Contracting Tenure in a Dual Labor Market*

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Abstract

This paper investigates why firms offer contracts subject to firing restrictions. The coexistence of costly open-ended contracts with cheaper temporary employment is still a theoretical puzzle. We provide a new answer that hinges on three undocumented empirical facts: knowledge intensive firms I) primarily rely on tenured workers, II) stipulate longer fixed-term contracts (FTCs), and III) are more sensitive to firing restrictions when converting FTCs into open-ended positions. Based on this evidence, we introduce match-specific human capital in a labor-demand model which is able to solve the puzzle. First, we find that longer contracts and employment protection increase human capital. This mechanism explains the existence of open-ended contracts. Second, complementarity between workers' ability and human capital pushes firms to offer FTCs to low worker types, and open-ended positions to high types. Such endogenous selection justifies the presence of positive assortative matching in the data. Third, workers with FTCs are offered tenure if productive enough. This fact explains the existence of "up-or-out" policies in several industries. Our simulations show that the introduction of FTCs in a one-tier labor market, and lower firing restrictions decrease unemployment. Finally, we exploit a reform to test our policy results on Italian matched employer-employee administrative data.

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1 Introduction

A persistent question in the labor literature concerns the reasons why firms stipulate open-ended contracts. In this paper, we argue that heterogeneity in labor-demand and in match productivity makes it possible to endogenize and explain hiring patterns. Open-ended contracts often carry wrongful dismissal clauses. Their violation leads to long and costly judicial procedures, resulting in workers' reinstatement or monetary compensation. In practice, these non-transferable dead-weight losses act as a firing tax. Therefore, we would expect firms to prefer more flexible contracts to avoid long-term commitments. Rather, empirical evidence shows that open-ended contracts account for a large proportion of the workforce stock, and of new hires. This "puzzle" is not exclusive to European countries, where Employment Protection Legislation (EPL) is particularly stringent[1]. In the U.S., where access to temporary employment is unrestricted in several jurisdictions, firms may voluntarily commit to offering job stability[2]. Academia is a familiar example of such instances. Employers, free to hire under a flexible contract, spontaneously segment careers into tenure-track and tenure. Such a system imposes a mandatory expiration on the first contract, and significant termination costs on the second. Similar career profiles, commonly referred to as "up or out", characterize various professions such as accounting, consulting and law.

Theoretically explaining the existence of open-ended contracts, and more so their co-existence with temporary employment, is a challenging task. Several contributions have concluded that firms must always prefer fixed-term contracts (FTCs). These papers either assume that all matches start as temporary, see for instance Blanchard and Landier (2002), or impose an exogenous limit on their usage, as in Cahuc and Postel-Vinay (2002). Other studies focus on the conditions guaranteeing

[1]During the last 20 years, legislators reformed labor markets' margins by introducing several types of temporary contracts. While regulation on short-term jobs varies across countries, their use allows firms to reduce prospective employment costs.

[2]Although Anglo-Saxon countries are rather characterized by the "employment at will" presumption, they also acknowledge the distinction between permanent and short-term positions. Autor (2003) reports how court exceptions to the firing at-will ("for good cause, bad cause, or no cause at all") doctrine in the US has led to a sharp increase in the utilization of Temporary Help Supply services between 1979 and 1995. Autor, Donohue III, and Schwab (2006) estimates the social costs of common-law protection against wrongful discharge.

a "pooling equilibrium"[3]. Many of them rely on exogenous structural differences between the two contracts: distinct matching technologies in Wasmer (1999); higher productivity levels in permanent jobs in Caggese and Cunat (2008) and Fialho (2014); on-the-job search by temporary workers in Cao, Sao, and Silos (2010). Only a few contributions, however, have obtained full endogenous sorting of firms and workers. Berton and Garibaldi (2012) propose a model with directed search and exogenous wages while, in Cahuc, Charlot, and Malherbet (2012), firms face a distribution of production opportunities of different lengths.

In light of the difficulty to provide a theoretical answer to this puzzle, we come back to the data, looking for possible explanatory patterns. Evidence from a large Italian region allows us to document three new, interesting facts. I) The share of FTCs varies across industries. In particular, knowledge intensive (KI) firms[4] primarily rely on long-term workers, while short-term contracts are concentrated in less specialized markets. II) KI firms stipulate longer FCTs. Indeed, "low-type" employers (first quartile of our KI measures) structurally offer extremely-short-term jobs. FTCs are longer for skilled workers, but their length does not depend on firms' knowledge intensity. This fact suggests that skilled workers are similarly employed across firms. III) When converting a FTC into an open-ended position, low-type firms are less sensitive to the existence of firing taxes[5]. Thus, these firms most likely employ FTCs for structural reasons, not as a substitute for open-ended matches.

This evidence suggests that human capital (HC) investment plays an important role in explaining hiring patterns. Our theoretical setup attempts to rationalize these findings. In doing so, we refrain from studying optimal contracts and focus on a second-best economy, constrained by exogenous institutions. We build a random search model with heterogeneous match quality, and two types of contracts, open-ended and temporary (convertible to open-ended at expiration). A representative

[3]This term does not carry any game-theoretical significance. Rather, we refer to the existence of a solution in which temporary and open-ended contracts coexist in the stationary distribution of both the stock of employed workers, and the flow of new hires. In this sense, "pooling equilibrium" and "interior solution" will be used interchangeably.

[4]We obtain similar results employing two measures of knowledge intensity: $\frac{\text{white collars}}{\text{(blue+white)collars}}$, and $\frac{\text{college trained}}{\text{total workforce}}$.

[5]The Italian EPL entails higher costs for firms above 15 employees. However, the threshold is fuzzy due to the complex computation of the relevant workforce. See for instance Garibaldi, Pacelli, and Borgarello (2004).

firm meets workers, whose types are perfectly observed by both parties. Based on the candidate's ability, the employer decides whether to hire her, and under which contract. Once the match is formed, the pair agrees on the efficient investment in HC, sharing its cost according to their bargaining power. This pair-specific HC raises productivity, but is lost once the match is severed. Furthermore, as in Acemoglu and Pischke (1998) and Lise, Meghir, and Robin (2013), we assume complementarity between workers' ability and HC investment. We also introduce a HC-augmenting parameter to account for firms' knowledge intensity. In this manner, we stylize the interaction observed empirically between firms' and workers' types.

These ingredients lead to endogenous sorting of firms between open-ended and temporary contracts. In the former, the firing tax acts as a threat point in the Nash bargaining, increasing wages. Job stability, however, leads to higher HC investment and productivity. The (endogenous) firing rate decreases in ability and in the tax. On the other hand, FTCs entail a fixed stipulation cost (quotas, reasons of use), less HC investment, and a higher separation rate. Yet, workers' bargaining power is reduced, and so are wages, making FTCs cheaper. This is also due to an anticipation effect: knowing that, if converted to open-ended, FTC will cost more, firms immediately cut present compensations. In this setting, we are able to show the existence of a unique equilibrium with three possible outcomes: two corner solutions (only open-ended, or only FTCs), or an interior one. In the latter, super-modularity in the production function guarantees that firms offer FTCs to low-type matches, and open-ended contracts to the high ones.

The paper is structured as follows. Section 2 presents some stylized facts. In Section 3, we first consider a benchmark model in which only open-ended contracts exist, and solve for the equilibrium. Although we only conduct a positive analysis, we could argue that, since HC positively depends on firing restrictions, our model offers some justification for the adoption of non-mandatory dismissal costs, as in Autor (2003). Section 4 adds fixed-term contracts (FTCs). Our simulations show that their introduction reduces unemployment with respect to the benchmark. Eliminating all restrictions on their use, however, may lead to the opposite conclusion. As expected, the higher the firing tax, the more firms want to use temporary contracts, while KI firms are more prone to offer "permanent" positions[6]. Section 5 uses two matched employer-employee datasets taken from administrative sources to test the predictions of the model simulation. Section 6 concludes. Finally, in the Theoretical Appendix, we introduce learning, in the spirit of Jovanovich (1979), and probationary periods for permanent contracts. With a few supplementary conditions, our model predictions are robust to these extensions.

2 Stylized Facts

In several European countries, the steady introduction of flexicurity policies has widely reduced EPL restrictions[7]. In turn, between 1990 and 2013, the share of temporary jobs on total dependent employment has risen from 4 to 13% in Italy, from 9 to 15% in France, while averaging 31% in Spain (see Figure 1). The youngest cohorts of workers have absorbed most of this increase.

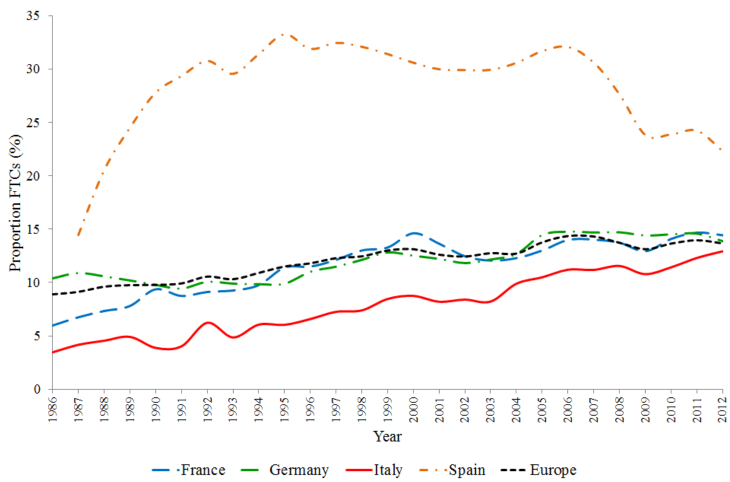


Figure 1: Share of Temporary Employment: all age groups

[6]From this point on, we will interchangeably employ the terms "permanent" and "open-ended" to refer to contracts protected by a firing tax.

[7]The OECD computes an aggregate measure of employment protection legislation (EPL), rated on a (0-6) scale. EPR represents the index for regular (open-ended) contracts, rating legislation on individual and collective dismissals. EPT is the corresponding index for standard fixed-term positions, and contracts stipulated by temporary work agencies. EPT measures valid cases for use, the maximum number of successive contracts and maximum cumulated duration.

Source: OECD calculations on Labor Force Surveys (LFS). Temporary job definition in the LFS: "A job may be considered temporary if employer and employee agree that its end is determined by objective conditions such as a specific date, the completion of a task or the return of another employee who has been temporarily replaced (usually stated in a work contract of limited duration). Typical cases are: (a) persons with seasonal employment; (b) persons engaged by an agency or employment exchange and hired to a third party to perform a specific task (unless there is a written work contract of unlimited duration); (c) persons with specific training contracts."

While keeping in mind the European context, this work will exploit Italian data for the model calibration, and the empirical analysis. Italy's labour market is characterized by a particularly high youth unemployment rate, and by a strongly informal matching process[8].

An empirical fact mostly overlooked by the literature concerns the great amount of heterogeneity in the utilization of temporary contracts across workers' occupations and industries. To address this element, we present descriptive evidence from a large Italian region[9]. Table 1 reports the percentage of temporary contracts by workers' qualification: focusing on standard FTCs, notice that managers are virtually all employed in permanent positions, while almost 10 and 12% of blue and white collar workers, respectively, are employed in fixed-term contracts.

[8]Various sources (see next note) show that more than 50% of job seekers mainly rely on informal channels (family, friends) and spontaneous candidacies when applying for jobs. In this sense, firms mostly operate in a random search framework, rather than segmenting vacancies ex-ante.

[9]Veneto Working Histories dataset. See the Empirical Appendix for a detailed description.

Table 1: Temporary contracts by workers' qualification

Contract/Position	Appr.	Blue collar	White collar	Manager	Principal	% Contr.	Tot. Contr.
Seasonal	-	2.11	0.79	0.09	0.01	1.52	104,977
Substitution	-	0.05	0.13	0.01	0.00	0.07	4,981
Training	-	2.82	3.73	0.04	0.00	2.87	198,499
Interim	-	1.96	1.27	0.01	0.00	1.58	109,199
FTC	-	9.85	12.11	0.66	3.05	9.75	675,677
Apprenticeship	97.95	1.26	0.79	-	-	7.2	498,518
Permanent	-	81.96	81.18	99.18	96.94	77.02	5,334,779
% Position	6.19	60.23	31.28	1.45	0.85	100	
Tot Position	428,859	4,172,078	2,166,950	100,354	58,554		6,926,771

Source: Veneto Working Histories.

Table 2 shows that the percentage of workers employed in temporary contracts greatly varies depending on the sector of activity. Even more interestingly, heterogeneity is present also at finer levels of disaggregation: we have selected two examples. Table 3 shows that the high percentage of temporary workers observed in the finance sector, is entirely due to auxiliary and real estate activities, while employees in credit institutions and insurance companies mostly have open-ended contracts. At the 3-digits level of disaggregation, Table 4 shows that the pharmaceutical industry tends to offer more permanent positions relatively to other branches of chemical manufacturing.

Overall, we interpret this evidence as an indication that temporary contracts are comparatively more used in low skilled occupations, while knowledge-intensive jobs require employing more workers in permanent contracts. To support our interpretation, the last column of Tables 2, 3 and 4 reports the percentage of white collars on the sum of blue and white collar workers: we view this measure as a rough indicator of the sectoral knowledge-intensity[10]. Our theoretical setup is going reproduce

[10]We adopt this simple measure to avoid confounding effects stemming from heterogeneities in the presence of the other categories, namely apprentices, managers and principals. While these always represent a minor share of the workforce, we also noticed that the proportion of managers is higher in sector employing a larger fraction of white collar workers. Results are robust to the use of a different measure of KI based on workers' average education, namely the share of college educated employees in the sector.

Table 2: Temporary contracts by sector - 1 digit level

	Sector	**Obs.**	**% temporary contracts**	**% white collars**
0	Agriculture, forestry and fishery	38446	3.79	37.48
1	Manufacturing: energy, gas and water	74288	2.37	52.26
2	Manufacturing: minerary and chemical	339910	8.41	28.06
3	Manufacturing: metals and mechanics	1414556	10.77	28.28
4	Manufacturing: food, textile, leather, clothing, timber, paper, other	1397618	10.47	19.88
5	Building and constructions	485269	7.90	14.32
6	Wholesale and retail trade; lodging and catering; recovery and repair service	1364684	13.15	46.65
7	Communication and transport services	322669	12.37	20.62
8	Credit, insurance, business services provided to enterprises	768192	23.22	48.51
9	Public administration, private and public services	721164	30.04	54.33
	Total	6926796	14.19	34.18

Source: Veneto Working Histories. Sector classification: ATECO 1981 - 1 digit level.

Table 3: Temporary contracts by sector - 2 digits level

	Sector 8 - Credit, insurance, business services provided to enterprises	**Obs.**	**% temporary contracts**	**% white collars**
81	Credit institutions	162429	6.70	99.88
82	Insurance (except compulsory social security)	29672	5.50	97.41
83	Activities auxiliary to financial services and insurance activities; real estate activities	576091	28.71	34.24
	Total	768192	23.16	48.50

Source: Veneto Working Histories. Sector classification: ATECO 1981 - 2 digits level.

Table 4: Temporary contracts by sector - 3 digits level

	Sector 25 - Chemical industries	Obs.	% temporary contracts	% white collars
251	Basic chemical products	30973	10.12	34.90
257	Pharmaceuticals	31413	7.89	68.35
258	Soaps, cleaning products and cosmetics	6369	13.02	40.42
	Total	68755	9.37	50.14

Source: Veneto Working Histories. Sector classification: ATECO 1981 - 3 digits level.

this finding.

It is worth mentioning that some of these sectors display structurally higher proportions of temporary contracts (FTCs and seasonal): this is the case for arts and entertainments, and lodging services. This is clearly due to the particular need of flexibility required to face occasional peaks of economic activity. In this paper, we do not attempt to address this issue.

Table 5: Reasons for using temporary contracts

Reason	% FTCs
Trial period before permanent contract	26.7
Replacement absentees	10
Seasonal work/peaks of productivity	15.9
Link to a specific project	9.3
Professional training	10.3
No particular reason	21.7
Don't know	6.1

Source: ISFOL.

The last stylized fact we present regards the adoption of the so-called "up or out" policies. These are adopted whenever a match starts as temporary and, upon expiration, may be either destroyed or upgraded by the firm. In line with this idea, a recent survey[11] documents that almost 30% of

[11]The "Participation, Labour, Unemployment Survey" (PLUS), conducted by the Institute of Studies on Training and the Labour Market (ISFOL).

temporary contracts are employed as stepping stones towards permanent positions (see Table 5). In our model, matches are heterogeneous with respect to their productivity. Then, firms find profitable to convert only part of the temporary positions, whereas the rest of the workers are let go because they are deemed not sufficiently productive relatively to the cost of an open-ended contract.

3 Model

We start by outlying a simple setting with only one open-ended contract. Later on we extend the model by introducing the possibility of stipulating a short-term contract deprived of firing costs.

3.1 Environment

The economy is populated by a continuum of firms indexed by j and a continuum of workers, indexed by i. In a symmetric equilibrium, all agents adopt the same strategy; we can thus simplify the notation by omitting the indexes j and i. Workers inelastically supply labour: $\int_0^1 L(i)di = L = 1$, where L stands for labour force. We abstract from population growth and we assume L constant. $\int_0^1 N_t(i)di = N_t$ is aggregate employment at time t and $u_t = 1 - N_t$ is aggregate unemployment. In a stationary environment (as we assume in what follows), we can neglect the time index.

Firms produce using only labour, which is hired on a frictional labour market. We assume that the realized number of matches is the outcome of a Cobb-Douglas technology, which depends on the number of vacancies (V_t) and searchers (u_t): $M_t(V_t, u_t) = \chi V_t^{\eta}(u_t)^{1-\eta}$. The probability that a firm matches with a worker is $q(\theta) = \frac{M_t(V_t,u_t)}{V_t}$. $f(\theta) = \frac{M_t(V_t,u_t)}{u_t}$ expresses the job-seeker's probability of being hired. Labour market tightness is defined as $\theta_t = \frac{V_t}{u_t}$. It is easy to show that $q(\theta)$ is a decreasing function of θ, while $f(\theta)$ is an increasing function of θ. Furthermore, there exists the following relationship: $f(\theta) = \theta q(\theta)$.

Upon meeting, the match-specific productivity α_i is drawn from the continuous distribution $f_\alpha(\alpha)$ defined over the support $[\alpha_l, \alpha_u]$. We think to α as correlated to worker's ability but also to her fit to the proposed occupation[12]. The realization α_i is perfectly observed both by the firm and by the worker. According to the realization α_i the firm can either decide to hire the worker or to let her leave at no cost.

We start by assuming that employers can only hire under an open-ended contract which entails the payment of a fixed amount K in case of layoff.

At the beginning of the employment relationship, workers and firms jointly decide upon the investment in human capital (h_i) to raise the productivity of the match. We assume human capital is match-specific, so that it is completely lost once the match is severed. The cost of the investment is shared between the firm and the worker according to their bargaining power. This arrangement guarantees that the investment decision is efficient and supported by both parties[13]. We further assume complementarity between ability and investment in human capital in the production function:

$$y_i(\epsilon) = y(\alpha_i, h_i) + \varepsilon \tag{1}$$

where $\partial y/\partial\alpha_i > 0$, $\partial y/\partial h_i > 0$, $\partial^2 y/\partial h_i \partial\alpha_i > 0$ and ε is a firm specific component. The production function (1) is similar to the one adopted by Wasmer (2006), where output is the sum of a firm's component and the worker's human capital. The complementarity between the match-specific component and human capital is reminiscent of the specification adopted by Acemoglu and Pischke (1998) and by Lise, Meghir, and Robin (2013)[14].

All productive matches start with the same firm's productivity component, denoted as ε_0[15].

[12] To provide an intuition, imagine a game theorist applying for an applied econometrician job. Although she might excel in her field, she would poorly meet the requirements of that position. As we will see below, interpreting α as entirely worker's specific would imply that some individuals can never get a job. However, if α is correlated to worker's ability, the model still implies that less skilled individuals experience longer unemployment spells.

[13] One can interpret the joint decision of investment as made by two separate components. On the one hand, workers exert effort to acquire firm-specific skills; on the other hand, firms provide on-the-job training. However, both components contribute to a unique input in the production function (h). Furthermore, the associated cost is computed by taking into account the sum of the two contributions.

[14] Barron, Black, and Loewenstein (1989) find evidence that employers try to fill positions which require more on-the-job training with workers' with higher ability. Their concept of on-the-job training incorporates worker's investment in human capital too.

[15] A large part of the search literature follows Mortensen and Pissarides (1994) and assume that the initial productivity component coincides with the upper bound of the distribution (namely $\varepsilon_0 = \varepsilon_u$). We allow for the possibility of ε_0 to be an internal value. In this way, the matches hit by a shock can also experience productivity enhancements.

They are subsequently hit by i.i.d. random shocks at Poisson rate μ. When a shock occurs, a new independent value of ε is drawn from the distribution $f(\varepsilon)$, defined over the interval $[\varepsilon_l, \varepsilon_u]$. If the new productivity of the match is too low, the firm may prefer to fire the worker and the law obliges it to pay a fixed cost K. K represents the cost of legal procedures related to the firing of permanent workers; it can be interpreted as the model counterpart of the Employment Protection legislation on Regular contracts (EPR). As such, K is not paid to the worker but it's a pure waste. As shown by Lazear (1990), firing costs can be entirely internalized by the wage bargaining process if they take the form of severance payments[16].

3.2 Value Functions

In this section we characterize the value functions of the firm in the different states.

Firms post vacancies at unit cost κ. The vacancy is filled at rate $q(\theta)$, which negatively depends on the labour market tightness (θ).

Denote with $\mathbb{E}\left(J^P\right)$ the expected value of a new match subject to firing cost, where the expectation is taken w.r.t to the productivity component α. Let $\mathbb{E}\left(c(h)\right)$ be the expected cost of the total investment in human capital; a fraction $1-\beta$ is paid by the firm. The value of an unfilled vacancy is thus expressed by the following Bellman equation:

$$r\mathbb{E}(J^V) = -\kappa + q(\theta)(\mathbb{E}(J^P - (1-\beta)c(h)) - \left(1 - F(\underline{\alpha}^P)\right)\mathbb{E}(J^V)) \tag{2}$$

where $\mathbb{E}(J^P) = \int_{\underline{\alpha}^P}^{\alpha_u} J^P(\alpha)dF(\alpha)$ and $\left(1 - F(\underline{\alpha}^P)\right)$ is the probability that the contract is actually stipulated. As we will discuss in Section 3.5, $\underline{\alpha}^P$ is the unique ability value such that matches with $\alpha_i < \underline{\alpha}^P$ are not formed in the first place.

[16] In many countries, EPR also establishes a compensation to be paid to the fired worker. It seems unlikely that firms are able to transfer all these costs to the worker: evidence in this sense for the italian case is provided by Leonardi and Pica (2007). We will thus argue that the calibration of K must indeed take into account law provisions regarding the payments received by the worker.

The value of match producing $y_i(\varepsilon)$ is:

$$\begin{aligned} rJ^P(y_i(\varepsilon)) =& y_i(\varepsilon) - w^P(y_i(\varepsilon)) + s^P\left(\mathbb{E}(J^V) - J^P(y_i(\varepsilon))\right) \\ &+ \mu \int_{\varepsilon_l}^{\varepsilon_u} \max\left[J^P(y_i(\varepsilon')) - J^P(y_i(\varepsilon)); -K - J^P(y_i(\varepsilon))\right] dF(\varepsilon') \end{aligned} \tag{3}$$

Permanent jobs are hit by i.i.d. random shocks to the firm's productivity component at Poisson rate μ. When a shocks occurs, firms decide whether to keep the job in place at the new productivity ε' or to lay off the worker and paying K.

As regards the worker, her value of unemployment and the productive match are, respectively:

$$rU = b + \theta q(\theta)\left[\mathbb{E}\left(W^P - \beta c(h)\right) - \left(1 - F(\underline{\alpha}^P)\right)U\right] \tag{4}$$

$$\begin{aligned} rW^P(y_i(\varepsilon)) = & w^P(y_i(\varepsilon)) + s^P\left(U - W^P(y_i(\varepsilon))\right) \\ &+ \mu \int_{\varepsilon_l}^{\varepsilon_u} \max\left[W^P(y_i(\varepsilon')) - W^P(y_i(\varepsilon)); U - W^P(y_i(\varepsilon))\right] dF(\varepsilon') \end{aligned} \tag{5}$$

where b represents unemployment benefits and β is the worker's bargaining power. The expectation in (4) is taken over the match-specific productivity component α. As it is standard in the literature, we assume $c'(h_i) > 0$ and $c''(h_i) > 0$. Notice that we introduce the investment cost in the value of unemployment and the vacancy rather than in the flow value of the productive match. As in Wasmer (2003), this specification implies that the entire cost is paid at the beginning of the employment relationship.

3.3 Wage Setting

As it is customary in search models, we assume that wages are Nash bargained between the firm and the worker. The splitting of the surplus thus obeys the following rule:

$$(1-\beta)\left(W^P(y_i(\varepsilon)) - U\right) = \beta\left(J^P(y_i(\varepsilon)) + K\right) \tag{6}$$

$S^P(y_i(\varepsilon)) = W^P(y_i(\varepsilon)) - U + J^P(y_i(\varepsilon)) + K$ is the joint surplus of the ongoing match producing $y_i(\varepsilon)$, β is the workers' bargaining power and free entry holds. Combining (6) with (2) and (4) allows us to express the value of unemployment as follows:

$$rU = b + \theta q(\theta) \left[\frac{\beta}{1-\beta} \left(\frac{\kappa}{q(\theta)} + \left(1 - F(\underline{\alpha}^P)\right) K \right) \right] \tag{7}$$

The cost of investment in HC does not enter the unemployment value because the part of the cost paid by the worker is exactly offset by the increase in the surplus determined by the investment made by the firm. Firing costs raise the value of unemployment because they increase the value of the productive match the job seeker can obtain[17]. After some algebra we obtain:

$$w^P(y_i(\varepsilon)) = \beta \left[y_i(\varepsilon) + (r + s^P)K \right] + (1-\beta) rU \tag{8}$$

Notice that eq. (8) implies that the wage in continuing matches is a positive function of the firing costs. As emphasized by other authors (see Bentolilla et al. (2010)), the cost imposed by the law in case of layoff can be used by the worker as a threat on the employer in the bargaining game. Furthermore, we ensure that each job beats the worker outside option by requiring that the effective wage is always higher than the reservation wage, represented by rU.

3.4 Job Destruction

In this simple setting, a match is severed either because the worker quits at exogenous rate s^P or because the firm layoffs the worker. Before defining an aggregate measure of job destruction, let us study the firing problem in continuing open-ended jobs. When a shock ε' occurs, the firm-worker pair compares the value of the ongoing relationship with its outside option, which is represented by the match surplus

$$S^P(y_i(\varepsilon)) = J^P(y_i(\varepsilon)) + K + W^P(y_i(\varepsilon)) - U \tag{9}$$

[17] To avoid this effect of firing costs one should assume that a new match is not initially subject to EPL provisions. This extension is considered in Section A.2.

Call ε_d^P the firm productivity component such that the firm-worker pair is indifferent between continuing to produce and breaking the match. Then, ε_d^P is the solution to $S^P(y_i(\varepsilon_d^P)) = 0$. Doing the computation leads to an implicit formula for the firing threshold:

$$\varepsilon_d^P + \mu \int_{\varepsilon_d^P}^{\varepsilon_u} S^P(y_i(\varepsilon'))dF(\varepsilon') - rU + (r + s^P)K + y_i = 0 \tag{10}$$

It is apparent from eq. (10) that the firing threshold crucially depends on the intrinsic match quality and the firing costs. For what follows, it is convenient to highlight the dependence on y_i, thus writing $\varepsilon_d^P(y_i)$. We summarize these results in the following lemma:

Lemma 1. *There exists an $\varepsilon_d^P(y_i)$ such that $S^P(y_i(\varepsilon_d^P(y_i))) = 0$. Any match of quality y_i hit by a shock ε' is continued iff $\varepsilon' > \varepsilon_d^P(y_i)$ and severed otherwise. Moreover:*

i) $\frac{\partial \varepsilon_d^P}{\partial y_i} = -\frac{1}{1-\frac{\mu(1-F(\varepsilon_d^P))}{r+s^P+\mu}} < 0$

ii) $\frac{\partial \varepsilon_d^P}{\partial K} = -\frac{r+s^P}{1-\frac{\mu(1-F(\varepsilon_d^P))}{r+s^P+\mu}} < 0$

For future convenience, we can define the firing rate as $\check{s}(y_i) = \mu F(\varepsilon_d^P(y_i))$. This can be interpreted as the arrival rate of a shock sufficiently bad to destroy the match. By combining Lemma 1 with the monotonicity of the c.d.f. we can state

Lemma 2. *Define the firing rate as: $\check{s}(y_i) = \mu F_\varepsilon(\varepsilon_d^P(y_i))$. Then, the firing rate is a decreasing function of y_i.*

Lemmas 1 and 2 say that a match is less likely to be destroyed the higher its productivity and the higher the firing costs.

3.5 Investment in Human Capital and Job Creation

Workers and firms jointly decide upon the level of investment in human capital by maximizing the value of the new job relationship minus the cost:

$$\max_{h_i} \qquad S^P(y(\alpha_i, h_i) + \varepsilon_0) - c(h_i)$$

The optimal investment level is thus defined by the first order condition:

$$
\begin{aligned}
-\frac{1}{r+s^P+\mu}\frac{\partial \varepsilon_d^P(y_i)}{\partial y_i}\frac{\partial y(\alpha_i,h_i)}{\partial h_i} &= c'(h_i) \\
\frac{1}{r+s^P+\mu F(\varepsilon_d^P(y_i))}\frac{\partial y(\alpha_i,h_i)}{\partial h_i} &= c'(h_i)
\end{aligned}
\tag{11}
$$

where in the second line we have replaced $\frac{\partial \varepsilon_d^P(y_i)}{\partial y_i}$ as defined in Lemma 2. Equation (11) says that optimality requires equating the marginal cost of investing with the marginal benefit, represented by lower destruction and increased match productivity. In Appendix A.1 we discuss existence and uniqueness of the solution to eq. (11). Firing costs enter expression (11) indirectly, by affecting $\varepsilon_d^P(y_i)$ and reducing job destruction. The worker's ability influences the optimal choice of investment because it affects the job destruction threshold in two ways: i) directly, because, *ceteris paribus*, matches with higher α are more productive; ii) indirectly, through the complementarity with human capital in the production function which fosters investment and further reduces the firing rate.

Let us now study how worker's ability and EPL on permanent contracts influence the decisions on human capital accumulation. In order to have a clear prediction of the model on this point, we restrict the class of admissible functions as discussed in Appendix A.1. We thus introduce Assumption H2, which requires the slope of the marginal benefit in investing in human capital to be lower than the slope of the marginal costs.

Lemma 3. *Under Assumption H2, around the optimal level of investment h^*, the match-specific productivity component α_i and the firing costs K both induce more accumulation of human capital. Formally,*

$$\frac{\partial h^*}{\partial \alpha_i},\ \frac{\partial h^*}{\partial K} > 0$$

Intuitively, Lemma 3 states that both ability and EPL provisions increase the expected length of the match, thus encouraging human capital accumulation.

Therefore, eq. (11) implicitly defines the optimal level of investment as a positive function of α:

$$h_i^* = h(\alpha_i) \qquad \text{with} \qquad h'(\alpha_i) > 0 \tag{12}$$

Competition among firms drive the value of a vacancy to zero. Imposing the standard free entry condition on eq. (2) yields

$$\mathbb{E}(J^P) = \frac{\kappa}{q(\theta)} + (1-\beta)\mathbb{E}\left(c(h)\right) \tag{13}$$

Eq. (13) is the job creating condition (JCC). Firms post vacancies up to the point where the real cost (rhs) equals the expected return of the productive match (lhs).

Having defined the job destruction threshold as in (10), we can rewrite the joint surplus of a productive match as:

$$S^P(y_i(\varepsilon)) = \frac{\varepsilon - \varepsilon_d^P(y_i)}{r + s^P + \mu} \tag{14}$$

Notice that eq. (14) refers to the surplus of an ongoing match; however, before stipulating the contract the firm judge upon the profitability of the match without the threat of the firing costs. Let thus define the ex-ante surplus of a permanent contract (i.e. the surplus before the formation of the match) as $S^0(y) = S^P(y) - K$. Then, we can define a profitability threshold $\underline{y}^P$ such that $S^0(\underline{y}^P) = 0$. Below this productivity value the firm is not interested in stipulating the contract. By combining equations (10) and (14) we obtain:

$$\underline{y}^P = y(\alpha_i, h(\alpha_i)) = rU + \mu K - \varepsilon_0 - \frac{\mu}{r + s^P + \mu} \int_{\varepsilon_u - (r+s^P+\mu)K}^{\varepsilon_u} (1 - F(\varepsilon'))d\varepsilon' \tag{15}$$

Firms require a higher initial productivity the higher is the flow value of unemployment and the higher the firing costs. For the latter we can compute $\frac{\partial \underline{y}^P}{\partial K} = \mu F(\varepsilon_d^P(\underline{y}^P)) > 0$. By inverting the $y(\cdot)$ function we can identify the unique value $\underline{\alpha}^P$ which defines the profitability threshold:

$$\underline{\alpha}^P = \underline{y}^P(\alpha, h(\alpha))^{-1} \tag{16}$$

A firm and a worker who meet and observe that their match would be characterized by a productivity level below $\underline{\alpha}^P$ prefer not to form the match and keep searching for better opportunities.

Given eq. (16), we can now define the expected value of a new open-ended match as $\mathbb{E}(J^P) = \int_{\underline{\alpha}^P}^{\alpha_u} J^P(y(\alpha, h(\alpha))dF(\alpha)$.

3.6 Equilibrium

The results presented above can be collected in the following definition of stationary equilibrium.

Definition 1. *An equilibrium is a scalar θ and a triple of functions $(h(\alpha),\ \check{s}(\alpha), w^P(\alpha, \varepsilon))$, such that*

1. *Inflows into unemployment equal outflows.*
2. *The value of all newly created productive matches is constant over time. Formally: $\dot{J}^P(y(\varepsilon_u)) = \dot{W}^P(y(\varepsilon_u)) = 0$.*
3. *Free entry holds: $J^V = 0$.*
4. *Firms maximize their expected payoff.*
5. *Workers and firms jointly choose the investment in human capital by maximizing over the value of the existing job relationship net of the cost of the investment.*
6. *Wages are established through Nash bargaining.*

The first point implies that the following flow-balance equation holds:

$$N^P \int_{\underline{\alpha}^P}^{\alpha_u} (s^P + \check{s}(\alpha))dF(\alpha) = \theta q(\theta) \left(1 - F(\underline{\alpha}^P)\right) u \tag{17}$$

In (17), inflows into unemployment are represented by quits and layoffs; outflows are new matches[18]. From eq. (17), we can derive a modified version of the Beveridge curve:

$$u = \frac{\bar{s}}{\tilde{f}(\theta) + \bar{s}} \tag{18}$$

[18] N^P can be taken out of the integral because we assume random matching and the value of α is discovered upon meeting. Had firms the possibility of directing their search according to the value of α, the distribution of α among the employed would differ from the distribution in the population.

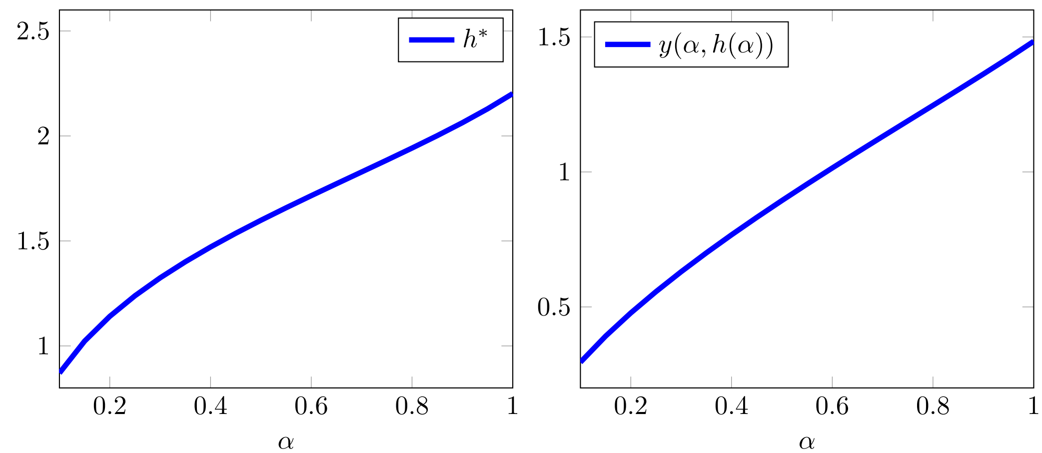


Figure 2: Optimal human capital accumulation and production

where $\bar{s} = \int_{\underline{\alpha}^P}^{\alpha_u} (s_P + \check{s}(\alpha) dF(\alpha)$ is the composite separation rate and $\tilde{f}(\theta) = \theta q(\theta) \left(1 - F(\underline{\alpha}^P)\right)$ is the job finding rate which takes into account also the probability of the match to be accepted by the firm as profitable. As usual, the Beveridge curve defines an inverse relationship between vacancies and unemployment. The novelty relies on the endogeneity of the firing rate, which depends on the EPL on open-ended contracts and the distribution of the match-specific productivity component in the population of employed. Then, in our model policy provisions affect the position of the Beveridge curve, hence the equilibrium unemployment rate.

Point 2 of Definition 1 was already implicit in the definition of the Bellman equations provided above, which were assumed to be time-invariant. Points 4 and 5 imply that $\check{s}(\alpha)$, $h(\alpha)$ and θ are the solutions to the optimality conditions (10), (11) and (13), respectively. Finally, the last point implies that the equilibrium wage is given by eq. (8).

The model is then calibrated and solved. The calibration is discussed below, when the results for the two-tier labour market are presented. It is sufficient to mention here that χ, the parameter which governs the efficiency of the matching technology, is chosen to obtain an equilibrium unemployment rate of 10%. The equilibrium values obtained in the one-tier market do not have a special interest by themselves; nevertheless, they represent a useful benchmark for a comparison with the outcomes in presence of FTCs.

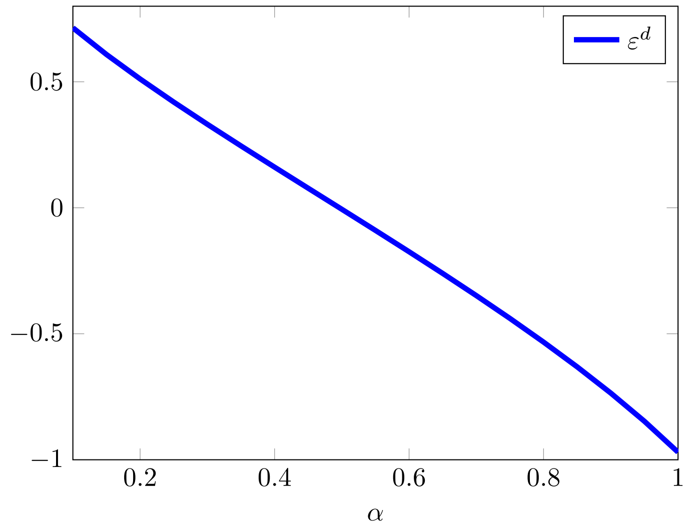


Figure 3: One tier labour market: job destruction threshold as function of α

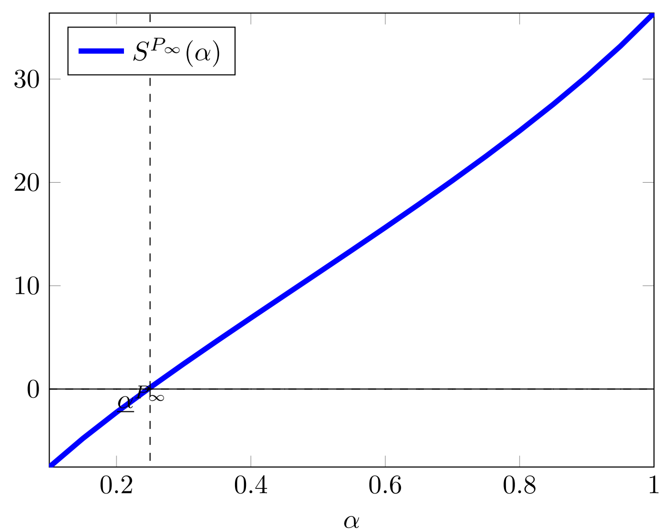


Figure 4: One tier labour market: surplus of a new match as function of α

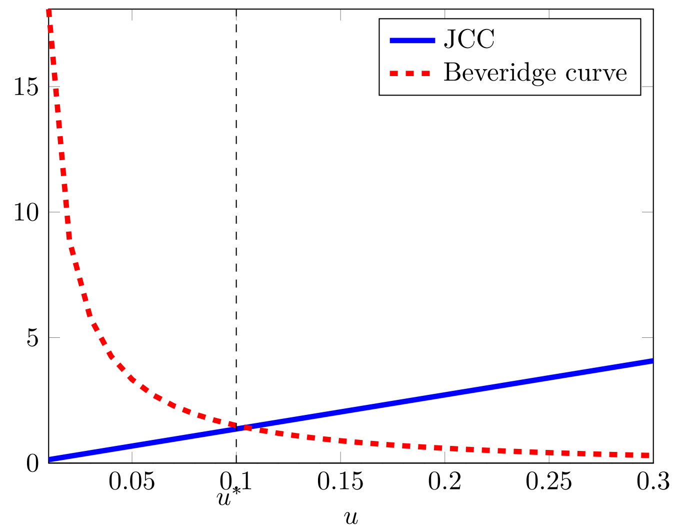


Figure 5: One tier labour market; job creating condition and Beveridge curve

We choose to present the results graphically. Figure 2 plots the optimal level of investment in human capital and the associated production level as functions of α. Figure 3 shows that low productivity workers are dismissed more frequently than the highly productive ones. Figure 4 depicts the behavior of the surplus of a new match, which enters in positive territory starting from $\underline{\alpha}^P$. Finally, the intersection between the Beveridge curve and the JCC which yields the equilibrium value of unemployment is displayed in Figure 5.

4 Two-tier Labour Market

In this section we extend the model presented in Section 3 by introducing the possibility of stipulating a second type of contract, which we label as temporary or fixed-term contract (FTC). Like open-ended contracts, FTCs start with firm specific productivity component ε_0, but they are exempted from firing costs in the initial period. To proxy the restrictions imposed by the law on the use of FTCs, we hypothesize that firms have to pay a fixed cost c^F if they opt for this contract. At rate μ^F, a new productivity value is drawn and the firm decide whether to continue the match under an open-ended contract or rather layoff the worker at no cost. Hence, in this case we need not to distinguish between ex-ante and ex-post surplus of the match because the outside option is the same.

The value of a new FTC is thus given by:

$$\begin{aligned} rJ^F(y_i(\varepsilon_0)) =& y_i(\varepsilon_0) - w^F(y_i(\varepsilon_0)) + s^F\left(\mathbb{E}(J^V) - J^F(y_i(\varepsilon_0))\right) \\ &+ \mu^F \int_{\varepsilon_l}^{\varepsilon_0} \max\left[J^P(y_i(\varepsilon')) - J^F(y_i(\varepsilon_0)); -J^F(y_i(\varepsilon_0))\right] dF(\varepsilon') \end{aligned} \tag{19}$$

The value of a new match to the worker is:

$$\begin{aligned} rW^F(y_i(\varepsilon_0)) = w^F(y_i(\varepsilon_0)) +& s^F\left(U - W^F(y_i(\varepsilon_0))\right) \\ &+ \mu^F \int_{\varepsilon_l}^{\varepsilon_0} \max\left[W^P(y_i(\varepsilon')) - W^F(y_i(\varepsilon_0)); U - W^F(y_i(\varepsilon_0))\right] dF(\varepsilon') \end{aligned} \tag{20}$$

The wage setting mechanism implies:

$$(1-\beta)\left(W^F(y_i(\varepsilon_0)) - U\right) = \beta J^F(y_i(\varepsilon_0)) \tag{21}$$

where $S^F(y_i(\varepsilon_0)) = W^F(y_i(\varepsilon_0)) - U + J^F(y_i(\varepsilon_0))$ is the joint surplus of a new match. We can thus compute the wage in the new match:

$$w^F(y_i(\varepsilon_0)) = \beta\left[y_i(\varepsilon_0) - \mu^F\left(1 - F(\varepsilon_d^F(y_i))\right)K\right] + (1-\beta)rU \tag{22}$$

where $\varepsilon_d^F(y_i)$ is the job destruction threshold for fixed-term contracts.

Equation (22) shows that the wage is lower than in continuing matches because of the absence of EPL provisions. Furthermore, initial wages are even lowered by the subsequent presence of firing costs, as the firms are able to partly transfer this cost from permanent to temporary workers.

Regarding the destruction of new matches we can easily show what it is summarized in the following Lemma.

Lemma 4. *Indicating with $\varepsilon_d^F(y_i)$ the job destruction threshold of a FTC producing y_i, then it* *satisfies* $S^0(y_i(\varepsilon_d^F(y_i))) = S^P(y_i(\varepsilon_d^F(y_i))) - K = 0$. *From Lemma 1 it follows that*

$$\varepsilon_d^F(y_i) = \varepsilon_d^P(y_i) + (r + s^P + \mu^P)K$$

where we have re-named μ as μ^P for clarity. Then, we can define the firing rate for FTCs as $\check{s}^F(y_i) = \mu^F F(\varepsilon_d^F(y_i))$. Lemma 4 implies that temporary contracts are generally destroyed more frequently except if μ^F is significantly lower than μ^P[19]. The job destruction threshold for FTCs is raised by firing costs because firms anticipate that future matches will be subject to them. However, there is an additional effect hidden in the expression reported in Lemma 4: as we are going to show below, for the same α, workers in temporary relationships tend to invest less in human capital, so that the their total productivity is reduced, making them more prone to layoff. The conversion rate from temporary to permanent for a worker producing y_i is $\mu^F(1 - F(\varepsilon_d^F(y_i)))$[20].

We can then compute a productivity threshold $\underline{y}^F$ below which creating a temporary match is unprofitable. This is defined as the productivity value such that $S^F(\underline{y}^F) - c^F = 0$. Computations yield:

$$\begin{aligned} \underline{y}^F &= rU - \varepsilon_0 - \frac{\mu^F}{r + s^P + \mu^P} \int_{\varepsilon_d^F(\underline{y}^F)}^{\varepsilon_u} (1 - F(\varepsilon'))d\varepsilon' + c^F \\ &= \underline{y}^P - \mu^P K + c^F + \frac{1}{r + s^P + \mu^P} \left[\mu^P \int_{\varepsilon_d^P(\underline{y}^P)}^{\varepsilon_u} (1 - F(\varepsilon'))d\varepsilon' - \mu^F \int_{\varepsilon_d^F(\underline{y}^F)}^{\varepsilon_u} (1 - F(\varepsilon'))d\varepsilon' \right] \end{aligned} \tag{23}$$

With respect to the profitability threshold for open-ended contract, fixed-term contract are more profitable because firms are not afraid of paying the firing costs in case of layoff. However, destruction occurs more often, thus implying higher losses, and EPL on FTCs aims at discouraging their usage. It follows that we cannot draw a clearcut prediction about the relationship between the two profitability thresholds. However, the first effect is likely to dominate.

[19] However, in this case it would be hard to justify the assumption that workers in FTCs are not hit by shocks to the firm's productivity component.

[20] We define the aggregate conversion rate as $\frac{\mu^F \int_{\underline{\alpha}^F}^{\tilde{\alpha}} \left(1 - F(\varepsilon_d^F(\alpha))\right) dG(\alpha)}{G(\tilde{\alpha}) - G(\underline{\alpha}^F)}$.

Now consider the choice of human capital accumulation in FTCs. The foc reads as:

$$\frac{1}{r+s^P+\mu^P F(\varepsilon_d^P(y_i))}\frac{\partial y(\alpha_i,h_i)}{\partial h_i}\left[\frac{r+s^P+\mu^F(1-F(\varepsilon_d^F(y_i)))+\mu^P F(\varepsilon_d^P(y_i))}{r+s^F+\mu^F}\right]=c'(h_i) \qquad (24)$$

To keep the problem interesting, we make the following assumption:

H 1. *We assume:*

$$s^F+\mu^F F(\varepsilon_d^F(y_i)) \geq s^P+\mu^P(\varepsilon_d^P(y_i)) \qquad \forall\ \alpha\ \in\ [\alpha_l,\alpha_u]$$

Assumption H1 simply means that a permanent contract is expected to last longer than a FTC. This occurs even when $s^F = s^P$ and $\mu^F = \mu^P$, because the job destruction threshold for FTCs is always higher than the corresponding threshold for permanent matches and the cdf is strictly increasing. Under the previous assumption, the comparison between equations (11) and (24) implies that the marginal benefit of investment in human capital (the l.h.s) is lower in FTCs than in open-ended contracts.

Proposition 1. *Assume $c''(h) > 0$ and Assumption H1 holds. Then, workers in temporary contracts invest less in human capital than workers in permanent matches. Formally,*

$$h^F(\alpha) \leq h^P(\alpha) \qquad \forall\ \alpha\ \in\ [\alpha_l,\alpha_u]$$

Proposition 1 makes clear that the firm-worker pair chooses to invest more in the job matches expected to last longer, since HC is lost upon separation.

We now want to characterize the model solution. Depending on the parameterization, different configurations may emerge. Suppose, for instance, that EPL on FTCs is set to a high value. Then, most likely FTCs would never be preferred to permanent ones. Instead of exploring all these different possibilities, we rather focus on the more interesting case of FTCs being more convenient for low-productivity matches and permanent contracts being more profitable for higher values of

α. Appendix A.1 discusses the set of parameter configurations which guarantee the emergence of a pooling equilibrium in the flows of hiring[21]. Let define $\tilde{\alpha}$ as the match productivity value such that the parties are indifferent between stipulating a temporary or a permanent contract[22].

The following Proposition introduces the three equilibria in the flows of hirings that may emerge.

Proposition 2. *Under Assumption H3 and $\tilde{\alpha}$ as defined in Lemma 5, three equilibria in the flows of hirings may emerge:*

1. $\tilde{p} = 1$ *iff* $\underline{\alpha}^P \leq \underline{\alpha}^F$ *(separating equilibrium with all permanent).*
2. $\tilde{p} = 0$ *iff* $\underline{\alpha}^P > \underline{\alpha}^F$ *and* $\tilde{\alpha} \geq \alpha_u$ *(separating equilibrium with all temporary).*
3. $\tilde{p} \in (0, 1)$ *iff* $\underline{\alpha}^P > \underline{\alpha}^F$ *and* $\tilde{\alpha} < \alpha_u$ *(pooling equilibrium: co-existence of temporary and permanent).*

The first case occurs when the advantages of a fixed-term contract (lower wages, no firing costs in case of layoff) never overcome the benefit of inducing more human capital investment related to the expected longer duration of a permanent contract. In the second case, FTCs are always superior to open-ended contracts in the range of admissible productivity values, so that new matches are never stipulated directly as permanent. The third case is the most interesting one, where low-productivity matches are offered a FTC and high-productivity matches start directly as permanent. We have thus shown that, for some parameterizations, it is possible to obtain the endogenous emergence of duality in hiring activities. Notice that duality in the stock of employed workers can still be present under the second case, which does not exclude that some matches starting as temporary are converted later on.

From now on we focus on the third case as the most interesting one. The value of a vacancy needs to be modified to take into account the presence of two types of contracts, which are chosen

[21] With this term we denote the co-existence of hirings both under temporary and permanent contracts, i.e. $\tilde{p} \in (0, 1)$.

[22] See Lemma 5 in Appendix A.1 for a formal definition.

according to their relative convenience:

$$J^V = -\kappa + q(\theta)\left[\int_{\underline{\alpha}^F}^{\tilde{\alpha}} (J^F(\alpha) - c^F - (1-\beta)c(h^F(\alpha))dF(\alpha) + \int_{\tilde{\alpha}}^{\alpha_u} \left(J^P(\alpha) - (1-\beta)c(h^P(\alpha))\right) dF(\alpha)\right] =$$

$$= -\kappa + q(\theta)\left[\mathbb{E}(J^F) - \left(F(\tilde{\alpha}) - F(\underline{\alpha}^F)\right) c^F + \mathbb{E}(J^P) - (1-\beta)\mathbb{E}\left(c(h)\right) - (1 - F(\underline{\alpha}^F))J^V\right]$$

Free entry implies:

$$\mathbb{E}(J^F) + \mathbb{E}(J^P) = \frac{\kappa}{q(\theta)} + (1-\beta)\mathbb{E}\left(c(h)\right) + \left(F(\tilde{\alpha}) - F(\underline{\alpha}^F)\right) c^F$$

The flow value of unemployment does not change much, except for the profitability threshold to take into account and the presence of EPL on FTCs:

$$rU = b + \theta q(\theta)\left[\frac{\beta}{1-\beta}\left(\frac{\kappa}{q(\theta)} + \mathbb{E}(c^F) + \left(1 - F(\underline{\alpha}^F)\right) K\right)\right] \tag{25}$$

Finally, the flow-balance equation now reads as follows:

$$N^F \int_{\underline{\alpha}^F}^{\tilde{\alpha}} (s^F + \check{s}^F(\alpha))dF(\alpha) + N^P \int_{\tilde{\alpha}}^{\alpha_u} (s^P + \check{s}^P(\alpha))dF(\alpha) = \theta q(\theta)\left(1 - F(\underline{\alpha}^F)\right) u$$

$$(1-u)\bar{s} = \theta q(\theta)\left(1 - F(\underline{\alpha}^F)\right) u$$

where the composite separation rate is

$$\bar{s} = (1-\tilde{p})\int_{\underline{\alpha}^F}^{\tilde{\alpha}} (s^F + \check{s}^F(\alpha))dF(\alpha) + \tilde{p}\int_{\tilde{\alpha}}^{\alpha_u} (s^P + \check{s}^P(\alpha))dF(\alpha)$$

and the proportion of new hirings stipulated under a permanent contract is $\tilde{p} = \frac{1-F(\tilde{\alpha})}{1-F(\underline{\alpha}^F)}$.

4.1 Calibration and Results

We calibrate the model on a monthly basis. The annual interest rate is set to 10%: with this fairly high value we want to capture an average between the risk-free rate paid by the market and the actual interest rate often faced by financially constrained households. The elasticity of the

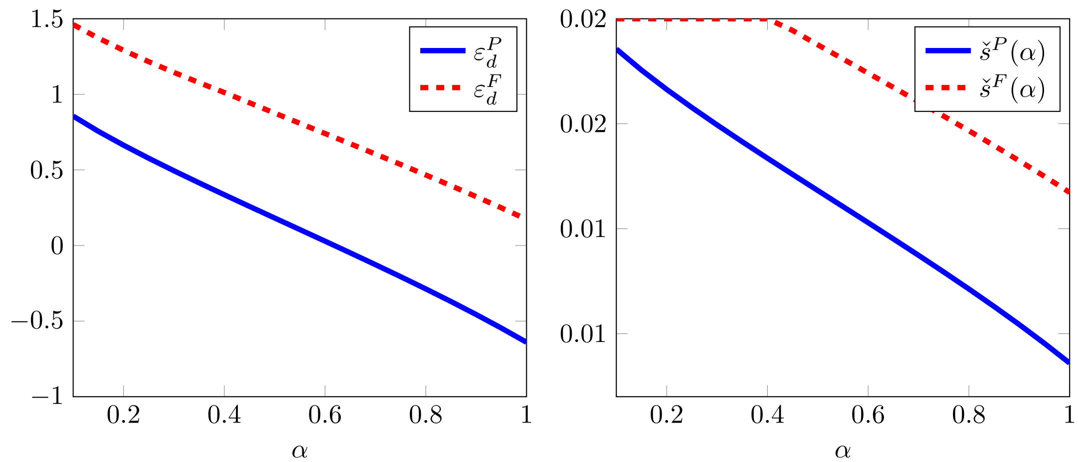


Figure 6: Job destruction threshold (left) and firing rates (right) for permanent and FTCs

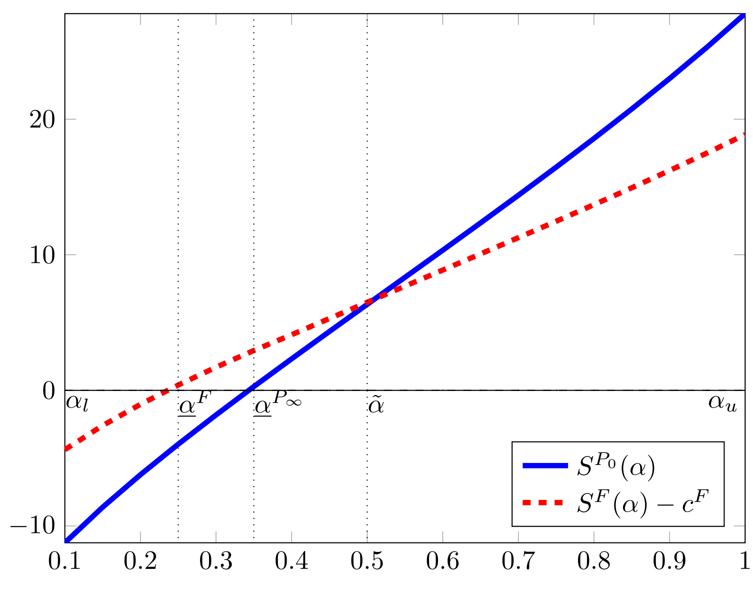


Figure 7: Joint surplus of permanent and FTCs

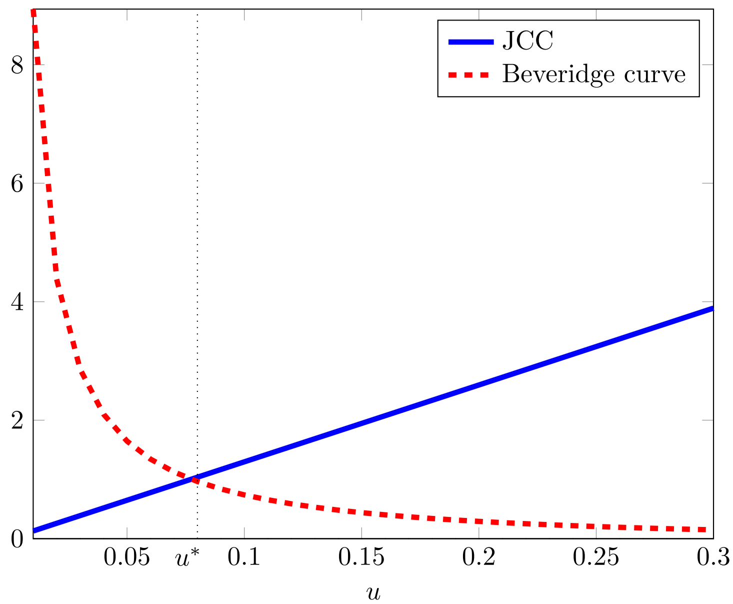


Figure 8: Two tier labour market: job creating condition and Beveridge curve

matching function and the workers' bargaining power are both set to the standard values of 0.5, such that the Hosios-Pissarides condition holds. The matching efficiency (χ) is calibrated to target an unemployment rate of 10% in the benchmark setting where only open-ended contracts exist. The vacancy posting cost κ corresponds to roughly 0.5% of the average wage in the benchmark setting. Production occurs according to a Cobb-Douglas function whose arguments are the match-specific productivity component and human capital, to which is added the firm-specific component ε. The weight on α in the Cobb-Douglas part is denoted by ζ and set to 0.5[23]. The quit rate in permanent contracts is set to 0.01, while we assume a higher exogenous separation rate for FTCs. There are number of reasons to believe that this is a sensible assumption: workers hired with temporary contracts feel more insecure about their future career and are likely to search more intensely for

[23] Formally, $y(\varepsilon) = \alpha^{\zeta}(Bh)^{1-\zeta} + \varepsilon$, where B is a human capital augmenting factor.

another job[24,25]. We impose symmetry in the arrival rate of shocks in permanent and FTCs, by setting $\mu^P = \mu^F = 0.02$. For simplicity, we assume that both the match and the firm specific productivity components follow uniform distributions, the first ranging from 0.1 to 1 and ε from -1 to 1. The EPL on the creation of FTCs (c^F) is normalized to 1, while firing costs are about 8 months of pay. The calibration is summarized in Table 6.

The endogenous outcomes of the model are reported in Table 7, where different parameterizations are compared. With respect to the benchmark setting, the introduction of FTCs substantially lowers the unemployment rate (from 10.4% to 7.7%). For the benchmark two tier labour market, roughly 35% of new hirings are temporary positions, and 90% of the labour force holds a permanent job. This last figure is remarkably close to the Italian data. As for the distinction of inflows into employment by contract type, it is more difficult to find data comparable to the model. Indeed, one would like to select the subsample of temporary workers considered by the firm as closely substitute to the permanent ones, thus excluding FTCs stipulated for short-lived projects, replacement of absentees, etc. However, data on flows are scarce and do not allow this type of analysis. As expected, permanent jobs feature higher wages than temporary ones: this is due both to selection of highly productive workers in more stable jobs and to the presence of firing costs. This empirical implication of our model has been verified by a number of authors[26]. The wage distribution of open-ended contracts is more compressed than for FTCs, because only matches featuring high productivity are stipulated and promoted to permanent.

Moving from the second to the third column, we consider a framework with higher firing costs ($K = 20$). First, notice the highly detrimental effect on unemployment, which raises to 11%. In this

[24]For a formal justification of this assumption and evidence based on European data, see Kahn (2012).

[25]Although we assume $s^F > s^P$ for simplicity, one should not necessarily believe that quits occur more often in FTCs rather than in permanent jobs. An equivalent interpretation requires that at the expiration of a temporary contract, there is a non-zero probability that the match cannot be continued even if the surplus is positive. This can occur because, for instance, the worker has found another match in the meanwhile or because the firm needed the worker only for a short-term project or to replace another worker on leave.

[26]For the British case, Booth, Francesconi, and Franck (2002) find that temporary workers suffer from wage gaps, but they catch up quickly if they are converted: this is consistent with our model which predicts that an important component of the wage in permanent jobs is related to the presence of firing costs. The existence of a wage premium for permanent contracts in several European countries has been documented by Comi and Grasseni (2009), Santangelo (2011) and Cazes and Laiglesia (2014).

world, firms are more discouraged to use open-ended contracts: the fraction of new hirings stipulated directly as permanent lowers to 58% but conversion rates are slightly higher. The average wage in permanent contracts is higher than in the benchmark, both because only very productive workers are granted a permanent job and because the direct and indirect effect of firing costs. The first one operates because firing costs act as a threat and they increase the workers' effective bargaining power; the indirect effect comes from the induced higher investment in human capital which raises productivity for any given α.

The fourth and fifth columns consider the case of a flexibilization in the use of FTCs, either extending the maximum length ($\mu^F = 0.015$) or removing constraints on their stipulation ($c^F = 0$). The results are similar when either of the two policies is adopted. The use of FTCs is encouraged and job destruction increases. As for the fourth column, the increased length of the temporary contracts encourages investment in human capital and make conversions more likely to occur. Job creation, measured by labor market tightness, is strongly positively affected. It is apparent here the well known trade-off entailed by the liberalization of temporary contracts: since these reforms increase both job creation and job destruction, the net effect on unemployment is ambiguous. In our simulations, unemployment is increased by 0.8 percentage points with respect to the benchmark case.

Finally, in the last column we consider a higher weight of HC in the production function ($\zeta = 0.4$). This amounts to consider the response of knowledge intensive (KI) sectors, where investment in firm specific skills is more valuable. The third row shows that they are willing to stipulate more matches directly with open-ended contracts because they are more interested in fostering HC investment. However, conversions radically diminish, because all matches stipulated as FTCs are those which provide low value to the firm. Job creation increases, as well as employment; however, the latter outcome is not very meaningful *per se*, since one would think that the aggregate unemployment rate is determined by the hiring strategies of a composition of more and less KI sectors.

Overall, the magnitude of conversion rate results too low with respect to its empirical counterpart. This happens not only because firms are too selective in the required productivity level, but

Table 6: Benchmark calibration

Parameter	**Definition**	**Value**
r	discount rate (annual)	0.10
κ	vacancy posting cost	0.01
χ	matching efficiency	0.04
η	elasticity of the matching function w.r.t V	0.5
β	workers bargaining power	0.5
s^F	quit rate FTC	0.02
s^P	quit rate permanent contract	0.01
μ^P	arrival rate of shocks	0.02
μ^F	arrival rate of ending FTC	0.02
α_l	skills distribution: lower bound	0.1
α_u	skills distribution: upper bound	1.0
ε_l	shock distribution: lower bound	-1.0
ε_u	shock distribution: upper bound	1.0
c_F	EPL on FTCs	1
K	firing costs	15

because conversions are decided when the match is hit by a shock which almost certainly lowers the initial firm-specific productivity component.

Table 7: Endogenous outcomes and policy simulations

	Bench One Tier	Bench Two Tier	Longer FTCs	no EPL on FTCs	KI sector	Higher Firing Costs
u	0.104	0.077	0.085	0.084	0.077	0.077
θ	13.6	13.0	17.3	16.3	13.0	13.0
$\tilde{p}$	n.a.	0.64	0.38	0.47	0.79	0.55
p	n.a	0.91	0.79	0.84	0.94	0.88
$\check{p}$	n.a	0.00025	0.00056	0.00038	0.00010	0.00024
$\bar{s}$	0.015	0.011	0.012	0.012	0.011	0.011
$\mathbb{E}(w^P)$	1.80	1.93	2.06	2.02	2.00	2.01
$\mathbb{E}(w^F)$	n.a	1.49	1.67	1.60	1.48	1.48
$\sigma(w^P)$	0.68	0.96	0.93	0.98	0.88	1.00
$\sigma(w^F)$	n.a	1.40	1.28	1.33	1.58	1.33

Column 1: benchmark model (see calibration Table 6) with open-ended contracts only. Column 2: benchmark model (see calibration Table 6) when both permanent and temporary contracts are available. Column 3: two-tier model with $K = 20$. Column 4: two-tier model with $\mu^F = 0.015$. Column 5: two-tier model with $c^F = 0$. Column 6: two-tier model with $\zeta = 0.4$ (higher weight on HC in the production function).

5 Empirics

In this section, we set out to test the predictions derived from the theory. The analysis can be separated into a correlation part [A] and a causation one [B]. In the former, we seek to directly verify on the data our main results. The latter tests our simulated policy scenarios (see Table 7) through the evaluation of a reform liberalizing the use of FTCs.

5.1 Correlations [A]

Let us first review the main model predictions. The first set of results concerns the [I] length of FTCs. In facts, [i] FTCs should be longer in KI sectors because firms are more interested in enhancing investment in HC; [ii] moreover, their length increases when conditioning on the conversion rate to permanent jobs.

The second set of results pertains the [II] impact of firing costs. To begin with, [iii] firing costs should discourage conversions. Additional implications may be observed on [iv] wage levels, and on [v] wage dispersion. The analysis of the last two objects relies on the possible combinations of two effects driven by firing costs. [a] Indirect effect: higher dismissal taxes induce more investment in human capital, thus raising productivity. [b] Direct effect: by raising workers' bargaining power, firing costs increase wages. With respect to the wage level [iv]: under [a], for equal job positions, permanent workers earn wages higher than temporary ones. Furthemore, due to [iv.b], this difference increases in the firm's size (higher firing costs). On the wage dispersion side, [v.a] implies that bigger firms display greater variance, as the HC distribution is more spread out[27]. Finally, as under [v.b] higher firing costs increase the worker's threat point, firms become more selective when stipulating permanent positions, which leads to a concentrated wage distribution. Table 7 simulations shows that the latter effect strongly dominates over [v.a].

Finally the third [III] set of outcomes concerns the [vi] dynamic and [vii] equilibrium distributions of new contracts.

[27]Recall the complementarity assumed between match-specific productivity and investment in HC.

Below we present results on the FTCs length [I.i] and [I.ii], and on the impact of firing costs on conversions [II. iii]. The analysis on wage levels and dispersion relies on information of workers' and job characteristics, which are still under revision. With respect to the distribution of contracts [III], we confirm the results found in Table 7 concerning [III.vii] the equilibrium share of permanent contracts in the economy ($p = .91$). This figure is remarkably close to average observed in the data. Testing for the distribution of new hires ($\tilde{p}$) requires the constitution of hiring flows, currently under construction. Overall, the magnitude of conversion rate results too low with respect to its empirical counterpart. This happens not only because firms are too selective in the required productivity level, but because conversions are decided when the match is hit by a shock which almost certainly lowers the initial firm-specific productivity component.

5.1.1 Length of temporary contracts: sectoral heterogeneity [I]

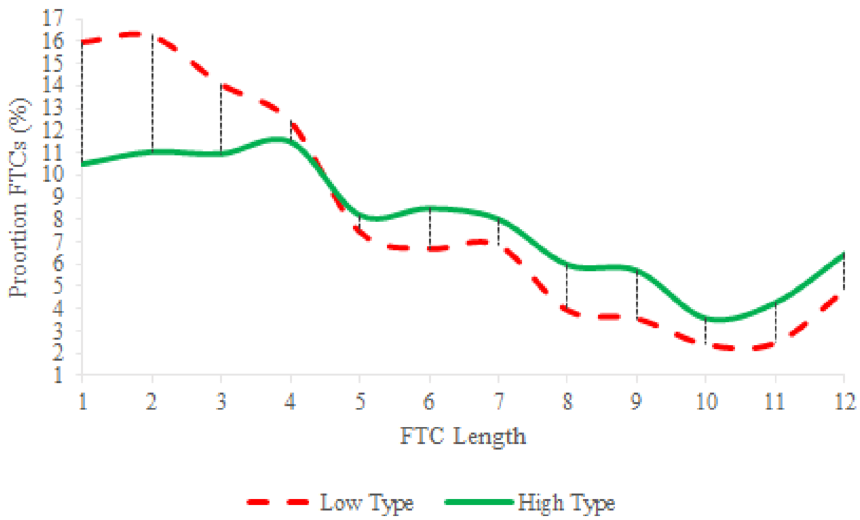
First, we want to know whether different industries vary in their FTCs use. To this end, we disaggregate our knowledge intensity measure into quartiles[28], and analyse the relative density of FTCs length. Figure 9 compares the first and last quartiles. As expected, panel (a), the proportion of extremely short contracts is systematically smaller for KI firms. Interestingly, passed the 5-month length, the fourth quartile dominates the first one. This means that, on average, KI firms employ longer contracts than low-type firms. We then split the observations between blue and white collars, and obtain further useful information. Panel (b) shows that low-type workers have shorter contracts in low-type firms. Panel (c) tells us that the density of FTCs length for white collars is skewed to the right with respect to its blue-collar counterparts. Not surprisingly, Q1 and Q4 show very similar trends. This suggests that the few skilled workers in manual industries are similar to those employed in KI firms. Finally, note there are less high-type workers with a FTC

[28]In doing so, we exclude industries regulated by special disciplines, or that structurally employ very short contracts. These are agriculture, forestry and fishery; public administrations and related sectors; entertainment (audio-visual productions, theatre, cultural events). Furthermore, to avoid denominator issues, we also exclude industries with less than 100 observations.

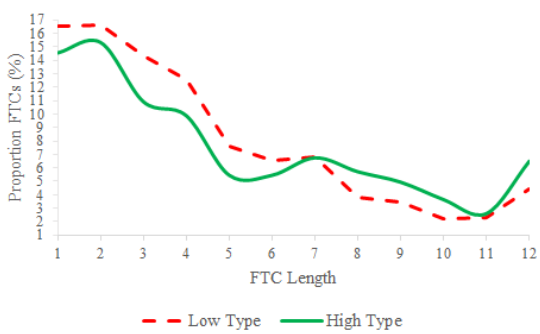
than low types.

Figure 9: Density of FTCs Length

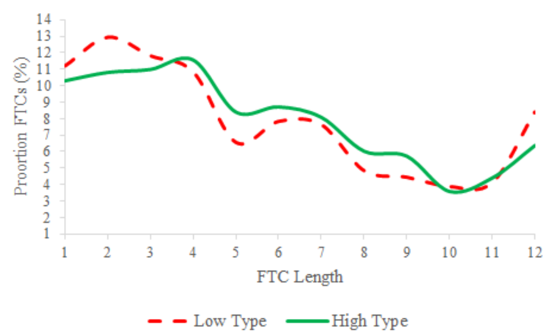
(a) Blue and White Collars



(b) Blue Collars



(c) White Collars



Source: Veneto Workers History.

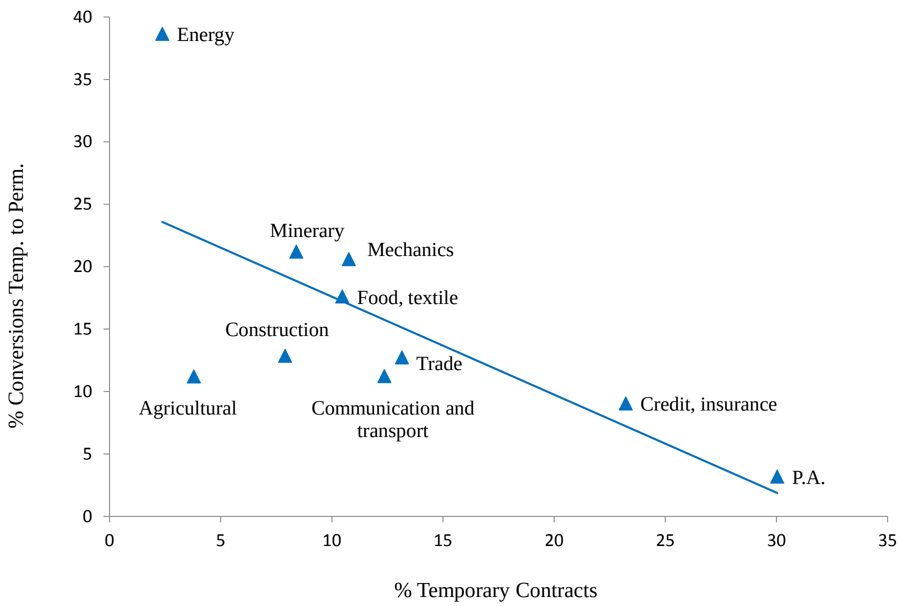
We use the share $\frac{white-collars}{(blue+white)-collars}$ to measure industry knowledge intensity. The graph depicts the first (0-0.25) and last (0.75-1) quartiles of the index.

Tables 8, 9, 10 extend Tables 2, 3, 4 in Section A.2, and provide additional evidence on the average length of temporary contracts by industry. Table 8 seems to point to a substantial homogeneity in the average length of temporary contracts across sectors. However, this is due to a pure aggregation effect. When looking at more disaggregated data, we can detect significant heterogeneities: Tables 9 and 10 provide two of such examples at 2 and 3 digits of classification levels, respectively. Notice the negative correlation between the fraction of temporary contracts and their average length. As for financial services, auxiliary activities employ almost 30% of workers in very short-term positions, whose average length does not go beyond four months. On the contrary, credit institutes and insurance companies offer much less temporary jobs and for a longer duration. Similarly, pharmaceuticals do offer relatively more stable jobs, both because more positions are permanent and because even temporary contracts last longer. In summary, comparatively more KI sectors tend to offer more permanent jobs and lengthier FTCs.

These findings are in line with the theoretical predictions. In our model, KI firms are more interested in inducing sustained HC accumulation: they can do that by offering permanent contracts and lengthening short-term contracts. Taking into account the screening motive further reinforces the intuition. If more qualified positions are characterized by a slower learning process of the productivity of the match, firms operating in KI sectors prefer to profit from longer screening time through FTCs. Moreover, we expect the average contract length to be higher conditional on conversions. A realized conversion, in fact, indicates that the firm was already considering that match as a good candidate for a permanent position. As such, it is interested both in inducing a higher level of HC investment and in properly detecting the true productivity of the worker by offering longer contracts. This prediction is robustly confirmed by the last column of the same Tables.

Another evidence that emerges from Tables 8-10 is a negative correlation between the fraction of temporary contracts and conversion rates. We provide a graphical representation for macro sectors in Figure 10. This observation seems in contrast to the simulation results reported in Table 7. In the benchmark two-tier model with perfect observation of match quality, KI firms sort matches into different contracts types from the formation of the match, and conversions are rare. However, the extension we consider in Section A.2 offers additional insights. Assuming that firms need more time to learn the quality of highly qualified jobs, KI sectors recur more often to FTCs for screening motives. Then, they convert those matches that prove to be sufficiently productive. On the contrary, if FTCs are not used for screening purposes but rather as buffer stock, there is no reason to upgrade them upon expiration.

Figure 10: Temporary contracts and conversion rates by industry



Source: Veneto Working Histories. Industry classification: ATECO 1981, 1-digit level.

Table 8: Temporary contracts by sector - 1 digit level

	Sector	**Tot. obs.**	**Temp. obs.**	**% temp. contr.**	**% conversions temp to perm.**	**Average length temp. contr.**	**Average length temp. contr. | conversion**
0	Agricultural, forestry and fishery	38446	145900	3.79	11.21	5.24	6.65
1	Manufacturing: energy, gas and water	74288	176400	2.37	38.65	4.73	4.18
2	Manufacturing: minerary and chemical	339910	2857900	8.41	21.21	5.34	6.41
3	Manufacturing: metals and mechanics	1414556	15228600	10.77	20.61	5.33	6.73
4	Manufacturing: food, textile, leather, clothing, timber, paper, other	1397618	14631300	10.47	17.61	4.86	6.57
5	Building and constructions	485269	3833700	7.90	12.86	4.54	5.75
6	Wholesale and retail trade; lodging and catering; recovery and repair service	1364684	17952100	13.15	12.74	4.23	6.38
7	Communication and transport services	322669	3990000	12.37	11.24	4.50	6.11
8	Credit, insurance, business services provided to enterprises	768192	17839800	23.22	9.05	4.01	5.57
9	Public administration, private and public services	721164	21661300	30.04	3.19	4.09	5.68
	Total	6926796	98317000	14.19	11.85	4.48	6.12

Source: Veneto Working Histories. Sector classification: ATECO 1981 - 1 digit level.

Table 9: Temporary contracts by sector - 2 digits level

	Sector 8 - Credit, insurance, business services	**Tot. obs.**	**Temp. obs.**	**% temp. contr.**	**% conversions temp to perm.**	**Average length temp. contr.**	**Average length temp. contr. | conversion**
81	Credit institutions	162429	1088600	6.70	25.48	7.25	8.24
82	Insurance (except compulsory social security)	29672	163100	5.50	75.41	6.40	7.22
83	Activities auxiliary to financial services and insurance activities; real estate	576091	16538600	28.71	7.89	3.78	5.52
	Total	768192	17790300	23.16	9.58	4.02	5.70

Source: Veneto Working Histories. Sector classification: ATECO 1981 - 2 digits level.

Table 10: Temporary contracts by sector - 3 digits level

	Sector 25 - Chemical industries	**Tot. obs.**	**Temp. obs.**	**% temp. contr.**	**% conversions temp to perm.**	**Average length temp. contr.**	**Average length temp. contr. | conversion**
251	Basic chemical products	30973	313300	10.12	18.74	4.77	5.85
257	Pharmaceuticals	31413	247900	7.89	22.87	7.14	7.21
258	Soaps, cleaning products and cosmetics	6369	82900	13.02	17.42	5.38	6.32
	Total	68755	644100	9.37	20.16	18.63	19.09

Source: Veneto Working Histories. Sector classification: ATECO 1981 - 3 digits level.

5.1.2 Firing Costs [II]

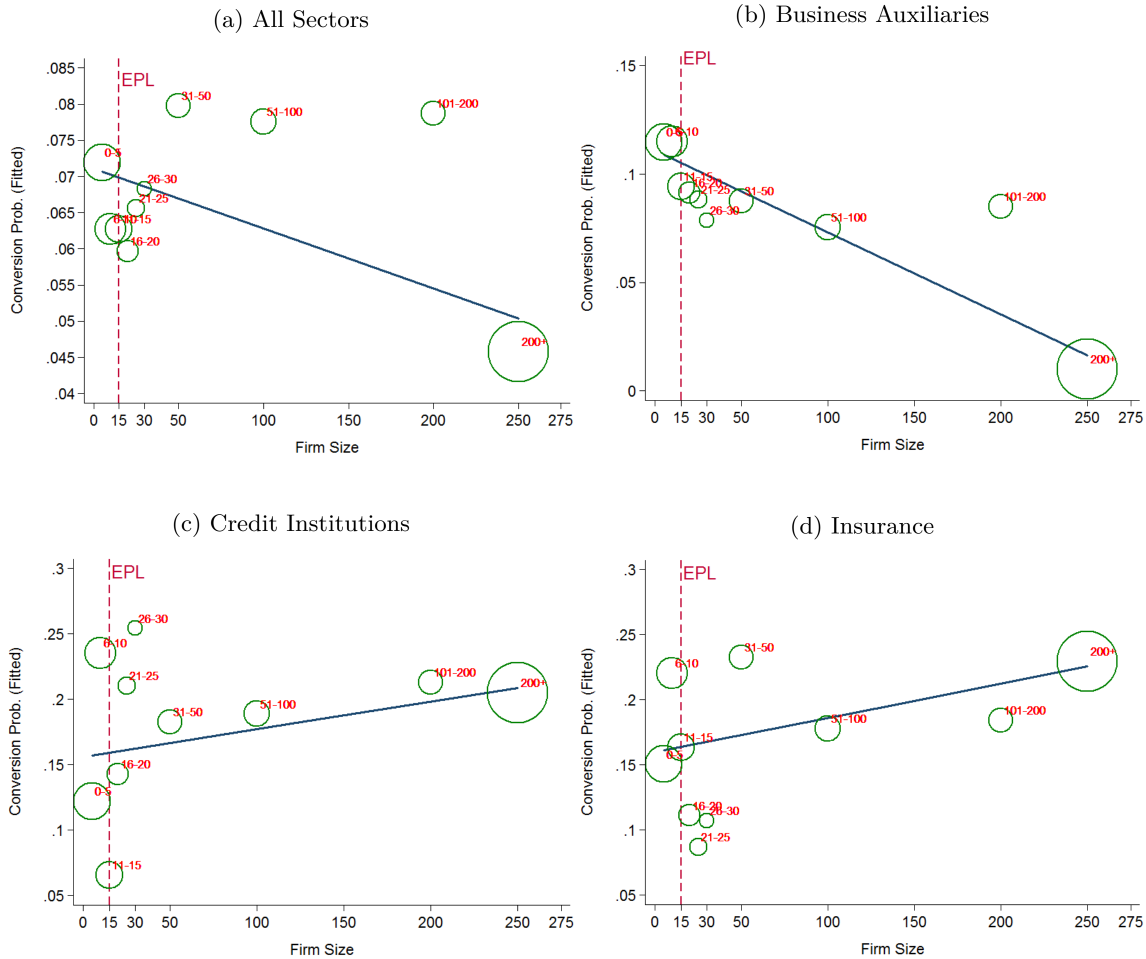
Conversions [II.iii]

A first, testable impact of firing costs on firms' decisions concerns the conversion of FTCs into permanent positions. From the model, we know that the contract-upgrading productivity threshold increases with workers' protection. Thus, we expect the conversion probability to decrease in firing costs. Empirically, the latter can proxied by firms' size. In various countries[29], EPL protection from unjustified dismissal triggers at specific thresholds. In Italy, all firms with workforce bigger than 15 employees face substantially stronger exit restrictions. These entail long and costly judicial procedures, leading to worker's reinstatement or monetary reparations. The analysis of firms' concentration around this threshold goes beyond the scope of this paper. However, a few contributions[30] find positive but small evidence of bunching. Indeed, because of various exceptions in the determination of the workforce size, the threshold's impact results less sharp than in other countries. Hence, if we were to expect any effects on conversions, these would be loosely distributed around the 15-employee threshold. We test this hypothesis on the INPS data, where we have identified all conversions from standard FTCs to permanent jobs. Figure 11 regresses the conversion dummy on firms' dimension and then plot the fitted probability values, weighted by the number of observations. As expected, panel (a), we observe that the likelihood of FTCs transformation rapidly decreases in firms' size, to bounce back up when firms are distant from the threshold. The drop in likelihood after size 200 could be imputed to the particular characteristics of these firms. Once again, industry disaggregation tells a more subtle story. The financial sector provides an interesting example. Indeed, firms employing many FTCs (panel (b)) show a decreasing conversion trend. On the contrary, panels c and d, once passed the dismissal-cost threshold, KI firms display an increasing tendency for conversions.

[29]See Empirical Appendix, Table 11, sixth column.

[30]See for instance Garibaldi et al. (2003), Schivardi and Torrini (2008), Leonardi and Pica (2013).

Figure 11: Fitted probability of conversion by firm size



Source: LoSai database, INPS. Years: 1998-2004. Industry classification: ATECO 1981, 2-digit level. Panel (a): All industries; 1,369,356 obs. Panel (b): industry 83; 242,729 obs. Panel (c): industry 81; 10,993 obs. Panel (d): industry 82; 2,104 obs. We identify all conversions between FTCs and permanent contracts. We then regress the resulting binary variable on firm size, and capture the regression's predicted values. The reference size bracket is fixed at [0-5]; standard errors are robust. The graphs report the correlation between the fitted probabilities of conversion and firm size, weighted by the density of each bracket. The EPL on open-ended contracts entails higher dismissal costs for firms above 15 employees. However, the cut-off is fuzzy due to the complex calculation of the workforce.

Wage Level [II.iv]

[Work in progress]

Wage Dispersion [II.v]

[Work in progress]

5.2 Causality [B]

The correlation analysis so far conducted has provided evidence in support of our main hypotheses. Indeed, firms in KI industries tend to employ more permanent workers, but if they recur to FTCs, they use them for a longer period and convert them more. Moreover, on average, firing costs seem to discourage the transformation of FTCs into permanent ones.

To complement these results, and to match empirically our policy simulations, we evaluate a reform that lifted several EPL restrictions on standard FTCs. The Italian labour market is characterized by a marked insiders/outsiders structure. Dismissal restrictions are among the strongest in the OECD, and there exist a plethora of different temporary work arrangements. A simple descriptive analysis reveals the existence of a veritable "contract jungle". Since the mid-nineties, almost every government has tried to remodel the existing labour structure[31]. A few milestones have marked the history of temporary contracts in Italy. FTCs were first introduced in 1962, surviving 40 years without any reform. Stipulation was allowed for a determined list of cases (negative liberty), and quantitative limits on their use were left to industry negotiation. Their length was limited to 6 months, extensible to a cumulated maximum of 12 months. However, in 1999, a European Union Directive issued guidelines for the liberalization of FTCs, shifting their liberty of stipulation from negative to positive. Each member state was left free to tailor the implementation of the Directive; Italy adopted its new measures in October 2001[32]. The new discipline abolished quotas for FTCs

[31]See the Legal Appendix for a description of all contract characteristics and a timeline of the most relevant reforms.

[32]Legislative Decree 6 September 2001, n. 368. See Legal Appendix for further details.

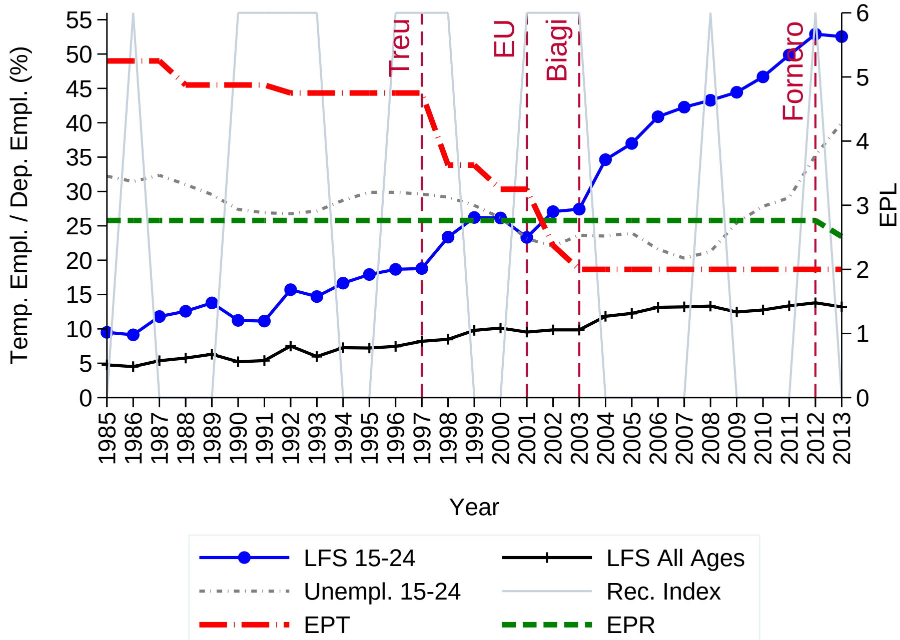
stipulated to replace absent workers, for seasonal needs or productive peaks, and at the start of new businesses. The cumulative length of FTCs increased up to 36 months. However, within this length, contracts could only be extended a single time. Furthermore, all quantitative restrictions were lifted from FTCs used for ordinary activities, if their length (extension included) was inferior to 7 months. Finally, the workforce computation for the application of EPL on permanent jobs was restricted to contracts longer than 9 months.

Before this reform, another major event had strongly affected the nature of temporary employment. Indeed, in 1997, the "Treu Law" introduced interim (TWA) contracts in the attempt to slow down the rapidly increasing unemployment rate. Figure 12 summarizes the evolution of the labour market over the last 20 years. We immediately observe that the young are the most sensitive category to changes in temporary contracts legislation. The decrease in EPT[33] is mirrored by a proportional increase of the young's short-term employment. This trend seems to diverge even more after the introduction of the "Biagi Law." Despite its graphical appeal, this reform is less pertinent to our theoretical analysis. Indeed, the new legal provision only further liberalized TWA jobs, and introduced new "project contracts" or "work missions" that can be assimilated to self-employment[34]. Our focus being on dependent employment only, we will target our analysis on the 2001 reform.

[33]Employment Protection Legislation on Temporary contracts.

[34]The Labour Force Survey (LFS), from which the data are drawn, does not make any distinction between standard FTCs, interim jobs, project contracts, and other specific training contracts.

Figure 12: Italy: Share of Temporary Employment by Age Groups

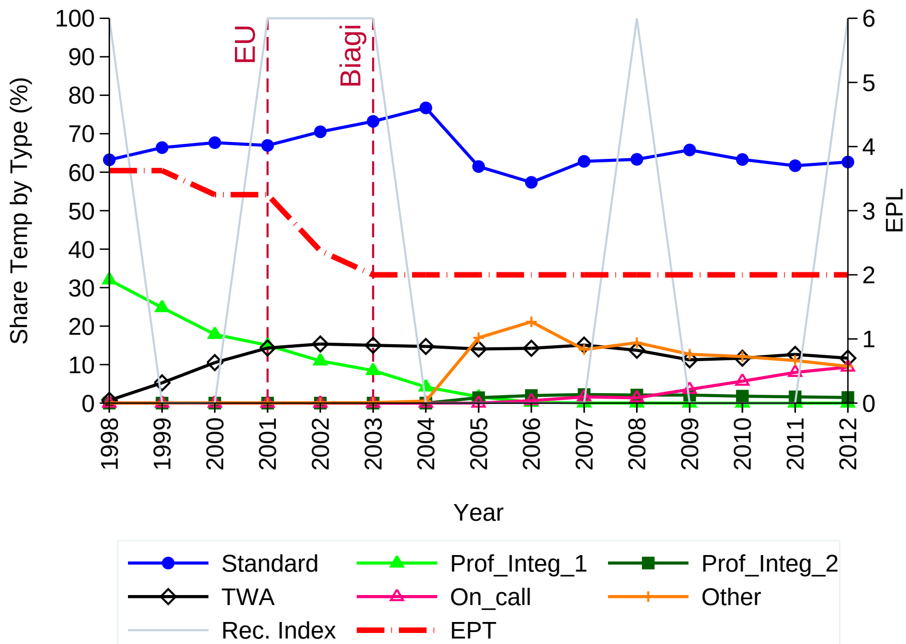


Source: Aggregate data from the Italian Labor Force Survey (LFS); OECD, Employment Protection Legislation (EPL) index; St. Louis Federal reserve, Recession Index.

Note: The OECD computes an aggregate measure of employment protection, rated on a (0-6) scale. EPR represents the index for regular (open-ended) contracts, rating legislation on individual and collective dismissals. EPT is the corresponding index for standard fixed-term positions, and contracts stipulated by temporary work agencies. EPT measures valid cases for use, the maximum number of successive contracts and maximum cumulated duration.
The LFS considers temporary workers: i)persons with a seasonable job; ii)persons engaged by an employment agency or business and hired out to a third party for the carrying out of a "work mission;" iii)persons with specific training contracts.
The vertical dotted lines mark labor reforms: a)Treu law (1997) introduced temporary work agencies (TWA) in Italy; b)EU directive (1999 but enforced in 2001) lifted qualitative and quantitative restrictions on standard temporary contracts; c)Biagi law further liberalized TWA jobs, and introduced new contract forms; d)Fornero law lowered firing costs for regular (permanent) contracts.

However, by looking at Figure 12, it could be argued that not much has changed after the implementation of the EU Directive. This is due to the level of aggregation of LFS data. Indeed, by looking at the same figure with INPS data (Figure 11), we see how the reform has significantly shifted the composition of temporary employment from interim contracts to standard FTCs. Indeed, the trend of FTCs has crowded-out the previously growing one of TWA. This fact confirms the idea that firms prefer to directly employ their workforce, either for investment or screening reasons. The 2003 introduction of new types of contracts complicates the picture, as some of the regular short-term jobs shifted from dependent to self-employed. We argue that this further shift has only affected those jobs corresponding with specific firms' organizational needs.

Figure 13: Temporary contracts composition



Let us now recapitulate the intuitions drawn from the empirical evidence, and from our simulations. KI firms employ a higher proportion of permanent contracts in the stationary distributions. However, when they recur to FTCs, these are longer than in other industries, in particular conditioning on conversions to open-ended jobs. On the one hand, this suggests a form of positive assortative matching in HC investment between workers and firms. On the other hand, KI firms seem to employ FTCs for different reasons than low type employers. This fact is confirmed by the differential impact of dismissal costs on firms operating in different industries. Evaluating the full theoretical impact of EPL on different firm types requires the computation of several cross-derivatives. For the time being, we forecast reforms' outcomes based on our bottom-line simulation predictions, and stylized facts.

The 2001 reform liberalized FTCs, extending their maximum length, and lifting restrictions (EPT) on their stipulation. These are precisely columns (4) and (5) of Table7. The evaluation of our quasi-natural experiment targets three objectives: p and $\tilde{p}$, respectively the proportions of permanent contracts in the stocks and the flows, and $\check{p}$, the equilibrium conversion rate from FTCs to open-ended jobs. Policy simulations are clear. With respect to the benchmark, permanent contracts decrease with both liberalization schemes. Conversions decrease with EPT restrictions, and increase in FTCs length. These is our theoretical counter-factual. A fourth target is the length l of FTCs itself. In facts[35], the density of FTCs duration is skewed to the right in KI industries, but there is no bunching at its maximum length (12 months). Thus, it is uncertain whether allowing longer FTCs would have a positive impact on contract duration[36]. We further plan to analyse wage distribution and jobs' skills distribution (measured by education).

Empirically, the reform's impact on l, p and $\check{p}$ is immediate to test, while for $\tilde{p}$ we need to construct a separate sample for new matches. We will adopt a difference-in-difference framework. Since the legislation affects all firms, we need to address its treatment intensity. We will use the share of white collars as reference measure.

[Work in progress]

6 Conclusions

[Work in progress]

[35] Here we look at VWH data from 1998 until 2001.

[36] For the moment, we abstract from considerations on the optimal length of FTCs.

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A Theoretical Appendix

A.1 Proofs and Computations

Human capital accumulation

Define

$$G(\cdot) = \frac{1}{r + s^P + \mu F(\varepsilon_d^P(y_i))} \frac{\partial y(\alpha_i, h_i)}{\partial h_i} - c'(h_i) \tag{26}$$

The optimal level of investment is such that $G(h^*) = 0$. To obtain an internal solution we need to ensure that there exists h^* such that the marginal benefit equals the marginal cost. Given our convexity assumption on the cost function, $c'(\cdot)$ is increasing in h. If we differentiate the first term of the $G(\cdot)$ function with respect to h we obtain:

$$\Gamma(h_i) = \frac{\frac{\partial^2 f(\alpha_i, h_i)}{\partial h_i^2} \left(r + s_P + \mu F(\varepsilon_d^P(y_i))\right) + \mu f(\varepsilon_d^P(y_i))(r + s^P + \mu) \left[\frac{\partial y(\alpha_i, h_i)}{\partial h_i}\right]^2}{\left[r + s^P + \mu F(\varepsilon_d^P(y_i))\right]^3} \tag{27}$$

The sign of $\Gamma(h_i)$ is uncertain, depending on the assumptions on the production function. Notice that there exist two corner solutions. The first occurs when the marginal cost always overcomes the marginal benefit of investment and implies zero investment in HC ($h_i^* = 0$). This verifies whenever $\Gamma(h_i) < c''(h_i) \ \forall \ h_i$ and $c'(0) > G(0)$. The second corner solution emerges when the marginal benefit of investing is always higher than the marginal cost and entails an infinite amount of investment ($h_i^* = \infty$) . Formally, $\Gamma(h_i) > c''(h_i) \ \forall \ h_i$ and $c'(0) < G(0)$. This case can occur iff $\frac{\partial^2 f(\alpha_i, h_i)}{\partial h_i^2} > 0$, that is for a production function displaying increasing marginal returns to human capital. Furthermore, the possibility of multiple equilibria cannot be excluded a priori. However, our choices of production and cost functions and our calibration ensure the existence and the uniqueness of an interior solution. Figure 14 provides a graphical representation for two different specifications of the production function. The red dashed line represents the marginal cost, increasing and convex. The schedules representing the marginal benefit for two distinct values of worker's ability are plotted in blue. The intersection between marginal benefit and marginal cost gives the optimal h. In all cases represented in Figure 14 the solution is interior.

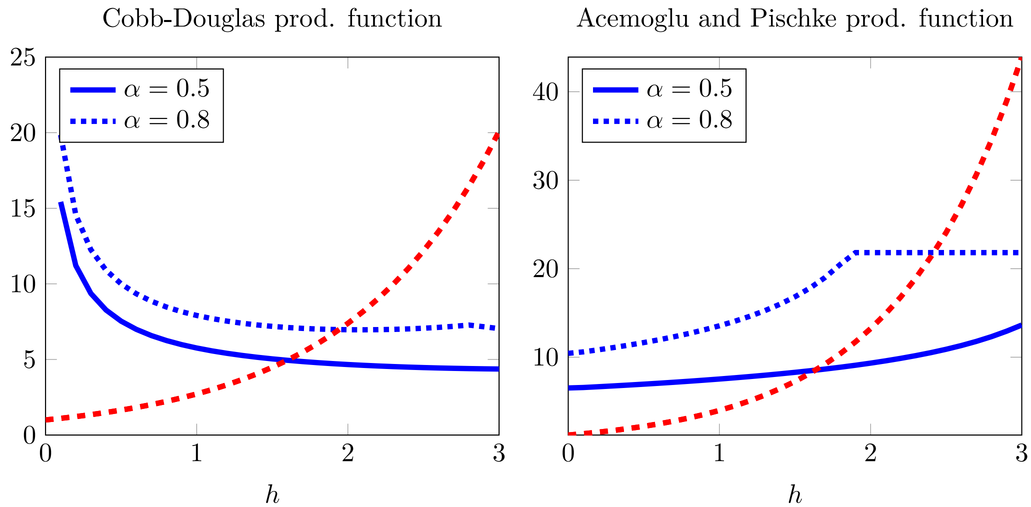

Figure 14: Optimal choice of investment in HC

Now consider the effect of firing costs and worker's ability on investment in human capital. For the implicit function theorem we have $\frac{\partial h_i}{\partial K} = -\frac{\partial G(\cdot)/\partial K}{\partial G(\cdot)/\partial h_i}$. It can be easily shown that $\partial G(\cdot)/\partial K$ is always positive, so that the sign depends on $\partial G(\cdot)/\partial h_i = \Gamma(h_i) - c''(h_i)$. A similar reasoning applies to the influence of ability. We thus make the following assumption:

H 2. *We assume a specification of the production function and the cost function of investment in human capital such that:*

$$\Gamma(h^*) = \frac{\left[\frac{\partial^2 f(\alpha_i, h_i)}{\partial h_i^2}\right]_{h_i=h^*} \left(r + s_P + \mu F(\varepsilon_d^P(y_i))\right) + \mu f(\varepsilon_d^P(y_i))(r + s^P + \mu)\left[\frac{\partial y(\alpha_i, h_i)}{\partial h_i}\right]^2_{h_i=h^*}}{\left[r + s^P + \mu F(\varepsilon_d^P(y_i))\right]^3} < c''(h^*)$$

This assumption allows us to introduce Lemma 3 in the main text.

Conditions for the existence of a pooling equilibrium

We shall focus on the interesting case of FTCs being preferred for less skilled workers and permanent contracts being offered to high-skilled job seekers. In this Section we study the conditions that need to be fulfilled to obtain such an outcome.

By computing the derivatives of $S^F(\cdot)$ and $S^P(\cdot)$ one can easily verify that they are both increasing in α. It follows that, if $\underline{\alpha}^F < \underline{\alpha}^P$, $S^F(\underline{\alpha}^P) > S^0(\underline{\alpha}^P) = 0$. This means that at least at $\underline{\alpha}^P$, FTCs are preferred to open-ended contracts.

The next step is to evaluate the relative slope of the two functions. Because of the envelope theorem we can neglect the investment choice and focus on the sign of $\frac{\partial(S^F - S^0)}{\partial\alpha}$. If the sign is negative on the whole support of α, this means that the slope of $S^F - c^F$ is always lower than the slope of S^0.

In this case, if $S^F - c^F$ lies above S^0 for low values of α, the two functions display the single-crossing property. We shall denote the crossing point as $\tilde{\alpha}$. The condition on the relative slope is verified whenever $s^F + \mu^F F(\varepsilon_d^F) > s^P + \mu^P F(\varepsilon_d^P)$. Notice that this condition coincides with Assumption H1, which guarantees that the investment in HC is always higher in open-ended than in temporary contracts. Then, we only need to guarantee that FTCs are preferred for less skilled worker. To this aim, we introduce the following assumption:

H 3. *We assume:*

- $S^F(\alpha_l) - c^F > S^0(\alpha_l)$

Under Assumptions H1 and H3, the values of the two contracts thus display the single-crossing property.

Lemma 5. *Under Assumptions H1 and H3, there exists a unique $\tilde{\alpha}$ such that*

$$\begin{cases} S^F(\alpha_i) - c^F > S^0(\alpha_i) & \forall\ \alpha_i \ \in\ [\alpha_l, \tilde{\alpha}) \\ S^F(\alpha_i) - c^F = S^0(\alpha_i) & \textit{if}\ \alpha_i = \tilde{\alpha} \\ S^F(\alpha_i) - c^F < S^0(\alpha_i) & \forall\ \alpha_i \ \in\ [\tilde{\alpha}, \infty) \end{cases}$$

The intuition is that both the value of a fixed-term (l.h.s) and an open-ended contract (r.h.s) are increasing in the level of the match-specific productivity component. However, the presence of firing costs reduces job destruction, lengthening the expected duration of a permanent match. Then, agents invest more in HC when they hold an open-ended contract. As a consequence, the value of a permanent match is more elastic to changes in α compared to the value of a FTC. Then, if the value of a FTC overcomes the value of a permanent match for low values of α, the two functions cross at $\tilde{\alpha}$. On the contrary, if the value of a permanent match is already higher for low productivity values, the two functions never cross and the open-ended contract is always the most convenient choice.

A.2 Probationary Periods and Learning

In the analysis conducted in the main text, we have considered a setting in which there is a clear dichotomy between FTCs, not subject to firing costs, and permanent contracts, which are covered by EPL from their very beginning. However, the difference is less pronounced in reality: indeed, the law generally allows firms to start a permanent contract with a trial period, during which dismissals can happen at no cost. In the light of the modeling strategy adopted above, probationary periods (PPs) appear very similar to FTCs. Therefore, we face the challenge of explaining the co-existence of two comparable contracts.

We argue that FTCs differ from probationary periods in two fundamental dimensions: the separation rate and the length. Separations are assumed to occur more often in FTCs rather than in PPs. This hypothesis, already discussed above, is important to preserve an essential feature of the model: workers hired on a permanent basis invest more in human capital, so that terminations occur less often and firms want to use this type of contract as an incentive mechanism when returns on investment are high.

Furthermore, we assume FTCs to be on average longer than PPs. While in reality the actual length of both is a chosen by the firm, the maximum length is regulated by law and it is much shorter for PPs[37]. While empirically a large number of very short FTCs is observed, our model actually applies to those contracts which are closely substitutes to permanent positions. Indeed, Tables 9 and 10 show that the average length of FTCs conditional on conversion is generally higher than 6 months, which is the maximum extension of trial periods according to the italian law.

[37]See Table 11 in Appendix B.2 for the law provisions on PPs and FTCs in several European countries.

From the combination of the separation rate and the length of the contract we can compute the expected duration of the match, which is the main dimension the workers look at when they take decisions on investment in HC. It follows that it is very likely that one of the two contracts will induce more investment in HC and will be preferred to the other for all values of α. We thus investigate a complementary explanation which is the main reason why probationary periods exist in the first place. The mechanism we are going to introduce is based on the concept of the job as "experience good", in Jovanovich (1979)'s terminology: the only way to determine the quality of the match is to experience it. However, differently from Jovanovich (1979), we postulate that the match quality is not entirely unknown before starting production. When meeting a worker for the first time, the firm observes a noisy signal of the match-specific productivity component α_i. We think to the signal as the information the firm can get through interviews and cv. To avoid additional complications, we assume that at any point in time the worker shares the same information and beliefs of the firm; this allows us to leave aside the issue of asymmetric information and adverse selection. While certainly restrictive, this assumption is consistent with our interpretation of the α parameter, which captures the correspondence between the worker's skill and her fit for the position she is supposed to fill. As a consequence, the worker takes decisions over the optimal level of investment in human capital as expected by the firm. More formally, upon meeting, the firm holds a subjective belief of the i-th match-productivity distribution: $y_i \sim G^0(y_i)$, with mean $\hat{y}_i$ and standard deviation $\sigma^0(y_i)$.

At first, we do not present a formal model of learning but we rather adopt a more intuitive reduced-form approach. However, in the following Section we show how our assumptions can be justified on the ground of a model of Bayesian learning[38]. We assume that the firm observes the worker during the trial period or the FTC and refines its initial estimate as time goes. The longer it can follow the worker, the more precise its estimate will be at the moment of taking the decision on whether upgrading the contract or not. Then, at the moment of hiring, the firm already expects

[38]For an application of the Bayesian learning model in the labor market see Jovanovich (1979) and Nagypal (2002). Learning in a dual labor market is also considered by Faccini (2014), who instead adopts an "all-or-nothing" learning scheme based on the results by Pries (2004).

it will have a better knowledge of the match at the expiration of the FTC rather than at the end of the trial period. Since we assume the initial estimate to be unbiased, in expectation the subjective distribution of y_i will have the same mean as the initial one ($\hat{y}_i$) but lower variance, with

$$\sigma^F(y_i) < \sigma^{P_0}(y_i)$$

where $\sigma^F(\cdot)$ and $\sigma^{P_0}(\cdot)$ are the standard deviations of the firms' belief on the productivity of worker i at expiration of the FTC and the trial period, respectively.

The precision of the estimate is particularly important for those matches which have signaled a productivity close to the threshold for conversion. In fact in this case the consequences of a mistake may be more serious, leading to losses and more frequent layoffs. For simplicity, we assume that the firm acquires a perfect knowledge of α_i after having taken a decision on conversion. Suppose that the firm has decided to convert a match but then it realizes that has overstated its productivity and it is actually convenient to fire the worker. Since the match has already been converted to permanent, the layoff entails the payment of the firing costs. Additionally, we assume that the firm is concerned about hiring workers with very low productivity, such as, for instance, those with ability inferior to the profitability threshold. If it turns out that a worker upgraded to a permanent position has such a low productivity, a cost is imposed on the firm[39]. It follows that the gains from learning are higher for low productivity values, that is those around the profitability threshold.

[39]Consider the situation of a firm which has converted a contract of expected productivity α_i. Clearly, $\mathbb{E}(\alpha_i) > \underline{\alpha}^{P_0}$. Framing the problem in statistical terms, the hypotheses considered by the firm are:

$$\begin{cases} H_0: \ \alpha_i = \mathbb{E}(\alpha_i) \\ H_1: \ \alpha_i \leq \underline{\alpha}^{P_0} < \mathbb{E}(\alpha_i) \end{cases}$$

A type I error occurs when the firm does not convert a match whose productivity is indeed sufficiently high. However, in expectation this situation does not occur if $\mathbb{E}(\alpha_i) > \underline{\alpha}^{P_0}$ in the first place. Conversely, a type II error occurs when the firm erroneously converts a low productive match. In expectation, this happens with probability $G^c(\underline{\alpha}^{P_0})$, where $c = F, P_0$.

Then, the cost we introduce in the firm's value function can be interpreted as a cost on type II errors committed in case of erroneous conversion. The specular case of erroneous missed conversion (i.e. a match which is not converted despite its high productivity) is not considered here, since we think that the foregone benefits implied by this case represent a minor issue with respect to the problems created by a too low productive worker mistakenly introduced in the productive unit.

Let us now introduce the expression of the value function of FTCs and PPs in case of learning:

$$
\begin{aligned}
rJ^c(\hat{y}_i(\varepsilon)) = \hat{y}_i(\varepsilon) - w^F(\hat{y}_i(\varepsilon)) + \mu^c \left[\int_{\varepsilon_d^F(\hat{y}_i)}^{\varepsilon_u} \int_{\alpha_d^P(\varepsilon')}^{\alpha_u} J^P\left(f(\alpha, h^c(\alpha)) + \varepsilon'\right) dG^c(\alpha) dF(\varepsilon') \right] \\
- \mu^c \left[\left(1 - F(\varepsilon_d^F(\hat{y}_i))\right) c^{learn} G^c(\underline{\alpha}^{P_0}) + K \int_{\varepsilon_d^F(\hat{y}_i)}^{\varepsilon_u} G^c\left(\alpha_d^P(\varepsilon')\right) dF(\varepsilon') \right] \qquad c = F, P_0 \quad (28)
\end{aligned}
$$

where $\alpha_d^P(\varepsilon')$ is such that $\varepsilon_d^P\left(f(\alpha_d^P, h^c(\alpha_d^P))\right) = \varepsilon'$. In words, $\alpha_d^P(\varepsilon')$ is the minimum value of α such that the permanent match with firm's productivity component ε' is not convenient to destroy. Equation (28) is modified to take into account the imprecision in the estimate of the true productivity value. The belief about the distribution of y_i depends on the contract, featuring lower dispersion for FTCs, that are assumed to last longer. The first term of the second line represents the cost of having converted a match whose actual productivity lies below the profitability threshold. The last term shows what happens when the firm has upgraded a match whose actual productivity is lower than the value which guarantees a positive surplus. In this case, the firm prefers to fire the worker and pay K. The worker's value function needs to be modified accordingly.

The job creating condition coupled with free-entry implies:

$$
\frac{\kappa}{q(\theta)} = \mathbb{E}(J^F - c^F) + \mathbb{E}(J^{P_0})
$$

The value of unemployment is modified as follows:

$$
rU = b + \theta q(\theta) \left[\frac{\beta}{1-\beta} \left(\frac{\kappa}{q(\theta)} + \mathbb{E}(c^F) \right) - \mathbb{E}\left(c(h)\right) \right] \tag{29}
$$

Notice the difference between equations (25) and (29): with probationary periods, the firing costs disappear from the unemployment value because the initial job is not protected against layoff by any EPL provision. In what follows, we discuss some issues related to the solution and the calibration of the extended model.

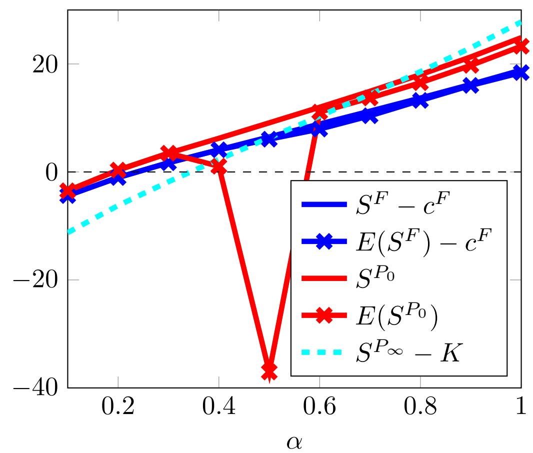

Figure 15: Surplus of FTCs and PPs under learning

A.2.1 Bayesian Learning

So far, we have introduced learning in a informal way. Importantly, we have assumed that the precision of the updated estimate of productivity positively depends on the time elapsed between the initial and the final observation. In this Section, we show how this assumption can be justified through a model of Bayesian learning. To focus on the main point, we abstract from human capital accumulation and assume that there exists a unique component of match productivity called y_i.

Upon meeting a worker, the firm observes a noisy signal of the match productivity:

$$s^0 = \log(y_i) + \delta$$

where y_i is drawn from the productivity distribution $g(y)$ and δ has pdf $f(\delta)$. To keep things simple, we assume that $\log(y) \sim \mathcal{N}(\mu_y, \sigma_y^2)$ and $\delta \sim \mathcal{N}(0, \sigma_\delta^2)$[40]. Firms then utilize Bayesian updating to obtain a first estimate of the unknown match quality y_i. Estimated productivities are denoted with a hat; the superscript stands for the number of updates; the very first estimate, which comes before

[40] We thus have that the mean and variance of y are $\bar{y} = e^{\mu_y + \sigma_y^2/2}$ and $v_y = e^{2\mu_y + \sigma_y^2}(e^{\sigma_y^2} - 1)$, respectively. The log specification is adopted to ensure the positivity of y.

stipulating the contract, is indicated with 0. The first estimate of y_i is thus distributed as follows

$$\hat{y}_i^0 \;\sim\; \mathcal{N}\left(\frac{\tau_y m_y + \tau_\delta s^0}{\tau_y + \tau_\delta}, \frac{1}{\tau_y + \tau_\delta}\right)$$

where $\tau_y = \frac{1}{\sigma_y^2}$ and $\tau_\delta = \frac{1}{\sigma_\delta^2}$ are the precision of the prior and the signal, respectively.

Upon meeting, firms already anticipate that they will be able to observe n^c other signals before the end of the contract. In expectation, the match quality would still be $\hat{y}_i^0$, but the confidence in the estimate would be higher. More specifically, the expected posterior distribution of match quality y_i after n^c updates is:

$$\mathbb{E}_0(\hat{y}_i^{n^c}) \;\sim\; \mathbb{E}\left(\hat{g}^{n^c}(y_i)\right) = \;\mathcal{N}\left(\hat{y}_i^0, \frac{1}{\tau_y + (n^c+1)\tau_\delta}\right)$$

If, for instance, we make the hypothesis that worker's productivity can be observed once a month, the number of updates will be higher the longer the contract. It follows that FTCs will allow firms to estimate y_i with higher precision, as we assumed in the main text.

A.2.2 Model solution

Evaluating eq. (28) is computationally intensive for the presence of the double integrals. Rigorously, the integrals cannot be split, because the value of the match-specific productivity under which the firm prefers to fire the worker ($\alpha_d^P(\cdot)$) depends on the realized value of the firm-specific productivity component ε'. However, we can take a shortcut which has a minor impact on the final result and has the advantage of greatly speeding up calculus. Instead of computing an ability destruction threshold for each value of ε, we consider an average α_d^P. We thus impose that the ability firing threshold is always equal to the value that one would observe for an average value of ε, irrespective of the actual realization of the firm-specific productivity component.

To have a sense on how the model changes with the introduction of probationary periods and learning, we can take as given the endogenous outcomes of the benchmark two tier model (θ, U) and compute the value of FTCs and PPs in the new setting. The new parameters are calibrated as follows. PPs are slightly shorter than FTCs ($\mu^{P_0} = 0.025$); $c^{learn} = 10000$; the subjective distributions of α are assumed to be uniform, centered on the initial signal α_i, with standard deviation double for the matches ending the trial period.

The results are reported in Figure 15. The blue and the red solid lines represent the surpluses of FTCs and PPs in absence of the screening motive. The crossed lines are the corresponding values where the match-specific productivity is noisily observed. For comparison, we also show the surplus of the permanent match starting without PP. With perfect information about α, permanent matches without initial firing costs always dominate FTCs because the lower quit rate implies more investment in HC and higher productivity. However, when the screening motive is introduced, there is scope for using FTCs in an intermediate range of α. At the lowest productivity values, the firm is not interested in screening because it already plans not to convert the match. When conversion becomes an interesting option, however, the firms does not want to commit mistakes and prefers observing the worker for a longer period of time: FTCs are preferred to PPs. As the initial signal becomes more and more positive, there is little chance that the firm erroneously converts a good match and the need for screening diminishes; then, permanent contracts are again preferred against temporary ones since the incentive interest becomes prevalent.

To solve the model, instead of considering all the possible configurations that may emerge, we focus on the case in which PPs are always preferred to FTCs when the match-specific productivity is perfectly observed. This amounts to impose the following assumption:

H 4. *We consider a calibration such that $J^{P_0}(\alpha) > J^F(\alpha)\ \forall\alpha$ when α is perfectly observed upon meeting.*

Assumption H4 ensures that we face the same situation depicted in Figure 15, with two intersections between the surpluses of PPs and FTCs under learning and FTCs that are preferred in an intermediate range of α[41].

[41] Clearly, we allow for the possibility that the curves do not intersect at all: this happens when firms convert only very high productive matches, where the risk of committing a mistake is so low that the gains from learning are not very valuable. We can also face the situation in which the first intersection occurs at negative surplus values or the case in which the second intersection is not comprised among acceptable values of α.

B Empirical Appendix

B.1 Data Sources

The empirical part of this paper makes use of three databases of Italian data, which we use for different purposes. We are now going to describe them in detail.

LoSai Database

This is a random sample of all contracts stipulated by any firm in Italy from 1985 to 2012. These data are collected by the Italian Social Security System (INPS) for administrative purposes. Workers and firms are identified through a unique id. For any observation, we know what follows: worker's qualification (blue collar, white collar, manager, principal); days worked, daily hours worked (full time, part-time), monthly wage, contract type (open-ended, temporary, seasonal), starting date, termination date, policy (this variable allows us to further disaggregate the different types of temporary jobs), reason for hiring (only from 2005 onwards), reason for termination (only from 2005 onwards), class size of the firm, firm's sector (2 digits ATECO 1981 classification).

Since this is random sample, this database does not allow to study the flows of hirings by contract type at the firm level. However, we can study workers' transitions controlling for the firm's sector and class size.

Veneto Working Histories (VWH) and Planet

VWH is a longitudinal panel built at the department of Economics of the University of Venice on the ground of the Social Secuity administrative data of the Italian Social Security System (Inps). It refers to the entire population of a large Italian region, Veneto, which is a dynamic territory based on manufacturing, with a large population of small firms (the average establishment size is 12 employees). The database covers each single plant and worker employed in the private sector from 1975 to 2001. Inps data include register-based information on all establishments and employees that have been hired by those establishments for at least one day during the period of observation, independent of the worker's place of residence. The entire working life for all employees that have worked at least one day in Veneto, has been reconstructed, considering the occupational spells out of Veneto as well. Employers are identified by their identification number, which changes if ownership, in a strict sense, changes. This has been amended: any time more than 50% of all employees are taken over by the new legal employer, the employment spell is said to be continuing. Similarly, if there are short breaks in the employment spell, as long as the worker continues at the old employer, his spell is considered uninterrupted.

The variables present in the dataset are the following:

- On the worker side: worker's id, gender, age, birth place, nationality, address
- For the job: year and month of work, working weeks, working days, place of work, gross wage, qualification, contract type, level.
- On the firm side: firm's id, name, activity description, address, sector code (3-digits ATECO, 1981 classification), establishment date, cessation date, artisan firm, area code.

VWH can be matched to another database, developed by the Veneto Employment Agency (Osservatorio Veneto Lavoro) and called Planet. While VWH contains more informations regarding the firm, Planet is richer on the worker's side, providing, for instance, the education level. Importantly, Planet allows to considerably extend the temporal range, given that the data go from 1998 to 2013. Then, the two databases overlap for 4 years, thus allowing to build a consistent panel of working histories from 1975 onwards.

An important selection issue may emerge when only part of the observations can be matched. This can be due to many different reasons: eg. firms that ended their activities or workers who retired before 1998 are present in VWH but not in Planet; similarly, workers who entered the labor market or firms which initiated their activity after 2001 are present in Planet but not in VWH. Other sources of missed matching derive from the fact the in VWH the unit of observation is the worker, who is followed even when he went to work outside the region; in Planet this possibility is rather limited. Furthermore, in VWH firms operating in the agricultural and public sectors are not observed, while they are present in Planet.

The working histories built through the linkage between VWH and Planet are particularly useful for our analysis because they contain the universe of the employment contracts at each firm for any time period. Then, we can precisely compute the share of temporary employment and flow of hirings at the firm level (which correspond to p and $\tilde{p}$ in the model) and study how they are affected by the co-variates we can control for.

B.2 Additional Empirical Evidence

Table 11: Legislation on probationary periods and use of temporary contracts (TC): EU - U.S. cross-country comparison

	Max prob length (months)		Valid reasons required for TC use	Quotas on TCs	Max number cumulated TCs	Max cum TC length (months)	Employees threshold for dismissal costs	Workforce under TC
	Blue collar	**White collar**						
Austria	1	1	no for first	yes	no limits	no limits	5	9.8
Belgium	0.25 / 0.5	6 / 12	no for first	yes	4	36	1	8.3
Denmark	-	3	yes		no limits	no limits	1	8.4
Finland	4 / 6	4 / 6	yes	cla	no limits	no limits	1	17.1
France	4 + 4	4 + 4	yes		2	24	10	15.2
Germany	6	6	yes	cla	4 / no limits	24 / no limits	10	13.7
Greece	12	12	yes		3 / no limits	24 / no limits	1	12.4
Italy	6	6	no for first	cla	5	36	15	14.2
Luxembourg	6	6	yes		3	24	1	9.4
Netherlands	1 / 2	1 / 2	no	cla	3	36	1	19.3
Portugal	3	6 / 8	yes		4 / no limits	36 / no limits	9	22
Spain	2 / 3	6	yes		2	6 / 24 /36	25	25.6
Sweden	6	6	no	cla	no limits	24 / no limits	1	17
UK	24	24	no		no limits	48 / no limits	1	6.3
U.S.	∞	∞	no	no	no limits	48 / no limits	-	4.2

Data source: Source: ILO - Employment protection legislation database - EPLex Access: `http://www.ilo.org/dyn/eplex/termmain.home?p_lang=uk`
The probationary period, or "qualifying period of employment", defines the initial contract time during which employees are excluded from the protection against unfair dismissal. In some countries unlimited renewals on FTC are permitted if justified by an objective reason or when the FTC has an uncertain term (Portugal). In the quotas' column, "cla" signifies regulated by collective labour agreement. Eurostat temporary job definition: "A job may be considered temporary if employer and employee agree that its end is determined by objective conditions such as a specific date, the completion of a task or the return of another employee who has been temporarily replaced (usually stated in a work contract of limited duration). Typical cases are: (a) persons with seasonal employment; (b) persons engaged by an agency or employment exchange and hired to a third party to perform a specific task (unless there is a written work contract of unlimited duration); (c) persons with specific training contracts." In the U.S., the short-term contracts estimate includes temporary help and contract company workers, as well as self-employed and independent contractors who work for one firm at a time and expect this arrangement to last for 1 year or less.

C Legal Appendix

[Work in progress]