The choice of the contract in a dual labour market

Riccardo Franceschin[1]

[1] Bocconi University
riccardo.franceschin@unibocconi.it

Abstract

This very preliminary work aims to build a theoretical model that describes the choice of the labour contract in a labour market where fixed-term contracts (FTCs) and open-ended contracts (OECs) coexist. Unemployed workers are randomly matched with vacancies and the agents learn the productivity of the match over time, observing the production. FTCs reduce the firing costs and can be used as screening devices, while OECs reduce the on-the-job search of employees. The model will be calibrated using administrative data from an Italian region and it can be used to evaluate the effects of different policies and government interventions.

Keywords: Employment protection, temporary contracts, on-the-job search

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1 Introduction

A labour contract often entails some protection for the worker in case of involuntary separation. In the USA there is no uniform legal requirement, but as shown in Parsons (2017), a large part of the labour force is still covered by voluntary severance packages offered by firms. In Europe institutional constraints play a central role. Allowed labour contracts are divided in two large categories:

- open-ended contracts (OEC), where the termination of the contract is not already stated at the beginning and it generally involves relatively high separation costs, if it is the firm that wants to separate;
- fixed-term contracts (FTC), where the two parties already fix an expiration date for the contract at the very beginning;

Fixed-term jobs have become much more common in Europe in last 25 years as a way for firms to avoid the Employment Protection Legislation and the associated high firing costs, especially in continental Europe. In particular they are largely use to employ younger workers. In some countries (for example Italy, Portugal, Poland, Spain) more than 40% of the young labour force (15-29 years) is employed with this kind of contracts [1].

FTC are always at the centre of the political debate, since workers seems to attach less value to them compared to standard OEC. According to surveys, the main reason for workers to accept a FTC is that they could not find a permanent job [2], while another important share of workers accepts them because at the same time they are also involved in Education.

If workers are risk-averse, they probably dislike fixed-term contracts for the higher risk of unemployment and for the consequent searching effort. In this sense a permanent job could be seen as a contract with higher returns for the worker, keeping everything else equal. For this reason, we would expect some form of wage compensation for workers employed through FTC.

However, this is not what we observe in the data. Booth et al. (2002) shows that FTC are employed for peculiar employees (young, inexperienced, with a long unemployment spell) and in particular sectors. In addition, these contracts are generally associated with a much lower salary.

These facts indicate that the choice of the contract cannot be treated as another simple component of the labour costs, included in the bargaining between agents. Instead, it is a choice associated with some characteristics of the agents.

In this work, I present a theoretical model 'a la Mortensen and Pissarides (1994) that tries to understand how the choice of the contract is performed in a dual labour market, where only two possible labour contracts are available.

[1] Source Eurostat, 2016
[2] Source Eurostat, 2016

As in Faccini (2014), I assume that the match-specific productivity is unknown and it is drawn from a normal distribution. At every period the agents observe the production, that is a noisy signal of the underlying productivity of the match and they update their belief. Under this assumption,the fixed-term contract is used by the firm as a screening device, to observe some signals of the productivity before hiring the worker with an open-ended contract.

In my model both agents are risk neutral. They will choose the contractual form that maximize the total surplus and they bargain over the wage at the beginning of every period. After the production, at the end of the period, the firm decides if she wants to keep the worker or break the relationship. Importantly, the fixed-term contract cannot be renovated forever in the model, but there is a maximum amount of time after which the firm has to transform it in a OEC. This feature tries to capture the legal restrictions present in most of the countries on this form of contracts.

The temporary contract has the clear advantage that it allows to save the firing costs when the firm dismisses the worker. This can happen both for exogenous reasons or for a deliberate decision to terminate an unproductive match. The firing costs take the form of a pure waste, capturing the red tape costs involved in the separation.

Until now, in the model there is no reasons to choose an OEC, since they involve firing costs, decreasing the joint surplus of a match. This is a standard results in the literature. However, as I will show, a FTC induces workers to exert a higher searching-effort while employed.

I provide some descriptive evidence of this phenomenon, that can be easily explained by the higher benefits coming from a new job offer for a worker employed with a FTC.

Indeed, the worker will choose optimally the searching effort while working, considering the risk of being fired in the next period, when a new signal will provide new information about the quality of the match.

However, in his optimization problem, he will not take into consideration the damage that he is inducing to the firm in the case that he actually quits the job by accepting the new offer.

Indeed, in this case, the firm will suffer from the fact that she will have another open vacancy.

In this way, the use of a FTC can lead to an "excess of turnover", meaning that even productive matches will be broken by the workers. In this specific situation, hiring directly with an open-ended contract increases the total surplus, since the worker will reduce his searching effort and the firm will have to open a new vacancy less frequently.

In my model, I could add some heterogeneity in workers and firms to capture other facts observed in the data:

- Workers with different characteristics (for example education) have a differ-

ent productivity distribution, then the need for screening is higher or lower, leading to a different choice about the contracts for these workers;

- if the market in which the specific firm operates is highly volatile, with a high probability for the job-relationship to become unproductive, the firing cost can become prohibitive for the firm, leading to a high incidence of FTC.

The main contribution of this preliminary work is to present the model developed for the decision about the contractual form of a job relationship in order to provide a theoretical framework that could explain the empirical evidence on the contractual choices.

The subsequent natural steps would be trying to predict the effects of a change in the labour legislation that affects the structural parameters of the model, in order to perform policies evaluations with respect to the long-term consequences on workers and firms.

In particular, I plan to calibrate the model with real administrative data from a longitudinal panel of workers. The dataset is called "Mercurio", from "Veneto Lavoro", and it collects all the job histories of workers of Veneto, an Italian region. However it does not provide directly workers' wages, therefore it needs to be matched with other administrative sources.

Once the model has been calibrated and the main predictions have been tested, it would be possible to test also the theoretical effect of a labour market reform versus the actual results of the Italian labour market reforms of these recent years, that considerably changed the labour institutions at least for a subset of workers.

2 Motivation and related literature

The literature on dual labour market developed after the liberalization of the temporary labour contracts in Spain, the first country that largely allowed for this kind of contracts. A good review of this literature can be found in Dolado et al. (2002). However, this literature has always been focusing on the impact of these labour market reforms on unemployment or labour market flows.

One main finding of these works is that an increase in the share of temporary contracts leads to higher volatility in the labour market, in line with the literature about the effects of a reduction in firing costs. García-Serrano and Jimeno (1999) use a pooled cross-section data from 17 sectors in 17 Spanish regions to estimate that an increase of the percentage of fix-term contracts lead to an increase in the flows from employment to unemployment, from unemployment to employment and also job-to-job flows.

Following a raise in the share of fix-term contracts (FTC), the increased volatility seems also to help in the reduction of the unemployment spell, even though some works (as Boeri (1999)) found that the increased job-to-job transitions of fix-term jobs crowd out the job-finding probability of the unemployed.

The overall effect of this increased volatility on the unemployment rate is ambiguous. The introduction of fix-term contracts, as a reduction in firing costs, seems to generate a *honey moon effect*, as shown in Boeri and Garibaldi (2007). This work also provides evidence that, in the long-run, the increased in fix-term contract could lead to a reduction of productivity. However, the evidence about the long-term impact on the level of employment is not conclusive.

There is instead some evidence of less training and investment in human capital for workers with temporary contracts (as documented in Booth et al. (2002), Lucidi and Kleinknecht (2009) and Albert et al. (2005)). However there is also some evidence of a boost in productivity, at least in the short term, deriving from the use of the same temporary contracts through a reduction in the absenteeism rate (Ichino and Riphahn (2005) and Engellandt and Riphahn (2005)). Overall, it seems that FTCs increases productivity in the short-term, but they could potentially lower long-term productivity.

To the best of my knowledge instead, not much papers focus on the possible "wage premium" earned by workers employed through less costly fixed-term jobs. This is an important element of my model, where the firm is able to save money offering an OEC in return for lower wages. This fact is not supported by real data if we take simple correlations. On the contrary, OEC are generally associated with higher wages, even considering some observable characteristics of the workers (Booth et al. (2002)).

The empirical estimation of this "wage premium" is obviously difficult, since many unobservable characteristics could bias the results and there are clear problems of self-selection of both workers and job positions. Indeed, it is not unrealistic that well-paid jobs generally offer a permanent contract and they are also attracting workers with higher unobservable abilities.

Both Brown and Sessions (2005) and Hagen (2002) do not found a "wage premium" for FTC, correcting for selection on observables, but they recognize that unobservable factors could play an important role. In Berton et al. (2015), performing a lab experiment, workers ask for higher salary in order to accept contracts with a lower expected duration, in particular they asked for compensation to accept FTCs with a duration of less than three years. Overall, the literature at least does not reject the idea that workers receive some form of compensation for accepting a FTC.

Returning to search and matching models, Cahuc and Postel-Vinay (2002) developed a model for the contractual choice in a dual labour market, in which to the standard search and matching model, the authors added the assumption of an exogenous fraction p of the new matches as fixed-term contracts. This contract last one period and then it can be transformed into a permanent one or it ends the worker-firm match.

Focusing on search and matching models that accounted for the coexistence of both kind of contracts, we often find the assumption of exogenous separations rates

and in general the separation rate of temporary contracts is higher. This is the case for example in Garibaldi (2006), where the firm faces the trade-off between hiring using the permanent contract and paying the firing costs if the match breaks, and increasing the separation rate using a temporary contracts, that does not involve firing costs.

More similarly to my model, another stream of literature assume that the separation between worker and firm is endogenous, for example because the productivity evolves along the employment spell. For instance in Cahuc and Postel-Vinay (2002), the idea is that even permanent contracts provide a *probationary period*, shorter than an usual temporary contract, during which the worker can be fired at no cost. In Cahuc et al. (2016) the authors include in the model the assumptions that writing contract is costly and, consistent with actual regulation, that it is very hard (or impossible) to terminate a temporary contract before its expiring date. In this way, they could explain the use of a permanent contract.

The question whether fix-term contracts can be seen as a screening device that then leads to a permanent contract has been addressed in many papers, for example Ichino et al. (2008) and Gagliarducci (2005), in which they found some evidence that temporary jobs are step stones to reach a permanent position and not a never-ending trap for the worker.

The idea of temporary contracts as screening device is presented also in Faccini (2014), where the fix-term contracts are used by firm to assess the quality of the match, before being forced to use an open-ended contract where the firing costs are much higher. The model used is similar to the one presented in this paper, but there is an important difference in the motivation for the presence of permanent contracts. In that work an FTC is always preferred by agents, only an exogenous binding regulation can lead to the choice of an OEC from the beginning.

Finally, Crechet (2018) addresses the same issue of the choice of the contract using optimal risk-sharing as a motivation for the presence of OEC. In his work the productivity of the match is a stochastic variable that follows a Markov process and the two agents have different risk-aversion. Under this assumptions a permanent contract can be optimal since it makes the firm credibly committing to provide a certain degree of insurance to the worker.

Moving towards the empirical evidence, there is a consensus that increasing the share of temporary contracts in the economy implies an increase in the job turnover. In contrast, mixed evidence is found for the effect on the level of employment in the medium-long term. Regarding the topic of this project, the empirical literature on the determinants of the choice between temporary and fixed contracts is not as developed as the theoretical counterpart.

Portugal and Varejão (2009) show that human capital is an important determinant for the contractual choice, both on worker's and firm's side. They find that highly-skilled vacancies are more likely to be filled with a permanent contract, given that the hiring process is harder, that the screening process is faster

and that firing a skilled-worker, on which the firm has invested, is relatively more expensive. For this reasons, firms that employed highly-skilled workers are more likely to have OEC with them. They also provide evidence of the FTC as a screening tool, given the correlation between the destruction of permanent positions and the creation of new fixes-term vacancies.

On the workers' side, they provide evidence, consistent with other works, that young, female and low-educated workers are more likely to be employed by fix-term contracts.

In Booth et al. (2002), the authors give a similar picture in describing the characteristics of workers employed through temporary contracts, with a striking difference that more educated men seem to be more likely employed with these kind of contracts. In addition, they provide evidence of a lower job satisfaction among workers with a FTCs. However, even in this work the authors find that temporary contracts are stepping stones toward a permanent job.

Finally, the recent Italian labour market reform has not yet been studied extensively, but some results can be found in Sestito and Viviano (2016). Using the same administrative source of my work, the authors use a diff-in-diff estimation that gives us the impact of the reduction in firing costs and the tax-incentive for OEC on the number of permanent contract signed in the first half of 2015. They find that almost half of the total amount of the new contracts can be attributed to the two reforms, but most of the effect comes from the tax-reduction.

Relevant for my work, they found that this reforms lead to an overall increase in the job-creation, raising even the number of FTC signed. The authors themselves suggest that the firms are probably using the FTC to screen workers that in the end of 2015 would become permanent workers in the firms thanks to a contractual transformation.

3 Theoretical Model

3.1 Basic model with exogenous cost for temporary contracts

First of all, I present a simple search and matching model, with discrete time and risk-neutral agents.

Workers can be either employed, with two possible contracts, or unemployed.

For the moment I do not analyze the match formation and vacancy posting, but I consider the labour market in equilibrium. This means that the number of vacancies and the unemployed are such that the free entry condition is satisfied, so that the value of a vacancy V is exactly zero.

Firms meet randomly workers and they can choose between two types of labour contracts: an open-ended contract (OEC) or a fixed-term contract (FTC).

I assume that for legal limitations, the FTC can last at maximum one period[3]. Then it has to be transformed into a permanent one. Regardless of the type of contract, the firm-worker match can be broken at the end of every period by an exogenous shock that arrived with a certain probability λ.

In figure 2 I represent the order of the events that the agents face. The first line refers to new matches, when the firm can offer a FTC or a OEC, while the second line indicate a match that was already formed and so it must be a OEC.

While writing the contract, the two parties bargain over the wage, that is set with a standard Nash-Bargaining process. It is important that the two agents bargain over the type of contract and the wage at the same time. If that was not the case, we could have another disadvantage of the firm to use the permanent contract, specifically the fact that the worker could use the firing costs to strengthen his bargaining position.

The productivity of the match is α that is ex-ante unobservable and it is drawn from a known distribution $F(\alpha)$, with moments θ_0. For the moment, the production at every period is equal to α, so that α is revealed after the first period and it becomes common knowledge. In one extension of the model, instead, the production will be a noisy signal of the underlying quality of the match, so that it will be a random variable. It is important to notice that the wage bargained at the beginning of every period has to be the same for every realization of α[4], however it will be rebargained, so that in the simple model, it will depend on α after the first "screening " period.

At the end of every period, there is a probability λ that the match is broken for an exogenous reason. In that case, the firm pays a cost f, that is a pure waste, meaning that it is not a transfer to the worker.[5] This f captures the legal and

[3] I will relax this assumption later on.

[4] This assumption is not crucial for the results of the baseline model, however there are several possible justification for the absence of state-contingent wages in the short term, for example a cost of writing contracts or incentives related to the efficiency wages theory.

[5] As I show in the appendix, this is not fundamental in this model.

bureaucratic costs related to the firing procedure. If the contract is a FTC instead, f is standardize to zero.

After the realized production, the agents update their belief about the productivity of the match. This is important, since the agents re-bargain over the wage at every period and the firm can choose to break the relationship with an endogenous firing, paying a cost f if there was an OEC in place. θ will indicate the updated moments of the productivity distribution.

As a consequence of this endogenous firing, we will have a threshold $\bar{\alpha}$ above which the firm will keep the worker, while she will fire all workers with a lower productivity. However, given the firing cost, this threshold will be higher for the FTC than for the permanent one.

I will keep the following notation through all this work. The superscript N will indicate the value a new relationship. Instead, if there is a p or a τ as superscript, I am referring to an old relationship after a period with, respectively, a permanent and a temporary contract.

Subscripts indicate the actual contract between agents, so that τ will refer to FTC, while p will indicate OEC.

For wages, we will have $w_p^i(\theta)$ and $w_\tau^i(\theta)$ as the results of a Nash-Bargaining of a worker with a prior distribution of the productivity θ. The former will be the wage of a permanent contract, while the latter will be the wage of FTC. Notice that this distribution will be a degenerate distribution in α once the productivity will be observed, so with an abuse of notation, I will indicate it as $w_p^i(\alpha)$. As before, the superscript i could be N, p or τ, depending on the contract of the previous period or if we have a new contract. Indeed, the bargaining power of the firm will be different in the three cases, leading to different wages.

In the model Π indicates firm's value function of a filled job, V is the value of a vacancy, W is worker's value function when employed, while U is the value of unemployment. Finally S indicates the surplus of a match.

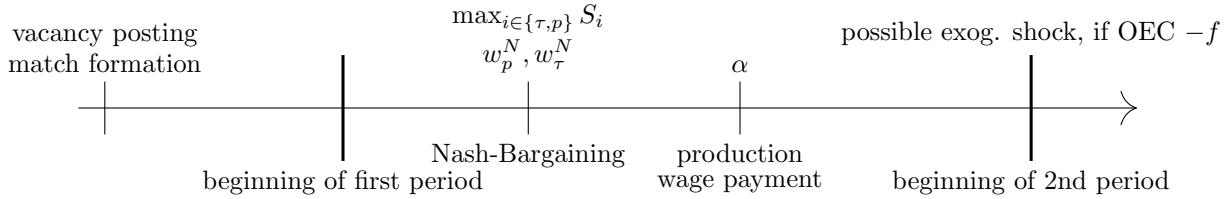
3.1.1 Firm's value functions

The value of an empty vacancy can be set equal to zero for the free-entry condition, hence:

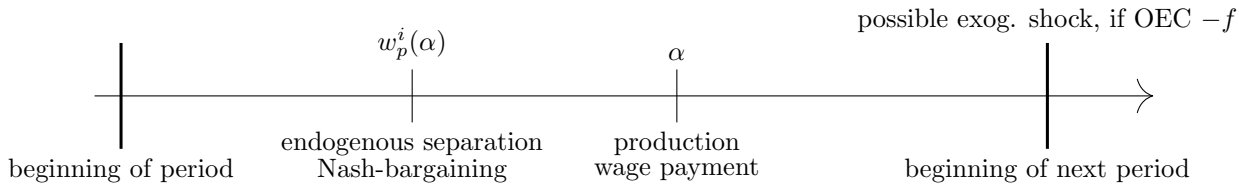
$$V = 0$$

The expected value of a filled vacancy will depend on the kind of contract that the agents choose and on the fact that the productivity has been already revealed or not.

New Matches



Old Matches



- New permanent contract

$$\mathbb{E}(\Pi_p(\theta_0)) = \mathbb{E}(\alpha) - w_p^N(\theta_0) + \beta(1-\lambda)\int_{-\infty}^{+\infty} Max(\Pi_p^p(\alpha), V-f)dF(\alpha) + \beta\lambda(V-f) \tag{1}$$

  In the first period the firm gets the output minus the initial wage, that is the same for every worker, given that the productivity is still unknown. Indeed, we will see that the wage will be determined through Nash-bargaining while the two parties still do not know the true productivity of the match. Then, with probability λ the match is destroyed and the firm pays the firing costs (assuming $V = 0$). Otherwise, the second period begins and she has to choose between paying the firing costs or continuing the match and receiving $\Pi_p^p(\alpha)$, where α is the updated degenerate distribution of the productivity.

- New temporary contract

$$\Pi_\tau^N(\alpha) = \alpha - w_\tau^N + \beta(1-\lambda)\int_{-\infty}^{+\infty} Max(\Pi_p^\tau(\alpha), V)dF(\alpha) + \beta\lambda V \tag{2}$$

  The equation is the same as before, but the firms is not paying the firing costs anymore.

- Old permanent contracts We have to distinguish the case in which the previous period the two agents had a OEC contract from the case in which they

had a FTC. However, the only difference is related to the wage- The former case gives:

$$\Pi_p^p(\alpha) = \alpha - w_p^p(\alpha) + \beta(1-\lambda)\Pi_p^p(\alpha) + \beta\lambda(V-f) \tag{3}$$

we can rewrite it as:

$$\Pi_p^p(\alpha) = \frac{\alpha - w_p^p(\alpha) - \beta\lambda f}{1-\beta(1-\lambda)}$$

In this case the firms has no more choice to do in equilibrium, given that she has already screened the worker. The match is broken only with the exogenous probability λ.

The second case reads is very similar:

$$\Pi_p^\tau(\alpha) = \frac{\alpha - w_p^\tau(\alpha) - \beta\lambda f}{1-\beta(1-\lambda)}$$

3.1.2 Workers' value functions

- New permanent contract

$$\mathbb{E}(W_p^N(\theta_0)) = w_p^N(\theta_0) + \beta(\lambda + (1-\lambda)F(\bar{\alpha}_p))U + \beta(1-\lambda)\int_{\bar{\alpha}_p}^{+\infty} W_p^p(\alpha)dF(\alpha) \tag{4}$$

The worker receives the wage and then, depending on his revealed productivity, he will return to unemployment or he will keep his job. Again, he could be fired also by exogenous reasons, with probability λ.

- New temporary contract

$$\mathbb{E}(W_\tau^N(\theta_0)) = w_\tau^N(\theta_0) + \beta(\lambda + (1-\lambda)F(\bar{\alpha}_\tau))U + \beta(1-\lambda)\int_{\bar{\alpha}_\tau}^{+\infty} W_p^\tau(\alpha) \tag{5}$$

The equation is the same, but the probability of being fired is higher, given that $\bar{\alpha}_\tau$ will be higher than $\bar{\alpha}_p$.

- Old permanent contract Again, we distinguish the case in which the previous period there was an OEC

$$W_p^p(\alpha) = w_p^p(\alpha) + \beta\lambda U + \beta(1-\lambda)W_p^p(\alpha) \tag{6}$$

or rewritten

$$W_p^p(\alpha) = \frac{w_p^p(\alpha) + \beta\lambda U}{1-\beta(1-\lambda)}$$

again, if there was a FTC the only difference involves the wage

$$W_p^\tau(\alpha) = \frac{w_p^\tau(\alpha) + \beta\lambda U}{1 - \beta(1-\lambda)}$$

- Unemployed

$$U = b + \beta p \mathbb{E}(Max(W_\tau^N(\theta_0), W_p^N(\theta_0))) + \beta(1-p)U \tag{7}$$

or

$$U = \frac{b + \beta p E(Max(W_\tau^N(\theta_0), W_p^N(\theta_0)))}{1 - \beta(1-p)}$$

The workers gains the unemployment benefit plus the discounted value of the future. In the next period he will get with probability p an offer or he will stay unemployed. Of course, given that the contract type will maximize the expected joint surplus, it will also maximize the expected value function of working for the agent, that is what in expectation the worker will get from the job relationship.

3.1.3 Wages

The wage is set using the standard result of Nash bargaining, where $\gamma \in [0, 1]$ represents the contractual power of the worker.

The wages for the new contracts will be determined by maximizing the following expressions:

$$\max_{w_p^N}(\mathbb{E}(W_p^N) - U)^\gamma(\mathbb{E}(\Pi_p^N) - V)^{1-\gamma}$$

$$\max_{w_\tau^N}(\mathbb{E}(W_\tau^N) - U)^\gamma(\mathbb{E}(\Pi_\tau^N) - V)^{1-\gamma}$$

It is important to notice that these wage will be the same for all workers and it is based on the expected value function for the agents, since the productivity is still unknown.

On the contrary, for the older contract, the productivity is already revealed, so the wage will be dependent on the revealed α.

In the Nash-bargaining an important role is played by the outside option of the firm, that will depend on the contract in the previous period. In particular, if the contract was a permanent one, the outside option will be paying the firing costs, Hence the maximization will be:

$$\max_{w_p^p}((W_p^p(\alpha) - U)^\gamma(\Pi_p^p(\alpha) - V + f)^{1-\gamma}$$

If instead the contract was a FTC, then the outside option will be 0, so the maximization will be:

$$\max_{w_p^\tau}((W_p^\tau(\alpha)-U)^\gamma(\Pi_p^\tau(\alpha)-V)^{1-\gamma}$$

The solutions for the older contracts is carefully describe in appendix A.

$$w_p^p(\alpha)=\gamma\alpha+\gamma(1-\beta)f+(1-\gamma)(1-\beta)U \tag{8}$$

$$w_p^\tau(\alpha)=\gamma\alpha-\beta\gamma f+(1-\gamma)(1-\beta)U \tag{9}$$

The wage is obviously increasing in the productivity and in the bargaining power of the workers. It also increase in the unemployment value, indeed the worker is able to capture part of the outside options of both players. This explain also why the wage is increasing in the firing costs when in the previous period there was a permanent contract. In the other case instead, the outside option for the firm is 0, so the firing costs have only a negative effect on the wage, since the firm shifts part of the expected future costs on the worker.

Notice that the wage after a temporary contract is lower than in the other case. This is consistent with the fact that the firm has a higher outside option after a temporary contract.

Using the expression for the wage we can rewrite the expressions for the value functions of older contracts, knowing the productivity-dependent wage. For an older contract after an OEC:

$$\Pi_p^p(\alpha)=\frac{(1-\gamma)\alpha-\gamma(1-\beta)f-(1-\gamma)(1-\beta)U-\beta\lambda f}{1-\beta(1-\lambda)}$$

$$W_p^p(\alpha)=\frac{\gamma(\alpha+(1-\beta)f)+(1-\gamma)(1-\beta)U+\beta\lambda U}{1-\beta(1-\lambda)}$$

Instead after a FTC:

$$\Pi_p^\tau(\alpha)=\frac{\beta\gamma f-\beta\lambda f-\beta(1-\lambda))(\beta\gamma f-\beta\lambda f+\beta\lambda f+\gamma(1-\beta)f)+(1-\gamma)\alpha-(1-\gamma)(1-\beta)U}{1-\beta(1-\lambda)}$$

$$\Pi_p^\tau(\alpha)=\frac{(1-\gamma)\alpha-(1-\gamma)(1-\beta)U-\beta\lambda f(1-\gamma)}{1-\beta(1-\lambda)}$$

$$W_p^\tau(\alpha)=\frac{\gamma\alpha-\beta\gamma f+\beta(1-\lambda)\beta\gamma f+\beta(1-\lambda)\gamma f-\beta(1-\lambda)\gamma\beta f+(1-\gamma)(1-\beta)U+\beta\lambda U}{1-\beta(1-\lambda)}$$

$$W_p^\tau(\alpha)=\frac{\gamma\alpha-\gamma\beta\lambda f+(1-\gamma)(1-\beta)U+\beta\lambda U}{1-\beta(1-\lambda)}$$

Notice that in both cases the sum of the value functions of firm and worker is the same

$$\Pi_p^p(\alpha) + W_p^p(\alpha) = \Pi_p^\tau(\alpha) + W_p^\tau(\alpha)$$

but given the difference in the outside options, we have that

$$\Pi_p^p(\alpha) < \Pi_p^\tau(\alpha)$$

and

$$W_p^p(\alpha) > W_p^\tau(\alpha)$$

The explicit solution for the contractual wages before the productivity is discovered is less obvious, given the endogenous choice of the firm. However, we can solve it numerically. In the end of the section I will show some examples.

Nonetheless, we do not need to determine the initial wages in order to predict the firm's choice about the contractual form. We can rely on the fact that firms choose the contract that grants the highest total surplus. Hence, we need to compute the total surpluses, starting from identifying the thresholds $\bar{\alpha}_p$ and $\bar{\alpha}_\tau$ above which the match will continue.

3.1.4 Thresholds

To determine the two thresholds we assume that the firms take the firing decision, so she will continue the relationship only if the value of the filled vacancy is higher than her outside option. Given the firing costs, the outside option is lower for a permanent contract and it is equal to $-f$:

$$\Pi_p^p(\bar{\alpha}_p) = -f$$

Instead, when the two agents has signed a temporary contract, the outside option of the firm is simply an empty vacancy:

$$\Pi_p^\tau(\bar{\alpha}_\tau) = 0$$

The resulting thresholds are the following:

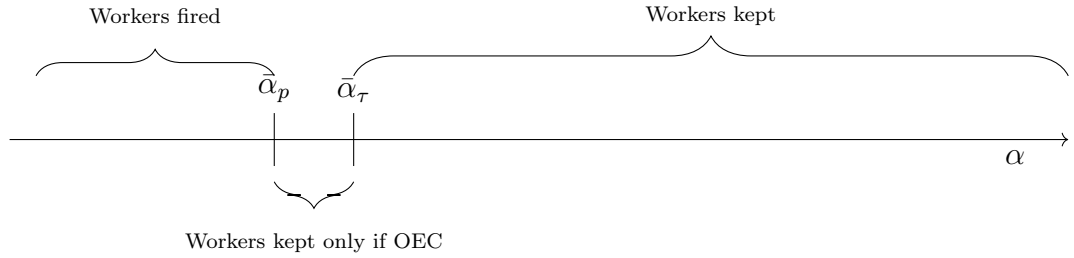
$$\bar{\alpha}_p = (1-\beta)(U-f) \tag{10}$$

$$\bar{\alpha}_\tau = (1-\beta)U + \beta\lambda f \tag{11}$$

The computation are reported in the appendix B.

Taking the difference we can confirm that the threshold for the FTC will be higher than the one for OEC.

$$\bar{\alpha}_\tau - \bar{\alpha}_p = (1-\beta+\beta\lambda)f > 0 \tag{12}$$



3.1.5 Surplus and contractual decision

We can assume that the decision about the contractual form is taken by the firm, that maximizes her expected profit before knowing the productivity of the worker. However, as we said, in order to get the solution, it is equivalent to maximize the total expected surplus instead of the expected firm profit. Therefore if we take the difference in the two expected surpluses, we can get the solution without having to explicitly account for the wages in the first period, simplifying the calculation.

$$\mathbb{E}\left(S_\tau^N(\theta_0)\right) = \mathbb{E}\left(\Pi_\tau^N(\theta_0)\right) - V + \mathbb{E}\left(W_\tau^N(\theta_0)\right) - U =$$
$$= \mathbb{E}(\alpha) + \beta(1-\lambda)\int_{\bar{\alpha}_\tau}^{+\infty} \Pi_p^\tau(\alpha) + W_p^\tau(\alpha)dF(\alpha) + \beta(\lambda + (1-\lambda)F(\bar{\alpha}_\tau))U - U \tag{13}$$

$$\mathbb{E}\left(S_p^N(\theta_0)\right) = \mathbb{E}\left(\Pi_p^N(\theta_0)\right) - V + \mathbb{E}\left(W_p^N(\theta_0)\right) - U =$$
$$= \mathbb{E}(\alpha) + \beta(1-\lambda)\int_{\bar{\alpha}_p}^{+\infty} \Pi_p^p(\alpha) + W_p^p(\alpha)dF(\alpha) + \beta(\lambda + (1-\lambda)F(\bar{\alpha}_p))(U-f) - U \tag{14}$$

$$S_p^p(\alpha) = S_p^\tau(\alpha) = \Pi_p^p(\alpha) - V + W_p^p(\alpha) - U + f = \frac{\alpha + \beta\lambda(U-f)}{1-\beta(1-\lambda)} - U + f \tag{15}$$

In the first period, the firm will choose the contract that maximize the expected surplus. Therefore I take the difference of the two expressions: the OEC is preferred if the difference is higher or equal of zero. To get the result, remember that $\Pi_p^p(\alpha) + W_p^p(\alpha) = \Pi_p^\tau(\alpha) + W_p^\tau(\alpha)$

$$\mathbb{E}(S_p^N) - \mathbb{E}(S_\tau^N) = -\beta f\left(\lambda + F(\bar{\alpha}_p)(1-\lambda)\right) + \beta(1-\lambda)\int_{\bar{\alpha}_p}^{\bar{\alpha}_\tau} \Pi_p^\tau(\alpha) + W_p^\tau(\alpha) - U dF(\alpha) \tag{16}$$

The first component is negative and it represents the additional firing costs that a permanent contract implies, in both cases of an exogenous or endogenous

separation. Also the second term is negative, since it represent the expected loss coming from the inefficient retention of unproductive matches due to the firing costs. To see this, notice that by definition at $\bar{\alpha}_\tau$

$$\Pi_p^\tau(\alpha) = W_p^\tau(\alpha) - U = 0$$

Since both value functions are strictly increasing in α, we conclude that the integral is negative.

We have obtained the usual result in literature that a temporary contract is always preferred to a permanent one. However we observe in reality that firms offer OEC to worker, even from the very beginning of a match.

Most of the past works assume some exogenous costs associated with FTC to explain this empirical fact. For example a higher exogenous separation rate for FTC or a cost for re-write the labour contract.

For the moment, I introduce an exogenous cost associated to temporary contract, that I call c.

This costs can be thought as a cost imposed by the law: in Italy FTC are subject to a higher social contribution and there are legal restrictions to their use. From 2012 for example, the number of employees in a firm with FTC cannot exceed the 20% of all the labour force.

If we assume a small cost in writing contract, also the transformation from a FTC to a OEC can motivate a higher cost for FTC.

If we buy this assumption, the condition for having a permanent contract is simply:

$$c > \beta f\left(\lambda + F(\bar{\alpha}_p)(1-\lambda)\right) - \beta(1-\lambda)\int_{\bar{\alpha}_p}^{\bar{\alpha}_\tau} S_p^\tau(\alpha)dF(\alpha) \tag{17}$$

However this exogenous higher costs of FTC is not completely satisfactory in explaining the choice of a permanent contract from the beginning of a match. One way to make the choice more endogenous in the model is addressed in the job market paper of Crechet, in which the two parties differ in their risk-aversion. In this way, a permanent contract could be seen as a way for the firm to provide an optimal contract that transfer risk from the more risk averse worker to herself.

In my model instead I will find instead a mechanism that explain the use of permanent contracts from the beginning assuming that workers can decide the amount of effort they invest in searching for a new job.

Some numerical simulations of this very basic model are present in Appendix C, in order to have an estimate of the wages paid by the two different contracts and how the optimal choice varies with the structural parameters.

3.2 Adding searching effort and on-the-job search

Searching for a job is a costly activity for workers. It is reasonable to think that unemployed people spend a considerable amount of time in this activity. Moreover, there is evidence that also an important share of workers performs at least some job search while employed. In Faberman et al. (2017), the authors report the result of a relevant survey done in the US on this topic. They show that 20% of employed workers can be classified as "searchers", with 23% of workers looking for a new job in the last 4 weeks and almost 20% having actively applied for a vacancy.

Importantly, even conditionally on searching, there is evidence that unemployed people search with a much higher intensity than employed ones: they spend roughly twice as much time.

In addition, the authors show that despite the different search intensity, employed people receive an higher amount of offers and contacts. However, these numbers include offers for additional works. If we count just for explicit offers of a new main job, the quantity drops well below to the unemployed average: only 13% of employed workers receive at least one offer, even informally, against 34.5% for unemployed.

Not surprisingly, the acceptance rate for employed worker is significantly lower, even if their offers are significantly better than the ones received by unemployed people. These fact is intuitively related to the higher outside option held by the workers.

3.2.1 Model modifications

To capture this empirical evidence, I modify the model adding the possibility for the worker to spend some effort in job search. Following the literature, for example Shimer (2004) or the same Faberman et al. (2017) the cost of the worker is a convex function, such as:

$$-hs^{\nu}$$

with $\nu > 1$, $s \in [0; \frac{1}{p(\theta)}]$ is interpreted as intensity of searching.

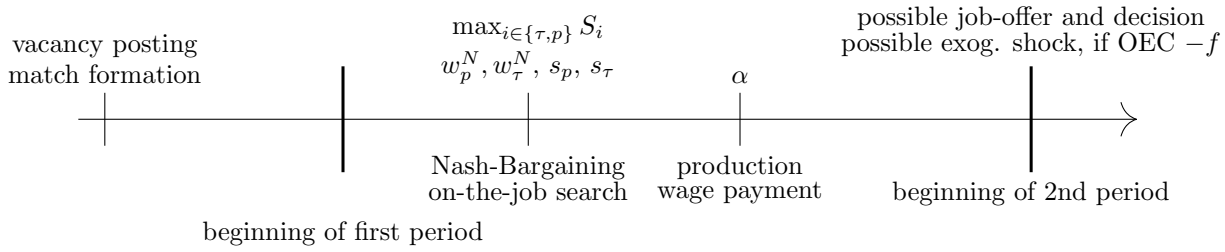
The probability of finding a job will be proportional to the effort:

$$sp$$

Since I am interested in the initial choice of the contract, for the moment I allow for on-the-job search just in the first period, while there will be no on-the-job search in all subsequent periods.

In the following figure I report the time-line of the events adding the new feature of the job-search for the workers for new matches. There will be no change in the old matches.

The worker will optimally search even if he has a job, given that there is a positive probability for him to be fired or he could be in a very unproductive match and he can improve his position changing job.



In this last case, he could use the opportunity to switch to a new match. However, his outside option is now given by the continuation value of his job and this is higher than the value of unemployment. In addition, the continuation value will depend on the now observed productivity α.

For the moment, I make the questionable assumption that workers receive the same offers of unemployed agents. I will try to eliminate this strong assumption in a possible extension in which the productivity is not entirely match-specific, but it is also worker-specific.

The firm is not paying any direct costs for the job-to-job transition, but she is obviously having a production loss due to the interruption of the match, if she would have continued the relationship.

The introduction of the on-the-job search will create another threshold in the productivity above which the worker will never accept a new offer, if not fired, given the high value of his job. Below this threshold instead, he will leave as soon as he finds another job.

This threshold will be different for matches that were previously formed with a temporary and a permanent contract. Indeed, as we shown in the previous section, for any given α, the value function of the worker is higher if he was hired with a permanent contract

$$W_p^\tau(\alpha) < W_p^p(\alpha)$$

Therefore, given that the job offers are all the same, if the starting contract was a permanent one, the worker will continue the relationship even with a lower α.

I call $\hat{\alpha}_i$ the new thresholds, with $i \in \{\tau, p\}$ where we will have

$$W_p^i(\hat{\alpha}_i) = max\left[\mathbb{E}(W_p^N); \mathbb{E}(W_\tau^N)\right]$$

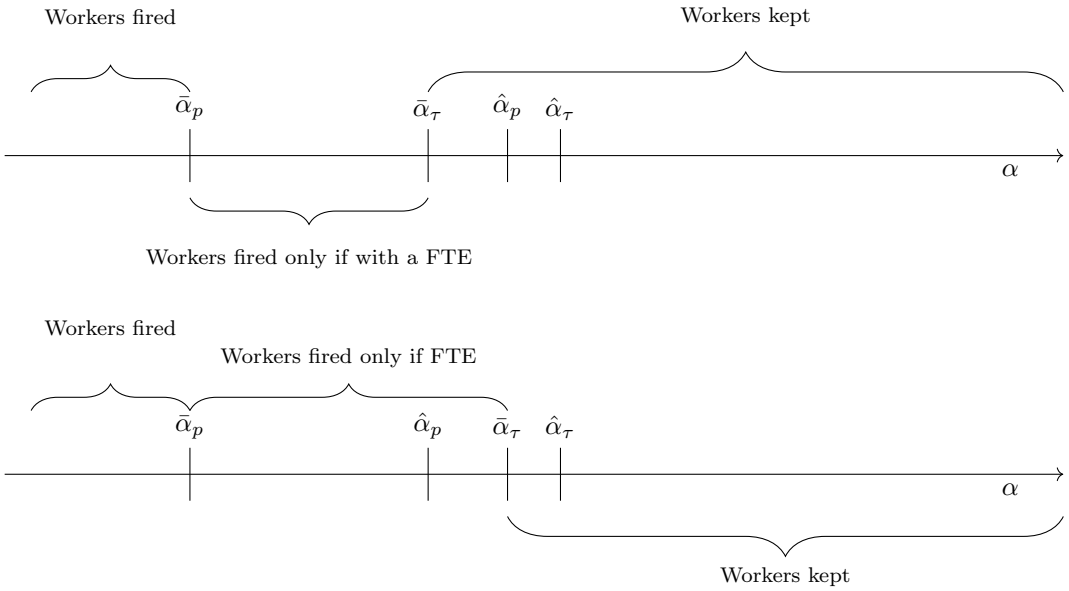
to simplify notation, from now on I will use $W^N = max\left[\mathbb{E}(W_p^N); \mathbb{E}(W_\tau^N)\right]$.

We can easily show that

$$\hat{\alpha}_i > \bar{\alpha}_i$$

Indeed, we remember that at $\alpha = \bar{\alpha}_i$, the surplus is exactly 0, therefore the worker is indifferent between working and being unemployed. Instead, if we have

Figure 4: **New thresholds**



an appropriate and realistic distribution of productivity, we have in expectation a positive surplus from a new match, meaning that $\mathbb{E}(W^N) > U$.

However, depending on the parameters we can have both $\hat{\alpha}_p > \bar{\alpha}_\tau$ or the opposite.

Hence, the decision about the continuation of the match can be represented in the two ways of figure 4, where we add the new thresholds

Now, we can modify the value functions for a new contract inserting the searching effort.

I will indicate as s_i the optimal searching effort, that will vary according to the working contract of the agent.

3.2.2 New firm's value functions

- New permanent contract

$$\mathbb{E}\left(\Pi_p^N(\theta_0)\right) = \mathbb{E}(\alpha) - w_p^N - \beta[\lambda + (1-\lambda)F(\bar{\alpha}_p)](1-ps_p)f + \\ +\beta(1-\lambda)\left[(1-ps_p)\int_{\bar{\alpha}_p}^{\hat{\alpha}_p}\Pi_p^p(\alpha)dF(\alpha) + \int_{\hat{\alpha}_p}^{+\infty}\Pi_p^p(\alpha)dF(\alpha)\right] \tag{18}$$

With probability $(1-ps_p)$ the worker does not find a new job. In that case, nothing change from the case without on-the-job search. Instead, with probability ps_p the worker has another job offer in his hand. If his productivity

is below the new threshold $\hat{\alpha}_p$, then the worker accepts the new offer and he leaves the place. In that case, the firm does not pay any cost, even if she would have fired him. Finally if the productivity is above $\hat{\alpha}_p$, the match will continue with probability $(1-\lambda)$.

- New temporary contract

$$\mathbb{E}\left(\Pi_\tau^N(\theta_0)\right) = \mathbb{E}(\alpha) - w_\tau^N + \beta(1-\lambda)\left[(1-ps_\tau)\int_{\bar{\alpha}_\tau}^{\hat{\alpha}_\tau}\Pi_p^\tau(\alpha)dF(\alpha) + \int_{\hat{\alpha}_\tau}^{+\infty}\Pi_p^\tau(\alpha)dF(\alpha)\right] \tag{19}$$

We have here the same expression as before, but the firm does not pay the firing cost. The expression for the older matches does not change, since we assume that the workers can search only in the first period.

3.2.3 New value functions for the worker

I recall that now W^N the following $max(E\{W_p^N(\theta_0)\}, E\{W_\tau^N(\theta_0)\})$, that is the expected value of a new job, with a still uncertain productivity.

- New permanent contract

$$\mathbb{E}\left(W_p^N(\theta_0)\right) = w_p^N - hs_p^\nu + \beta[\lambda + (1-\lambda)F(\bar{\alpha}_p)][U + ps_p(W^N - U)] +$$
$$+\beta(1-\lambda)\left[\int_{\bar{\alpha}_p}^{\hat{\alpha}_p} W_p^p(\alpha) + ps_p(W^N - W_p^p(\alpha))dF(\alpha) + \int_{\hat{\alpha}_p}^{+\infty} W_p^p(\alpha)dF(\alpha)\right] \tag{20}$$

The worker receives the wage and he pays the effort cost. Then, if he is fired, he gets the unemployment value. However, since he will receive with a certain probability a new job, he could use the new offer to start immediately a new job: this explain the term $ps_p(W^N - U)$. If he is not fired, he will continue. However, if his productivity is low, specifically below $\hat{\alpha}_p$, he has a probability ps_p to receive another job-offer and accept it to improve his position.

- New temporary contract

$$\mathbb{E}\left(W_\tau^N(\theta_0)\right) = w_\tau^N - hs_\tau^\nu + \beta[\lambda + (1-\lambda)F(\bar{\alpha}_\tau)][U + ps_\tau(W^N - U)] +$$
$$+\beta(1-\lambda)\left[\int_{\bar{\alpha}_\tau}^{\hat{\alpha}_\tau} W_p^\tau(\alpha) + ps_\tau(W^N - W_p^\tau(\alpha))dF(\alpha) + \int_{\hat{\alpha}_\tau}^{+\infty} W_p^\tau(\alpha)dF(\alpha)\right] \tag{21}$$

3.2.4 Optimal Choice of s

To get the optimal interior s in every different situation, we have just to take the partial derivative with respect to s.

For example:

$$\frac{\partial \mathbb{E}\left(W_p^N(\theta_0))\right)}{\partial s} = -\nu h s^{\nu-1} + p\beta(\lambda + (1-\lambda)F(\bar{\alpha}_p))(W^N - U) + \\ + p\beta(1-\lambda)\left[\int_{\bar{\alpha}_p}^{\hat{\alpha}_p} W^N - W_p^p(\alpha)dF(\alpha))\right]$$

Equalizing it to zero, we get

$$\frac{\nu h}{p\beta} s_p^{\nu-1} = (\lambda + (1-\lambda)F(\bar{\alpha}_p))(W^N - U) + (1-\lambda)\int_{\bar{\alpha}_p}^{\hat{\alpha}_p} W^N - W_p^p(\alpha)dF(\alpha) \quad (22)$$

Doing the same for the temporary contract the optimal amount of s will be such that

$$\frac{\nu h}{p\beta} s_\tau^{\nu-1} = (\lambda + (1-\lambda)F(\bar{\alpha}_\tau)(W^N - U) + (1-\lambda)\int_{\bar{\alpha}_\tau}^{\hat{\alpha}_\tau} W^N - W_p^\tau(\alpha)dF(\alpha) \quad (23)$$

The right-hand sides of the two equation are similar, except for the different thresholds: for the temporary contract the risk of being fired is higher and also it has a higher incentive to leave, given that $W_p^p(\alpha) > W_p^\tau(\alpha)$.

So, we can be sure that the marginal benefit of increasing s is higher for the temporary contract.

This higher returns of searching for a worker with a FTC will translate into $s_\tau > s_p$

3.2.5 Surplus for a new match

I compute the surpluses for the different contracts to have the optimal decision:

$$\mathbb{E}\left(S_p^N(\theta_0)\right) = \mathbb{E}\left(\Pi_p^N(\theta_0) + W_p^N(\theta_0)\right) - U = \\ = \mathbb{E}(\alpha) - h s_p^\nu + (\beta\lambda + \beta(1-\lambda)F(\bar{\alpha}_p))\left[U - f + p s_p(W^N - U + f)\right] + \\ + \beta(1-\lambda)\int_{\bar{\alpha}_p}^{\hat{\alpha}_p} W_p^p(\alpha) + \Pi_p^p(\alpha) + p s_p(W^N - W_p^p(\alpha) - \Pi_p^p(\alpha))dF(\alpha) + \\ + \int_{\hat{\alpha}_p}^{\infty} W_p^p(\alpha) + \Pi_p^p(\alpha)dF(\alpha) - U \quad (24)$$

The surplus equation is composed by different lines: in the first one we have the productivity minus the searching costs, plus the expected value coming from the

interruption of the relationship. This can be simply the outside option of the two agents or the value of the new job if the worker is able to find an offer. The second line is the continuation value when the worker is not fired, but he would like to quite if he finds a suitable offer. The last term instead is the average continuation value when the match is productive enough so that both parties wants to continue.

$$\begin{aligned}\mathbb{E}\left(S_\tau^N(\theta_0)\right) = \mathbb{E}\left(\Pi_\tau^N(\theta_0) + W_\tau^N(\theta_0)\right) - U = \\ = \mathbb{E}(\alpha) - hs_\tau^\nu + (\beta\lambda + \beta(1-\lambda)F(\bar{\alpha}_\tau))\left[U + ps_\tau(W^N - U)\right] + \\ +\beta(1-\lambda)\int_{\bar{\alpha}_\tau}^{\hat{\alpha}_\tau} W_p^\tau(\alpha) + \Pi_p^\tau(\alpha) + ps_\tau(W^N - W_p^\tau(\alpha) - \Pi_p^\tau(\alpha))dF(\alpha) + \\ + \int_{\hat{\alpha}_\tau}^{\infty} W_p^\tau(\alpha) + \Pi_p^\tau(\alpha)dF(\alpha) - U\end{aligned} \tag{25}$$

The expression is similar to the previous one, with the obvious changes.

3.2.6 Contractual decision

In this section, I compute the surplus for the case in which $\hat{\alpha}_p > \bar{\alpha}_\tau$, however the result is qualitatively similar in the other case.

As in the previous model, to obtain the optimal choice about the contract, I take the difference between the expected surplus of the two possible new contracts. If the difference is positive the agents will sign a permanent contract for a new match.

$$\begin{aligned}\mathbb{E}(S_p^N) - \mathbb{E}(S_\tau^N) = h(s_\tau^\nu - s_p^\nu) - \beta(f(1-ps_p) + p(s_\tau - s_p)(W^N - U))\left(\lambda + F(\bar{\alpha}_p)(1-\lambda)\right) + \\ +\beta(1-\lambda)\left(\int_{\bar{\alpha}_p}^{\bar{\alpha}_\tau}(\Pi_p^p + W_p^p - U)(1-ps_p) - p(s_\tau - s_p)(W^N - U)dF(\alpha) + \right. \\ \left. + \int_{\bar{\alpha}_\tau}^{\hat{\alpha}_p} p(s_\tau - s_p)(\Pi_p^p(\alpha) + W_p^p(\alpha) - W^N)dF(\alpha) + \int_{\hat{\alpha}_p}^{\hat{\alpha}_\tau} ps_\tau(\Pi_p^p + W_p^p - W^N)dF(\alpha)\right)\end{aligned} \tag{26}$$

The first line represents the most obvious differences in the contracts: there is a difference in the searching effort that translates also in a different probability of finding a new job-offer. In addition the OEC requires the firm to pay the firing costs if the match is broken. The second line is still negative and it is related to the loss of surplus given by the matches continued only because of the firing costs.

Finally, in the third line we have a possibly positive component that is given by the higher probability for a worker to receive a job-offer and leave, even if the surplus of the match was positive.

We can claim that the second integral in that line is positive:

$$\int_{\hat{\alpha}_p}^{\hat{\alpha}_\tau} ps_\tau(\Pi_p^p + W_p^p - W^N)dF(\alpha) > 0$$

Indeed, we have that $W_p^p(\alpha) = W^N$ at $\alpha = \hat{\alpha}_p$. So, for all other α in that interval, we can be sure that the expression inside the integral is positive.

Overall, the sign is ambiguous and the result will depend on the parameter as shown in the simulation results (see Appendix C).

The economic intuition is the following: the worker optimally searches for a new job considering the marginal benefits that he can receive by doing that, but he does not internalize the damage that he may perform to the firm by interrupting a profitable relationship. If the quality of the match is revealed to be low enough, even the firm benefits from the quit, while the opposite is true if the productivity is high enough.

I performed some numerical exercise in appendix C, in where it is possible to notice how the contractual choice changes with the structural parameters.

4 Data and Descriptive Evidence

The datasets that I am using to test the model predictions are administrative data coming from "Veneto Lavoro", the regional Institution that collects all the mandatory communications of working relationships in Veneto, a large region in the Norh-East of Italy. The panel is able to reconstruct all the working histories of the inhabitants after 2000, if they do not migrate outside the region.

The dataset gives access to many characteristics of the labour contracts, of workers and firms, such as education, living place, firm sector. Importantly, it provides information about the hiring contracts, transformation and also job-destruction motivations. However, it does not provide the wage. For this reason, it is necessary to merge the information with other administrative date coming from the INPS, the Italian social security Institution.

In terms of numbers, the dataset covers the working outcomes of more than 3 million workers, 8 hundreds of employer and more than 15 millions of job relationships. The dataset starts before 2000 and is updated until 2017. As said, one shortcoming of the dataset is that it does not follow workers that moves outside the Veneto region. In addition, people that were hired before 2000 and then they never change their job position may have not been included in the dataset.

Unfortunately, I cannot observe on-the-job search and outcomes directly. I must rely on indirect observation of quit and dismissal. However, I can use the Italian quarterly labour force survey to provide some descriptive evidence and calibrate the model. Indeed, the Labour Force Survey ask question concerning searching effort, on-the-job search and its motivation.

In figure 5 I report the percentage of workers searching on-the-job over time in Italy. They are workers that answered "Yes" to the question "Are you searching for another job?". It is quite clear that, in line with my model predictions, workers with a FTC actively search more than workers with a OEC.

Instead, in figures 6 and 7 I show the percentage of "searchers" that justify their research of a new job respectively to insure themselves against the separation risk or to improve their labour conditions [6]. Again, workers with FTC differs substantially from the others, indeed they anticipate a higher risk of separation.

However, we have to consider that several other characteristics could drive this evidence, in particular age, wage and the number of years from the beginning of the match could be responsible for the results. Nevertheless, even if we perform simple regressions, the correlations hold even controlling for observable, like the three mentioned and others as education. In Appendix D I attached some initial results.

Finally, I am planning to merge the data with another dataset of all incorporated firm in Italy, AIDA, in order to have also useful information about the balance

[6] The workers were asked to choose only one option, here I aggregate workers that want to improve place, time, wage, career conditions into the percentage represented in figure 7

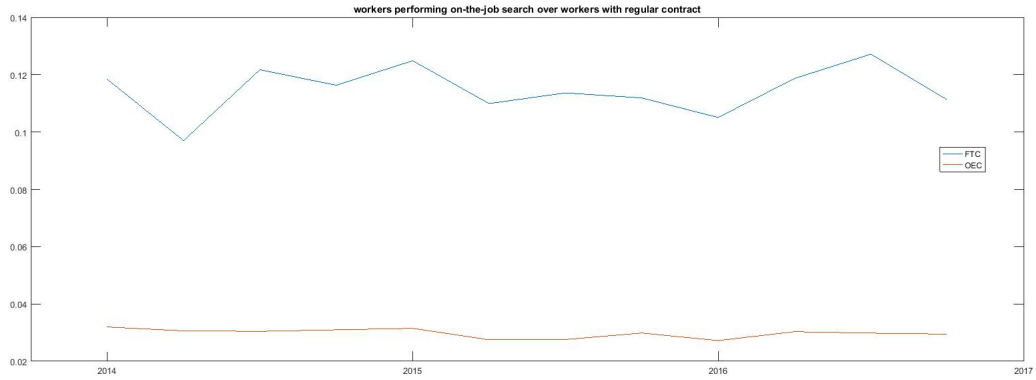


Figure 5: Percentage of searching workers per labour contract, source: ISTAT, RFL

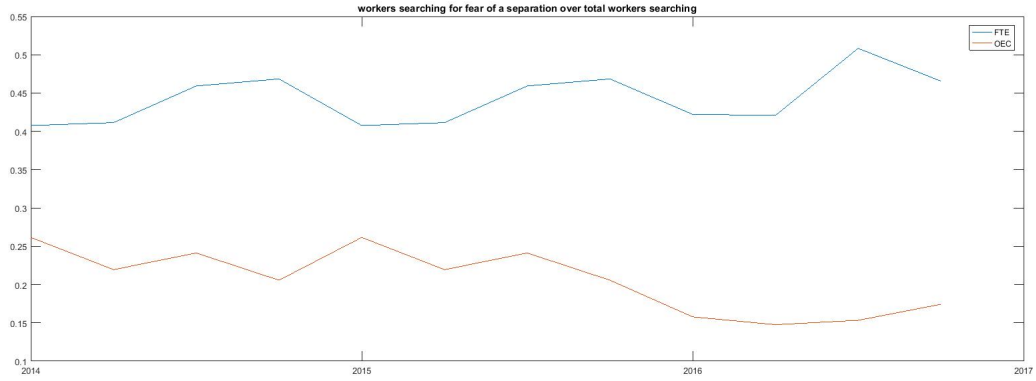


Figure 6: Percentage of searchers that named separation risk, source: ISTAT, RFL

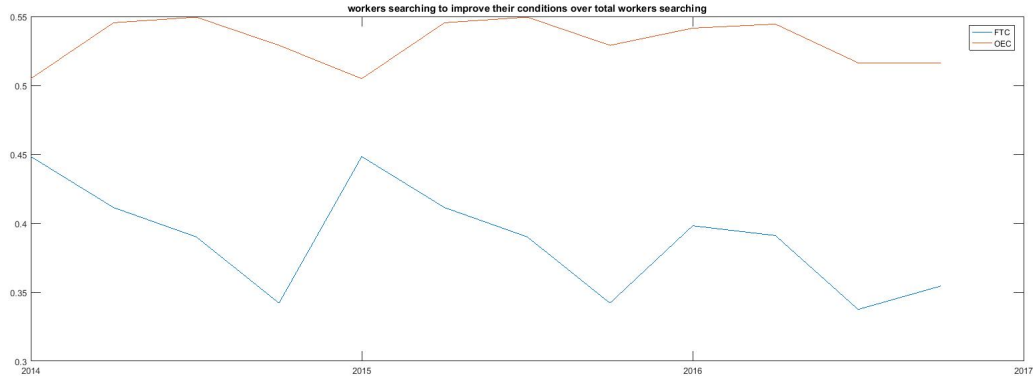


Figure 7: Percentage of searchers that named improving labour conditions, source: ISTAT, RFL

sheet of firm, to asses productivities distribution and possibly the impact of these contracts on productivity.

In table I report some observable characteristics for the two different contracts coming from the panel set. Here I report the data considering as unit the jobs relationship, meaning the match employer-employees as long as they did not change the contract type. In this way, if the agents signed multiple subsequent contract, they count as one and the duration is the real duration from the first to the last contract. In Appendix E I attach also the same data as they are collected, without this arrangement.

contracts from 2008	Averages per contract type		
	FTC	OEC	Total
Age	35.74	33.17	35.16
	(11.71)	(11.19)	(11.64)
Male	0.525	0.584	0.538
	(0.499)	(0.493)	(0.499)
Duration	199.0	549.1	264.8
(days, terminated only)	(279.3)	(617.2)	(391.9)
Educ level (1-6)	4.049	3.993	4.036
	(1.463)	(1.428)	(1.455)
First job	0.150	0.193	0.160
	(0.357)	(0.395)	(0.366)
Full time	0.832	0.719	0.807
	(0.546)	(0.521)	(0.543)
job-to-job	0.130	0.187	0.143
	(0.336)	(0.390)	(0.350)
Observations	2,943,764	858,123	3,801,887

mean coefficients; sd in parentheses

The data confirm some characteristics of FTC: lower duration and more common among females. However, surprisingly, they do not seem to be more use to employ low-educated people and younger. To explain this, we have to notice that we are looking at the flux of contracts, while the stock of people employed with OEC are probably older. However, it is also remarkable that almost 20% of OEC are signed by workers at their first (formal) working experience. The job-to-job variable indicates contracts signed less than 15 days from the end of another one in a different firm. As we can see, almost 20% of OEC are contracts with this characteristics, while this percentage is lower for FTC.

5 Extensions

5.1 Heterogeneity in firms

In my model I will have just one optimal contract, therefore to explain the coexistence of the two contracts, I need to introduce some form of heterogeneity.

To do so, I introduce a different a λ_j, where $j \in \{1, 2, ..., n\}$ indicates a sector. λ is increasing in j. To simplify the matching mechanism, I assume that the sector is drawn at the beginning, so that each sector has a probability $1/n$ to be selected.

In my real dataset, firms are divided in 45 sectors. I calculate the number of contracts signed from 2008 per sector, counting as 1 all the contracts signed by the same worker with the same firm in the same year adn excluding all seasonal contracts. For the moment I mark as a "separation" a contract that last less than one year, if the official motivation was not a quit from the employee or a individual layoff for disciplinary reasons. However, I should perform a structural estimation in order to disentangle endogenous from exogenous separations, especially for the FTC, where also the official motivation is simply the termination date.

However, I could observe in this way the distribution of separations across sectors that run from 26% in domestic services to 83% in agriculture.

The sector with lower λ_j will generate a higher surplus, so workers will have a lower incentive to leave, while the higher the exogenous separation rate the higher the benefit for on-the-job search. For this reason, even if the benefits of a FTC was increasing in λ in the previous model, a priori it is possible that more safe sector use FTC since they do not need to incentivize workers not to search on-the-job.

In appendix C we can have the result for a numerical simulation with just 10 sectors, with λ moving from 10% to 90%. Indeed, FTCs are signed for both the sectors with the lowest and the highest λ, while OECs are employed by the ones with a medium level. The sectors with the highest λ use FTCs to save the firing costs, while the ones with the lowest level enjoy the fact that their workers will hardly leave the job. So, they do not need to incentivize further their employees.

5.2 Production as a random variable

In the model, the production is equal to the match-specific productivity, that is therefore observed after the first period. I want to relax this assumption, by defining the production at every period t:

$$y_t = \alpha + \varepsilon_t$$

where ε_t is a gaussian error term with mean 0 and variance σ^2_ε.

The agents will observe the realized production and they will update their belief about the distribution of α. In this way we could have endogenous separations even after the first period.

With this extension we can also capture the optimal timing of transformation of a temporary contract, if we allow the employer to renew FTCs up to a certain limit imposed by the law. For example, if we consider one period as one year, we could set the legal limit for a FTC to a maximum of 3 periods, to be consistent with the Italian legislation.

Another difference is that the worker will be allowed to search on-the-job during all periods.

If the employer signs FTC until the legal maximum, in the third period the problem is similar to the case already analyzed, but workers will have different productivity distributions according to the realized production histories.

In this framework, it would be possible also to introduce workers heterogeneity. In this case workers would differ also in their initial prior distribution θ_0, for example according to their highest education achievement. Then we could look at the types of workers with higher probability of remaining employed for a long period with FTC.

6 Further steps and conclusion

This work gives just the basic model that I plan to calibrate in order to perform some public policies evaluation. To do so, I need to introduce the vacancy-posting aspect, that was neglected until now.

Once the model is calibrated, it could be possible to estimate the effect of government policies such as a reduction of f or a reduction of the maximum number of periods with a FTCs on the number and the duration of new FTCs, on average productivity or unemployment.

Another interesting result could be the estimation of the optimal f if the firm could freely choose it in order to compare the laissaiz faire equilibrium with the legally constrained one and to estimate the difference in welfare terms. Indeed, it is possible that the laissaiz faire equilibrium is not optimal, since searching behaviour of workers generate searching externalities.

In conclusion, in this work I developed a theoretical model that could describe the choice about the juridical form of a labour contract. If the productivity of the worker-firm match is unknown, a temporary contract has the advantage that it saves the firing cost in case the productivity is too low and do not force the firm to keep unproductive matches. However, workers perform searching activities while on-the-job and more so if they have a FTC rather than an OEC.

Therefore, even if both agents are risk-neutral, it could be optimal to sign an OEC in order to reduce the searching behaviour of the worker.

Appendix A: Wage Determination

We have a maximization of the type:

$$\max_x (W(x) - U)^\gamma (\Pi(x) - V)^{1-\gamma}$$

knowing that $\frac{\partial W(x)}{\partial x} = 1$ and $\frac{\partial \Pi(x)}{\partial x} = -1$, the solution is

$$(1-\gamma)(W(x) - U) = \gamma(\Pi(x) - V)$$

for the OEC contracts we have to add the fact that the outside option for the firm is $V - f$, so the equation is:

$$(1-\gamma)(W(x) - U) = \gamma(\Pi(x) - V + f)$$

Recalling the expressions for the value functions $\Pi_p^p(\alpha)$ and $W_p^p(\alpha)$, we have

$$(1-\gamma)\frac{w_p^p(\alpha) - (1-\beta)U}{1-\beta(1-\lambda)} = \gamma\frac{\alpha - w_p^p(\alpha) + (1-\beta)f}{1-\beta(1-\lambda)}$$

Solving for the wage we get the expression:

$$w_p^p(\alpha) = \gamma\alpha + \gamma(1-\beta)f + (1-\gamma)(1-\beta)U$$

Instead for $w_p^\tau(\alpha)$:

$$\begin{aligned}(1-\gamma)\left(w_p^\tau(\alpha) + \beta\lambda U + \beta(1-\lambda)\frac{w_p^p(\alpha) + \beta\lambda U}{1-\beta(1-\lambda)} - U\right) = \\ = \gamma\left(\alpha - w_p^\tau(\alpha) - \beta\lambda f + \beta(1-\lambda)\frac{\alpha - w_p^p(\alpha) - \beta\lambda f}{1-\beta(1-\lambda)}\right)\end{aligned}$$

$$w_p^\tau(\alpha) = \gamma\alpha - \beta\lambda((1-\gamma)U + \gamma f) - \beta(1-\lambda)\frac{\gamma(1-\beta(1-\lambda))f + (1-\gamma)(1-\beta(1-\lambda))U}{1-\beta(1-\lambda)} + (1-\gamma)U$$

$$w_p^\tau(\alpha) = \gamma\alpha - \beta\lambda((1-\gamma)U + \gamma f) - \beta(1-\lambda)(\gamma f + (1-\gamma)U) + (1-\gamma)U$$

$$w_p^\tau(\alpha) = \gamma\alpha + (1-\beta)(1-\gamma)U - \beta\gamma f$$

Notice that $w_p^\tau(\alpha) < w_p^p(\alpha)$, since the FTC gives a higher threatening point to the fire.

For the new contracts, we have to rely on numerical solutions, given that they will be vary according to the expected value of the value functions that depend on the endogenous thresholds $\bar{\alpha}$.

Appendix B: Thresholds

For the permanent contract we have

$$\bar{\alpha}_p - w_p^p(\bar{\alpha}_p) - \beta\lambda f = -f(1-\beta(1-\lambda))$$

$$\bar{\alpha}_p - w_p^p(\bar{\alpha}_p) = -(1-\beta)f$$

using the expression for the wage we get:

$$\bar{\alpha}_p - \gamma\bar{\alpha}_p - \gamma(1-\beta)f - (1-\gamma)(1-\beta)U = -(1-\beta)f$$

$$\bar{\alpha}_p = (1-\beta)(U-f)$$

For the temporary contract:

$$\frac{(1-\gamma)\bar{\alpha}_\tau - (1-\gamma)(1-\beta)U - \beta\lambda f(1-\gamma)}{1-\beta(1-\lambda)} = 0$$

$$\bar{\alpha}_\tau = (1-\beta)U + \beta\lambda f$$

New Thresholds for on-the-job offers

1. Determination of $\hat{\alpha}_p$

   At $\alpha = \hat{\alpha}_p$ we will have $W^N = W_p^p(\hat{\alpha}_p)$. Recalling that:

   $$W_p^p(\alpha) = \frac{w_p^p(\alpha) + \beta\lambda U}{1-\beta(1-\lambda)} = \frac{\gamma\alpha + \gamma(1-\beta)(f-U) + [1-\beta(1-\lambda)]U}{1-\beta(1-\lambda)}$$

   we have that

   $$\hat{\alpha}_p = \frac{1-\beta(1-\lambda)}{\gamma}(W^N - U) + (1-\beta)(U-f)$$

   Recalling the definition of $\bar{\alpha}_p$, we can see that

   $$\hat{\alpha}_p = \frac{1-\beta(1-\lambda)}{\gamma}(W^N - U) + \bar{\alpha}_p$$

2. Determination of $\hat{\alpha}_\tau$

   For the FTE: At $\alpha = \hat{\alpha}_\tau$ we will have $W^N = W_p^{tau}(\hat{\alpha}_p)$. As before:

   $$W_p^\tau(\alpha) = \frac{w_p^\tau(\alpha) + \beta\lambda U}{1-\beta(1-\lambda)} = \frac{\gamma\alpha - \gamma[\beta f + (1-\beta)U] + [1-\beta(1-\lambda)]U}{1-\beta(1-\lambda)}$$

now we have that

$$\hat{\alpha}_\tau = \frac{1-\beta(1-\lambda)}{\gamma}(W^N - U) + (1-\beta)U + \beta f$$

Recalling the definition of $\bar{\alpha}_\tau$, we can see that

$$\hat{\alpha}_p = \frac{1-\beta(1-\lambda)}{\gamma}(W^N - U) + \bar{\alpha}_\tau + \beta f(1-\lambda)$$

Appendix C: Numerical Simulations

Model without searching effort

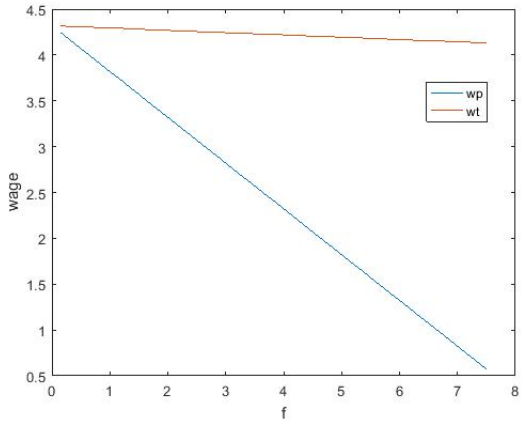
In the following table I show the baseline parameters, I chose them referring to the literature or on the empirical evidence coming from my longitudinal panel of working histories. One period has to be intended as one year, that is also the average (initial) duration of FTC in my dataset.

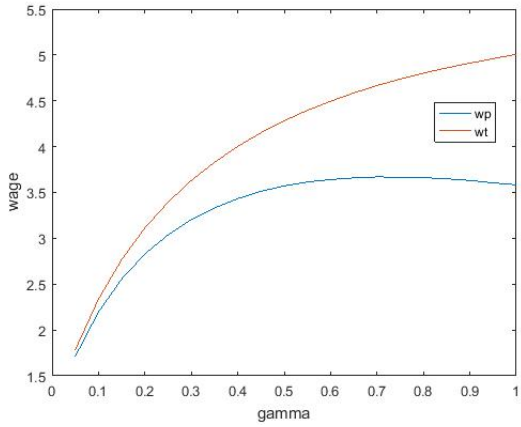
One important assumption is about the distribution of the productivity. I assume that it is normal distributed, with an average (5) that will be a benchmark for the other parameters, for example firing costs are assumed as 30% of an annual average production.

For the moment I assume that there is no exogenous cost for FTC, so $c = 0$.

Parameter	value	Parameter	value
β	0.95	p	0.5
$\mathbb{E}(\alpha)$	5	σ_α	1
b	1	f	1.5
γ	0.5	λ	0.1
c	0		

If I move just one of these parameters, the wages associated with the two contracts are the following:

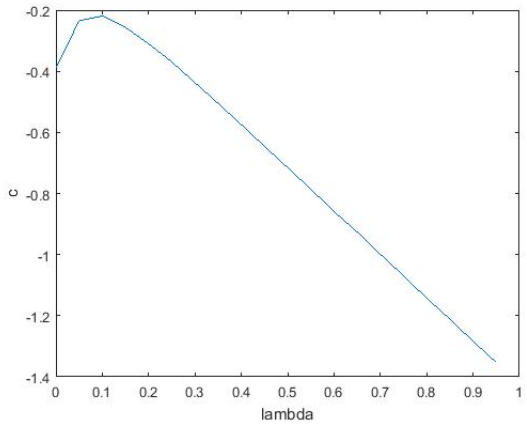


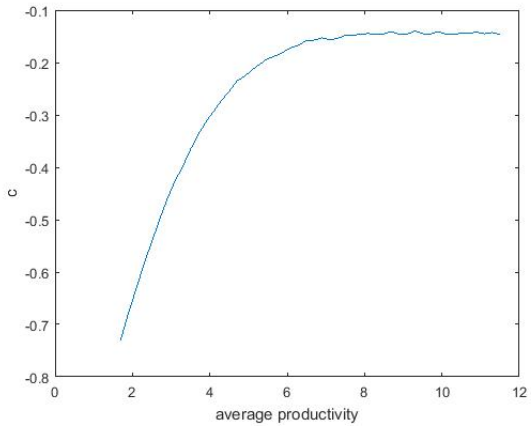


Not surprisingly, wages for FTC are less sensible to an increase of the firing costs for OEC and they increase more if we strengthen the bargaining power of the worker.

What it is at odds with empirical evidence is that the wage for FTC is higher than the one for OEC. However, as I already said, this empirical finding can be explained by selection of workers and firms into this contract.

Indeed, we can look at the following numerical examples, where I plot the required exogenous cost c that is necessary to switch the decision of a firm towards an OEC





The cost is decreasing with the average productivity, so that if the cost is the same for all the firms, but some of them have a higher average productivity, they will be choose the OEC, raising the observed wage.[7]

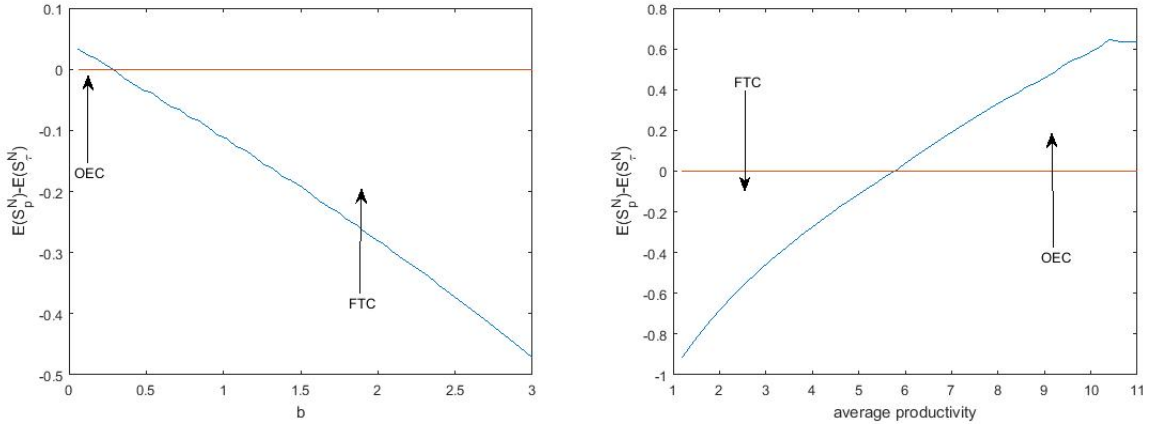
Another interesting finding is that the effect of λ is non monotonic with these parameters. The intuition is that if the probability of an exogenous separation is 0, the cost associated with a retention of unproductive workers can be substantial. So, an initial increase of the probability of exogenous separations can decrease it and this overcomes the obvious expected firing costs associated with the exogenous separations.

Model with searching effort

The numerical simulation use the same parameters showed before for the baseline model, but we have to add some assumption regarding the on-the-job parameters. In particular, notice that p now is the coefficient of proportionality for searching effort and instead I call p_u the probability of finding a job for unemployed. In the table, I report the parameters used.

[7]However, these considerations do not consider any equilibrium effect for the moment.

Parameter	value	Parameter	value
β	0.95	p_u	0.5
$\mathbb{E}(\alpha)$	5	σ_α	1
b	1	f	1.5
γ	0.5	λ	0.1
h	1	ν	2
p	1		



The incentive to use an OEC increases if we reduce the value of unemployment by a lower parameter b. The intuition is that the benefit for searching on the job is higher if the welfare drop in case of a layoff increases. Looking at the average productivity, keeping constant the productivity dispersion, we can notice how the OEC is more attractive for higher average productivity. Indeed, the need for screening is much less important in that case.

Extension with production as a random variable

Appendix D: Transfers vs pure waste in layoff

In the model the firing costs are a pure waste, however the main result could be obtained even if we assume that the firing costs for the firm are a simple cash transfer to the worker.

These transfers are not neutral, as in the standard literature (Lazear (1990)), since the two parties goes through a learning process of the productivity of the match. Therefore, a mandatory transfer in case of a layoff has the effect to inefficiently reduce the average quality of the workers kept, reducing the productivity threshold below which the worker is fired.

Importantly, if we assume that f is only a transfer from the firm to the worker, the exogenous firing probability λ does not influence the decision over the contract.

Indeed, in the case of f as transfer, the condition for having a permanent contract will be:

$$c > -\beta(1-\lambda)\int_{\bar{\alpha}_p}^{\bar{\alpha}_\tau} S_p^\tau(\alpha)dF(\alpha) \tag{27}$$

This condition implies that the cost of the temporary contract has to be larger than the expected cost of keeping a not-sufficiently productive match.

Empirically, Garibaldi and Violante (2005) estimates that in Italy transfers account for 2/3 of firing costs, while red tape and taxes are the remaining parts. Therefore, both components contribute in the determination of the firing costs.

Appendix E: On-the-job search Descriptive Evidence

The following table report the results of a simple regression of the dummy variable for being searching for another job on observables: OEC, age, monthly wage, sex, italian citizenship, duration of the job [8]. Province, year and quarter fix effects are also present in all specifications.

VARIABLES	(1) Searchers	(2) Searchers	(3) Searchers	(4) Searchers	(5) Searchers
OEC	-0.0758***	-0.0627***	-0.0613***	-0.0595***	-0.0593***
	(0.00112)	(0.00113)	(0.00113)	(0.00119)	(0.00119)
age	0.000927***	0.00220***	0.00241***	0.00268***	0.00204***
	(0.000242)	(0.000240)	(0.000241)	(0.000244)	(0.000244)
age2	-2.60e-05***	-3.54e-05***	-3.52e-05***	-3.65e-05***	-3.03e-05***
	(2.78e-06)	(2.76e-06)	(2.77e-06)	(2.82e-06)	(2.82e-06)
monthly wage		-5.08e-05***	-5.79e-05***	-5.03e-05***	-3.35e-05***
		(7.18e-07)	(8.44e-07)	(1.00e-06)	(1.09e-06)
male			0.0139***	0.0179***	0.0220***
			(0.000781)	(0.000933)	(0.000937)
ita			-0.0290***	-0.00702***	-0.00927***
			(0.00117)	(0.00130)	(0.00130)
duration				-3.98e-05***	-3.86e-05***
				(3.85e-06)	(3.84e-06)
part time					0.0417***
					(0.00110)
educ dummies	NO	NO	YES	YES	YES
sector dummies	NO	NO	NO	YES	YES
job dummies	NO	NO	NO	YES	YES
Observations	299,271	299,271	299,271	299,271	299,271
R-squared	0.033	0.049	0.053	0.066	0.071

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[8] Number of months from the beginning of the present job

In the next 2 tables instead I report the results of a regression of the dummy variables for the motivations for the on-the-job search. In the first table, the dependent variable takes the value of 1 if the "searchers" justified his research on the basis of a foresighted end of the job relationship. In the second one, the dependent variable is 1 if the motivation is related to jobs conditions.

The correlation observed in the simple graph is still present after controlling for the observables considered.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Separation	Separation	Separation	Separation	Separation
OEC	-0.260***	-0.272***	-0.270***	-0.271***	-0.265***
	(0.00890)	(0.00869)	(0.00877)	(0.00949)	(0.00949)
age	0.0104***	0.00321	0.00593**	0.00419	0.00560**
	(0.00271)	(0.00270)	(0.00272)	(0.00274)	(0.00273)
age2	-9.59e-05***	-1.07e-05	-4.61e-05	-2.05e-05	-3.42e-05
	(3.42e-05)	(3.40e-05)	(3.42e-05)	(3.42e-05)	(3.40e-05)
monthly wage		0.000149***	0.000147***	7.75e-05***	1.35e-05
		(7.78e-06)	(9.32e-06)	(1.14e-05)	(1.32e-05)
male			0.0152*	-0.0193**	-0.0232**
			(0.00856)	(0.00976)	(0.00973)
ita			0.0584***	-0.00361	-0.00439
			(0.00924)	(0.0102)	(0.0101)
duration				0.000197***	0.000199***
				(6.19e-05)	(6.15e-05)
part time					-0.109***
					(0.0114)
educ dummies	NO	NO	YES	YES	YES
sector dummies	NO	NO	NO	YES	YES
job dummies	NO	NO	NO	YES	YES
Observations	12,368	12,368	12,368	12,368	12,368
R-squared	0.103	0.129	0.138	0.181	0.188

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	(1) Improving	(2) Improving	(3) Improving	(4) Improving	(5) Improving
OEC	0.138***	0.168***	0.153***	0.155***	0.145***
	(0.00966)	(0.00906)	(0.00905)	(0.0101)	(0.0101)
age	-0.00361	0.0142***	0.0104***	0.0105***	0.00857***
	(0.00301)	(0.00281)	(0.00282)	(0.00286)	(0.00284)
age2	7.96e-05**	-0.000131***	-0.000103***	-0.000111***	-9.24e-05***
	(3.80e-05)	(3.52e-05)	(3.53e-05)	(3.55e-05)	(3.53e-05)
monthly wage		-0.000368***	-0.000293***	-0.000247***	-0.000157***
		(8.43e-06)	(1.01e-05)	(1.18e-05)	(1.33e-05)
male			-0.0269***	0.0185*	0.0239**
			(0.00901)	(0.0105)	(0.0104)
ita			-0.177***	-0.128***	-0.127***
			(0.0104)	(0.0115)	(0.0114)
duration				-0.000232***	-0.000234***
				(6.31e-05)	(6.25e-05)
part time					0.152***
					(0.0119)
educ dummies	NO	NO	YES	YES	YES
sector dummies	NO	NO	NO	YES	YES
job dummies	NO	NO	NO	YES	YES
Observations	12,368	12,368	12,368	12,368	12,368
R-squared	0.063	0.192	0.219	0.254	0.265

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The following table referred to the characteristics of contracts in the "Veneto Lavoro" dataset.

contracts from 2008	Averages per contract type		
	FTC	OEC	Total
Age	35.92	33.16	35.43
	(11.57)	(11.19)	(11.55)
Male	0.511	0.585	0.524
	(0.500)	(0.493)	(0.499)
Duration	178.2	545.9	231.8
(days, terminated only)	(254.8)	(615.8)	(357.2)
Educ level (1-6)	4.104	3.987	4.084
	(1.433)	(1.429)	(1.433)
First job	0.110	0.191	0.124
	(0.313)	(0.393)	(0.330)
Full time	0.823	0.718	0.804
	(0.537)	(0.521)	(0.536)
job-to-job	0.134	0.191	0.144
(< 15 days previous employer)	(0.341)	(0.393)	(0.351)
Observations	4,016,081	867,068	4,883,149

mean coefficients; sd in parentheses

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