **87**(6): 751–793.

Tesfaelassie, M. and Wolters, M. (2018). The impact of growth on unemployment in a low vs. high inflation environment, *Review of Economic Dynamics* **28**: 34–50.

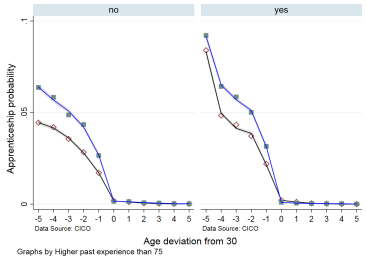
Upward, R. and Wright, P. (2019). Don't look down: The consequences of job loss in a flexible labour market, *Economica* **86**(341): 166–200.

Waldman, M. (1984). Job assignments, signalling, and efficiency, *RAND Journal of Economics* **15**(2): 255–267.

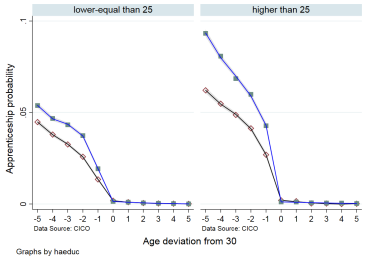
Waldman, M. (2016). The dual avenues of labor market signaling, *Labour Economics* **41**(C): 120–134.

# A1 Additional Figures of the Reduced Form analysis

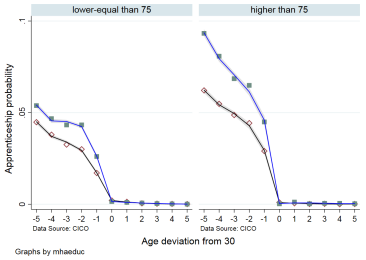
Figure A1: Difference-in-difference-in-discontinuity across contiguous cohorts generated by Law No. 92/2012



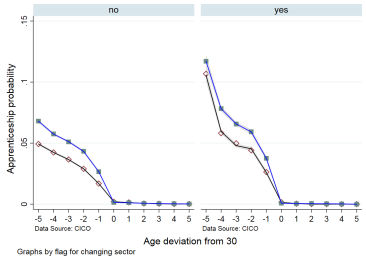

(a) Above/below the 75th percentiles: previous experience.



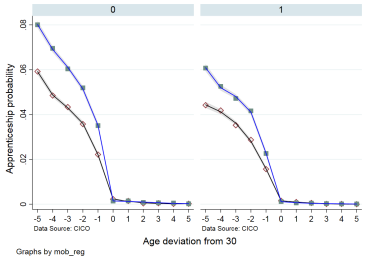

(b) Above/below the 25th percentiles: education.



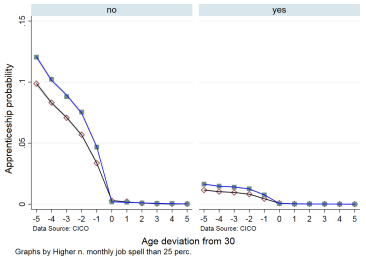

(c) Above/below the 75th percentiles: education.



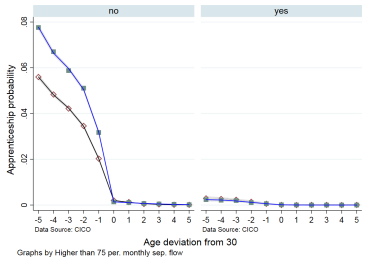

(d) (No) changing sector of activity.



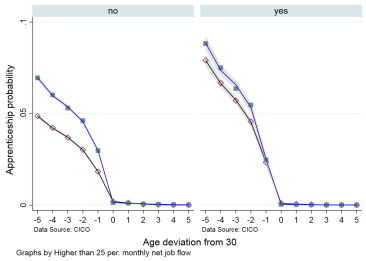

(e) (No) regional mobility.



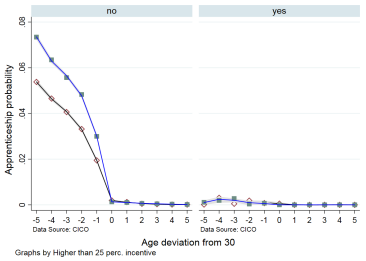

(f) Above/below the 25th percentiles: number monthly job episode.




(g) Above/below the 25th percentiles: number monthly job separations.



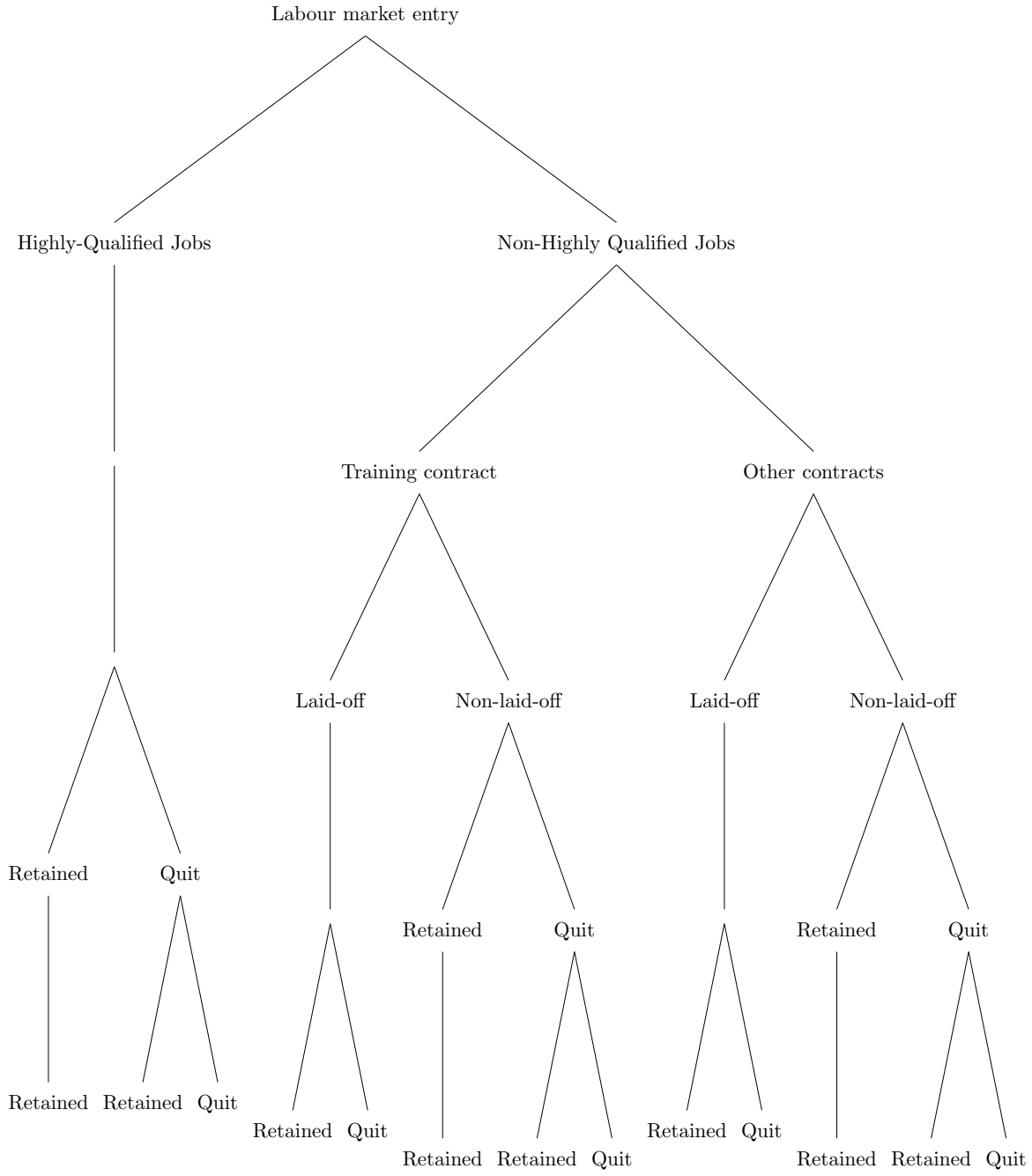

(h) Above/below the 25th percentiles: number monthly net job flows.



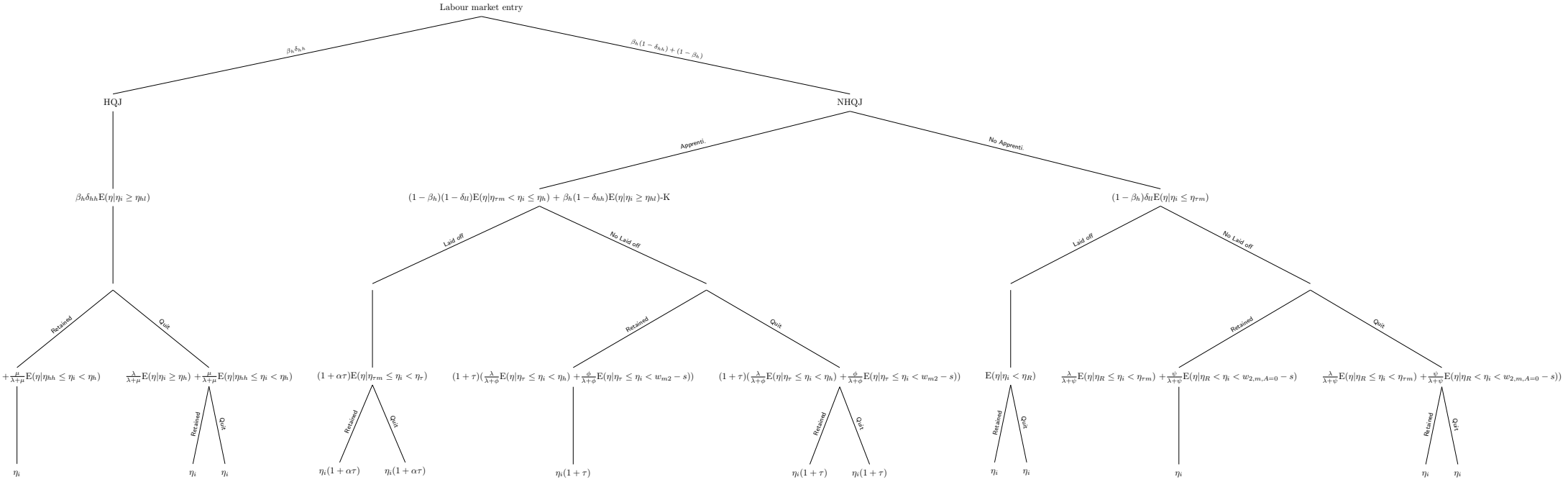

(i) Above/below the 25th percentiles benefitting of lower labour costs.

*Notes: The dots are averaged raw data points while the line and the gray area refer to the parametric fit (third order polynomial in age) and its* 99% *confidence intervals. Heteroskedasticity robust standard errors.*

## B1 The timing of the events in the model

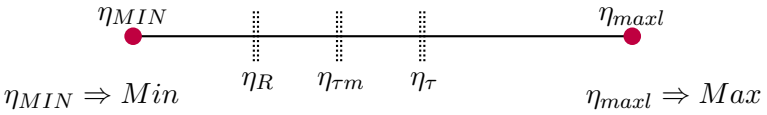


## B2 The wage setting game

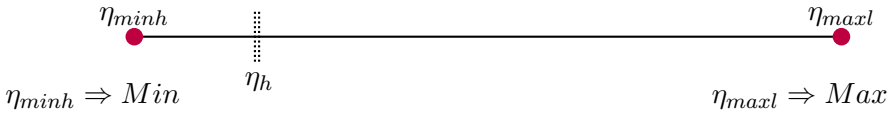


## B3 Ability distributions

Ability of individuals without a higher education degree




Ability of individuals with a higher education degree



## B4 Characterisation of the separating equilibrium

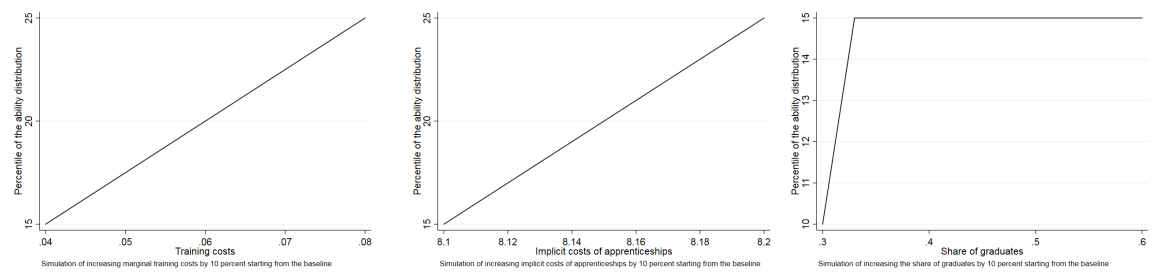
This appendix provides the details of the characterisation of the separating equilibrium. These characterisations follow Gibbons and Katz (1991). I start showing that exists a unique $\eta_1^*$ satisfying $\eta_1^* + s = E(\eta|\eta_1^* \leq \eta_i \leq \eta_{\tau m})$. At $\eta_1^* = \eta_R$, $E(\eta|\eta_1^* \leq \eta_i \leq \eta_{\tau m})$ exceeds $\eta_1^* + s$; at $\eta_1^* = \eta_{\tau m}$, $\eta_1^* + s$ exceeds $E(\eta|\eta_1^* \leq \eta_i \leq \eta_{\tau m})$ and the derivative of the left-hand side with respect to $\eta_1^*$ is one, which exceeds the derivative of the right-hand side because $f(\eta)$ is log concave. The same monotonicity argument implies that, if $\eta_R < \eta_1^*$, then $\eta_R + s < E(\eta|\eta_i \geq \eta_R)$. Given a value of $\eta_R < \eta_1^*$ , there exists a unique solution to equation 3.

At $w_{2,m,A=0,L=0} = \eta_{MIN}$, the right-hand side of equation 3 is higher than the left-hand side because $\frac{\lambda}{\lambda+\psi} E(\eta|\eta_R \leq \eta_i < \eta_{\tau m}) \geq w_{2,m,A=0,L=0} = \eta_{MIN}$ and the probability term $\psi$ in the second term is zero. At $w_{2,m,A=0,L=0} = \eta_{\tau m}$, the right-hand side is smaller than the left-hand side negative because $\frac{\lambda}{\lambda+\psi} E(\eta|\eta_R \leq \eta_i < \eta_{\tau m}) \leq w_{2,m,A=0,L=0} = \eta_{MIN}$ and the second term is either smaller than $w_{2,m,A=0,L=0}$ or zero (depending on whether the probability term is positive or zero). After rewriting equation 3 as a first order condition and taking the derivative of the right-hand side with respect to $w_{2,m,A=0,L=0}$, this derivative is negative for every x. Thus, given $\eta_R$, equation 3 has a unique solution in the interval $\eta_{MIN} - \eta_{\tau m}$. This is the optimal wage offer for prospective employers when incumbent firms lay off workers if and only if their ability is less than $\eta_R$. This is because no workers would accept a lower wage. All workers would accept a higher wage even the lowest-ability workers whose productivity is lower than the wage offered. Hence, firms would earn negative profits if offer a wage higher than 3. The same proof, by contradiction provided by Gibbons and Katz (1991), shows that if $\eta_R < \eta_1^*$ then $\eta_R + s_1 + s_2 \leq w_{2,m,A=0,L=0}$ where $w_{2,m,A=0,L=0}$ is the solution to equation 3.

Similar arguments can be applied all the other wage offer conditions that characterise the separating equilibrium.

## B5 Robustness analysis using PIAAC data

In what follows with replicate the analysis presented in Table 3 and Figure 5 using the shape and scale values estimated by maximum likelihood using PIAAC data for Italy.




(a) Cost of training. (b) Implicit cost of the contract. (c) Share of graduate students.

Figure B1: Sorting into training contracts and other model parameters

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[forthcoming as: Smyk, M., J. Tyrowicz. and L. van der Velde. A Cautionary Note on the Reliability of the Online Survey Data – the Case of Wage Indicator. *Sociological Methods and Research*.]

06/2018 How (Not) to Make Women Work?
*Karolina Goraus, Joanna Tyrowicz and Lucas van der Velde*
[published as: Goraus, K., J. Tyrowicz and L. van der Velde (2018). How (Not) to Make Women Work? *Social Science Research* 75, 154-167.]

07/2018 Efficiency Wages in a Cournot-Oligopoly
*Marco de Pinto and Laszlo Goerke*
[published as: de Pinto, M. and L. Goerke (2019). Efficiency Wages in a Cournot-Oligopoly, *The B.E. Journal of Economic Analysis and Policy* 19(4).]

08/2018 Inequality in an OLG Economy with Heterogeneous Cohorts and Pension Systems
*Joanna Tyrowicz, Krzysztof Makarski and Marcin Bielecki*
[published as: Tyrowicz, J., K. Makarski and M. Bielecki (2018). Inequality in an OLG Economy with Heterogeneous Cohorts and Pension Systems. *Journal of Economic Inequality* 16(4), 583-606.]

09/2018 Corporate Social Responsibility and Tax Avoidance
*Laszlo Goerke*
[published as: Goerke, L. (2019). Corporate Social Responsibility and Tax Avoidance*. Journal of Public Economic Theory* 21(2), 310-331.]

10/2018 A Regression Discontinuity Evaluation of Reducing Early Retirement Eligibility in Poland
*Oliwia Komada, Pawel Strzelecki and Joanna Tyrowicz*
[published as: Komada, O., P. Strzeleck and J. Tyrowicz (2019). A Regression Discontinuity Evaluation of Reducing Early Retirement Eligibility in Poland. *International Journal of Manpower* 40(2), 286-303.]

11/2018 Stigmatization, Liability and Public Enforcement of Law
*Clemens Buchen, Bruno Deffains and Alberto Palermo*
[published as: Buchen, C., B. Deffains and A. Palermo (2019). Stigmatization, Liability and Public Enforcement of Law. *Revue d'économie politique* 129(2), 239-259.]

12/2018 Sickness Absence and Relative Income
*Laszlo Goerke*
[published as: Goerke, L. (2019). Absence from Work, Sick Pay and Positional Consumption Concerns. *Labour: Review of Labour Economics and Industrial Relations* 33(2), 187-211.]

01/2019 Ostracism in Alliances of Teams and Individuals: Voting, Exclusion, Contribution, and Earnings
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02/2019 Evaluating Welfare and Economic Effects of Raised Fertility
*Krzysztof Makarski, Joanna Tyrowicz and Magda Malec*
[published as: Makarski, K., J. Tyrowicz and M. Malec (2019). Fiscal and Welfare Effects of Raised Fertility in Poland: Overlapping Generations Model Estimates. *Population and Development Review* 45(4), 795-818.]

03/2019 The Structure and Behavioral Effects of Revealed Social Identity Preferences
*Florian Hett, Markus Kröll, Mario Mechtel*
[forthcoming as: Hett, F., M. Kröll and M. Mechtel. The Structure and Behavioral Effects of Revealed Social Identity Preferences. *Economic Journal*.]

04/2019 All on board? New Evidence on Board Gender Diversity from a Large Panel of European Firms
*Joanna Tyrowicz, Siri Terjesen, Jakub Mazurek*
[published as: Tyrowicz, J., S. Terjesen and J. Mazurek. All on Board? New Evidence on Board Gender Diversity from a Large Panel of European Firms. *European Management Journal* 38(4), 634-645.]

01/2020 Thorstein Veblen, Joan Robinson, and George Stigler (probably) never met: Social Preferences, Monopsony, and Government Intervention
*Laszlo Goerke, Michael Neugart*
[forthcoming as: Goerke, L., M. Neugart. Social Preferences, Monopsony, and Government Intervention. *Canadian Journal of Economics/ Revue Canadienne d´Économique*.]

02/2020 Younger, Dissatisfied, and Unhealthy - Relative Age in Adolescence
*Luca Fumarco, Stijn Baert, Francesco Sarracino*
[forthcoming as: Fumarco, L., S. Baert and F. Sarracino. Younger, Dissatisfied, and Unhealthy - Relative Age in Adolescence. *Economics & Human Biology*.]

03/2020 Horizontal FDI in a Dynamic Cournot - Oligopoly with Endogenous Entry
*Laszlo Goerke*
[forthcoming as: Goerke, L. A Political Economy Perspective on Horizontal FDI in a Dynamic Cournot-Oligopoly with Endogenous Entry. *European Journal of Political Economy*.]

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*Cyprien Batut and Eric Maurin*

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*Laszlo Goerke*
[forthcoming as: Goerke, L. Trade Unions and Corporate Social Responsibility. *Annals of Public and Cooperative Economics*.]

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